CORPORATE MANAGEMENT IN THE AGE OF AI

Martin Petrin*

Recent media reports and press releases have created the impression that Artificial Intelligence (AI) is on the verge of assuming an important role in corporate management. While, upon closer inspection, it turns out that these stories should not always be taken at face value, they clearly highlight AI's growing importance in management and hint at the enormous changes that corporate leadership may experience in the future. This Article attempts to anticipate that future by exploring a thought experiment on corporate management and AI. It argues that it is not an insurmountable step from AI generating and suggesting expert decisions (which is already common today) to AI making these decisions autonomously. The Article then proceeds based on the assumption that next-generation AI will be able to take over the management of business organizations and explores the corporate law and governance consequences of this development. In doing so, the Article focuses on the fundamental areas of corporate leadership and management structures, managerial liability, and the corporate purpose. It also considers the phenomenon of algorithmic entities and leaderless entities.

* Professor of Corporate Law & Governance and Vice Dean (Innovation), University College London. For helpful comments and conversations on earlier drafts, the author thanks David Gindis, Lynn LoPucki, Andrew Tuch, the participants of the ECGI/UCL/Cambridge *Conference on The Future of the Firm*, and the Cambridge Centre for Corporate and Commercial Law Workshop. The usual disclaimers apply.

I. INTRODUCTION

In 2014, a Hong Kong based venture capital firm, Deep Knowledge Ventures, thrust us into a new age of corporate management. The firm announced in a press release that it "appointed VITAL, a machine learning program capable of making investment recommendations in the life science sector, to its board."[1] Two years later, Finnish IT company Tieto informed the public that it "appointed Artificial Intelligence as a member of the leadership team of its new data-driven businesses unit."[2] Similarly, in early 2018, the

[1] Charles Groome, *Deep Knowledge Ventures Appoints Intelligent Investment Analysis Software VITAL as Board Member*, CISION PRWEB (May 13, 2014), http://www.prweb.com/releases/2014/05/ prweb 11847458.htm [https://perma.cc/9U8D-Q94X].

[2] Press Release, Tieto, Tieto the First Nordic Company to Appoint Artificial Intelligence to the Leadership Team of the New Data-driven Businesses Unit (Oct. 17, 2016), https://www.tieto.com/news/tieto-the-first-

CEO of California-based software provider SalesForce revealed that he brings an artificial intelligence machine named "Einstein" to weekly staff meetings. He further noted that he asks Einstein to comment on proposals under discussion, describing how on one occasion the machine questioned whether a particular executive "is going to make their number."[3]

Several media outlets reacted promptly, with[4] one newspaper even asking its readers whether they would "take orders from a robot."[5] In the case of VITAL, it turned out that initial reports were technically incorrect, given that Hong Kong law does not allow non-human entities to serve on boards.[6] The phenomenon was also exaggerated, as Deep Knowledge Ventures later acknowledged that VITAL's role "was a little different from that of human directors," noting that the firm treats the software "as a member of our board with observer status" on the basis of an agreement that the board "would not make positive investment decisions without

nordic-company-to-appoint-artificial-intelligence-to-the-leadership-team-of-the-new [https://perma.cc/3C59-4YTA].

3 David Reid, *Marc Benioff Brings an A.I. Machine Called Einstein to His Weekly Staff Meeting*, CNBC (Jan. 25, 2018), https://www.cnbc.com/2018/01/25/davos-2018-ai-machine-called-einstein-attends-salesforce-meetings.html [https://perma.cc/9CN9-Y6TV].

4 *See e.g.*, Nicky Burrdige, *Artificial Intelligence Gets a Seat in the Boardroom*, NIKKEI ASIAN REV. (May 10, 2017), https://asia.nikkei.com/Business/Companies/Artificial-intelligence-gets-a-seat-in-the-boardroom [https://perma.cc/2HZQ-5WMU]; *Algorithm Appointed Board Director*, BBC NEWS (May 16, 2014), https://www.bbc.co.uk/news/technology-27426942 [https://perma.cc/59ED-JFEN]; Simon Sharwood, *Software 'Appointed to Board' of Venture Capital Firm*, REG. (May 18, 2014), https://www.theregister.co.uk/2014/05/18/software_appointed_to_board_of_venture_capital_firm [https://perma.cc/Z2B7-AW93].

5 Ellie Zolfagharifard, *Would You Take Orders from a Robot*? *An Artificial Intelligence Becomes the World's First Company Director*, DAILY MAIL (May 19, 2014), https://www.dailymail.co.uk/sciencetech/article-2632920/Would-orders-ROBOT-Artificial-intelligence-world-s-company-director-Japan.html [https://perma.cc/VX55-PFNF].

6 *See* Sharwood, *supra* note 4.

corroboration by VITAL."[7] As one commentator noted, this arrangement was no different from practices at other financial companies that use large data searches to survey markets and generate suggestions for boards or managers.[8]

Although the claims in the above-mentioned and similar news items may not always be taken at face value, they clearly highlight the growing importance of artificial intelligence ("AI") in corporate management and hint at the potentially enormous changes that corporate leadership may experience in the relatively near future. This Article attempts to anticipate that future by exploring a thought experiment on corporate management and artificial intelligence. It argues that the step from AI generating and suggesting expert decisions for managers (which in some areas is already common today) to AI making these decisions autonomously is hardly insurmountable.

On a terminological note, there is currently no singular, universally accepted definition of AI.[9] In fact, as one commentator has noted, "AI is an umbrella term, comprised by many different techniques" and notably includes the cutting-edge approaches of machine learning and deep learning.[10] This Article construes AI broadly, invoking a classic definition by John McCarthy, the late Stanford scientist often credited with coining the term artificial intelligence.[11] McCarthy described AI as "the science and

7 Burrdige, *supra* note 4.

8 *See Algorithm Appointed*, *supra* note 4 (citing Professor Noel Sharkey).

9 PETER STONE ET AL., ARTIFICIAL INTELLIGENCE AND LIFE IN 2030: REPORT OF THE 2015 STUDY PANEL 12 (2016), https://ai100.stanford.edu/sites/g/files/sbiybj9861/f/ai_100_report_0831fnl.pdf [https://perma.cc/BN9A-3CQA].

10 Ryan Calo, *Artificial Intelligence Policy: A Primer and Roadmap*, 51 U.C. DAVIS L. REV. 399, 405, 407 (2017) ("[M]any of the devices and services we access today—from iPhone autocorrect to Google Images—leverage trained pattern recognition systems or complex algorithms that a generous definition of AI might encompass.").

11 *See* V. Rajaraman, *John McCarthy – Father of Artificial Intelligence*, 19 RESONANCE 198 (2014),

engineering of making intelligent machines, especially intelligent computer programs."[12] This definition is better suited for our purposes than a definition of AI as an approximation of human intelligence,[13] because it leaves open the possibility that AI will eventually exceed humans' cognitive capacity and represent an entirely separate category of intelligence. As McCarthy noted, AI is related to using computers to understand human intelligence, but is not necessarily confined to methods that are biologically observable.[14]

Based on this understanding of AI, and based on the assumption that as AI further evolves it will be able to take over the management of corporations, this Article will explore the potential corporate law and governance consequences of this development. In doing so, it focuses on the fundamental areas of corporate leadership and management structures, managerial liability, and the corporate purpose. While the foregoing Parts of the Article will describe the consequences of AI management based on the underlying assumption that ultimate control of AI-led businesses remains with human shareholders, the final Section will discuss algorithmic entities ("AEs") and leaderless entities as particular forms of potential future corporate management/leadership models. AEs are legal entities that are not only fully managed by software, but, once established, are also otherwise devoid of any ongoing human involvement. Leaderless entities are organizations that function without a centralized management. The Article will go on to argue that this form is

https://www.ias.ac.in/article/fulltext/reso/019/03/0198-0207 [https://perma.cc/5W3V-MCLB].

12 John McCarthy, *What is AI?/Basic Questions*, http://jmc.stanford.edu/artificial-intelligence/ what-is-ai/index.html [https://perma.cc/4MUH-4XWF].

13 For example, a dictionary provides AI as "the capability of a machine to imitate intelligent human behavior." *Artificial Intelligence*, MERRIAM-WEBSTER ONLINE DICTIONARY (2018), https://www.merriam-webster.com/dictionary/artificial%20intelligence [https://perma.cc/K2YV-AMND].

14 McCarthy, *supra* note 12.

unlikely to become a dominant leadership model in the future given the persistent need for centralized management.

On leadership and management, the Article suggests that AI will usher in the end of the corporate board. It posits that AI will gradually replace human directors on boards, leading to "fused boards" where the various roles and inputs previously provided by a collective of human directors are incorporated into a single software program or algorithm, whose performance will be superior to today's human-led governance. AI will also replace human officers and managers below the board level. For reasons more fully explained below, these developments will eventually make the separation between boards of directors and management obsolete and lead to the "fused management" of corporations, with companies being managed comprehensively by a single AI unit. The Article also predicts that in the future, large commercial AI management software providers will offer these services to companies for sale or hire.[15]

Another area that is set to experience changes in an AI-dominated future is the corporate purpose. That is, to manage businesses, AI will require highly specific target outcomes, which will lead to more clearly defined corporate aims and strict implementations of corporate mission statements. Although AI managed entities, especially in the absence of human controllers, may provide a cover for illicit activities, the rise of AI also offers the potential for meaningful positive changes in terms of defining the corporate objective. Additionally, because AI can efficiently handle high degrees of complexity, AI-managed businesses will be in a better position to pursue multiple objectives simultaneously—specifically, the interests of multiple stakeholders—and optimize the outcomes of several objectives at once within given constraints. Shareholder wealth maximization as a singular corporate goal may thus become largely a concept of

[15] While the following will not attempt to describe what AI corporate leadership will specifically look like in terms of its physical appearance, it suffices here to suggest that this could range from purely software-based applications, combinations of software with laptop or tablet like hardware, to human-resembling robots that can listen and speak.

the past. At the very least, basic corporate responsibility should be expected to improve as AI management software is programmed to be aware of and strictly adhere to all applicable laws.

In this new world, directors' and officers' personal liability will change as well. In an initial phase, when humans and AI still work together on boards and in management, a number of challenging legal questions concerning personal liability will arise, including the extent to which human managers can and should monitor AI, and to what extent they may delegate tasks to machines without exposing themselves to personal liability. In a later phase, when AI dominate the management and governance of corporations, today's framework will either vanish completely, evolve into a system in which the artificial AI entities/managers themselves can be sued, or be replaced with a system akin to today's products liability paradigm. Under the latter system, which is arguably the most likely option, corporations and shareholders, instead of using the modern derivative action framework, would be able to bring actions against the developers and providers of AI management software based on faults in design and similar claims. Additionally, or as an alternative to fault liability, this system could also allow for strict liability against software developers and providers.

II. CAN AI TAKE OVER?

This Part will address the fundamental question of whether and to what extent AI can assume corporate management tasks. It begins with a brief examination of the tasks that today's corporate directors, officers, and managers carry out. These tasks can be roughly divided into administrative tasks and non-administrative tasks ("judgment work"). This bifurcation proves useful in mapping managerial tasks onto AI roles and capabilities. AI seems poised to take over completely in the area of administrative managerial tasks, however, disagreement persists over AI's role when it comes to non-administrative judgment work, which includes corporate leadership tasks relating to strategy, innovation, creative thinking, and people

management.[16] Still, some commentators convincingly demonstrate that AI will likely reach and even exceed human-level skills in the area of judgment work as well.[17] This development would allow AI to assume all the tasks of today's directors and managers, allowing AI to take over the future leadership of business corporations.

A. Corporate Leadership Tasks

1. Directors

Given the corporate board's importance in decisionmaking, it may come as a surprise that the law offers little guidance on the tasks it must or should perform. While some jurisdictions provide detailed enumerations of (sometimes non-delegable) board powers,[18] the U.S. does not. The Delaware General Corporation Law (the "DGCL"), for instance, states that "[t]he business and affairs of every corporation . . . shall be *managed* by or under the direction of a board of directors."[19] This general reference to "management" by the board would, by itself, represent a misleading or at least highly inaccurate description of what modern boards do. It is only the DGCL's additional reference to corporations being managed "under the direction" of the board that provides a more accurate reflection of contemporary governance. Public companies are rarely managed by the board. Rather, the board transfers significant managerial responsibilities to officers and managers.[20] In turn, the board supervises management and only retains for itself a limited number of high-level managerial tasks.[21]

16 *See infra* Section II.B.2.

17 *See id.*

18 *See, e.g.*, OBLIGATIONENRECHT [OR][Code of Obligations] Mar. 30, 1911, SR 220, art. 716a (Switz.).

19 DEL. CODE ANN., tit. 8, § 141(a) (2016) (emphasis added).

20 STEPHEN M. BAINBRIDGE, THE NEW CORPORATE GOVERNANCE IN THEORY AND PRACTICE 74 (2008).

21 *Id.*; *see also In re* Caremark Int'l Inc. Derivative Litig., 698 A.2d 959, 968 (Del. Ch. 1996) ("Legally, the board itself will be required only to

Indeed, over the course of the last several decades, monitoring has become the accepted core function of Anglo-American boards.[22] Instead of "managing" the company, boards—to a large extent—entrust full-time executives with this role, including running the company on a daily basis and delegating certain tasks and responsibilities further down the corporate hierarchy to employees.[23] Directors' focus on supervision instead of management is also a necessity that is dictated by the fundamental modus operandi of the modern board. Today's boards are part-time, intermittent, decisionmaking bodies.[24] Boards only meet periodically, and the majority of board members are not employees of the company on whose board they sit—that is, they may also have other board mandates.[25] In practice, this setup makes it impossible for boards to comprehensively manage a company on a daily basis.

Although monitoring is the board's chief role, it is not *limited* to this task. Modern boards take on a multi-faceted role that combines supervision with a number of other activities.[26] For example, boards set their corporations'

authorize the most significant corporate acts or transactions: mergers, changes in capital structure, fundamental changes in business, appointment and compensation of the CEO, etc."). On the functions of U.S. and U.K. boards, see also MARC MOORE & MARTIN PETRIN, CORPORATE GOVERNANCE: LAW, REGULATION AND THEORY 174–77 (2017), which this Section partially relies on.

22 Stephen M. Bainbridge, *Corporate Directors in the United Kingdom*, 59 WM. & MARY L. REV. ONLINE 65, 73–74 (2017). For a pioneering work on the monitoring board model, see MELVIN A. EISENBERG, THE STRUCTURE OF THE CORPORATION 165 (photo reprt. 2006) (1976) ("[T]he role of the board is to hold executives accountable for adequate results (whether financial, social, or both), while the role of the executives is to determine how to achieve these results.").

23 *See* BAINBRIDGE, *supra* note 20, at 74.

24 MOORE & PETRIN, *supra* note 21, at 176.

25 *See infra* text accompanying note 29 and notes 150–54 (discussing the prevalence of independent directors and the limited time that directors typically spend on board work).

26 *See, e.g.*, DAVID KERSHAW, COMPANY LAW IN CONTEXT: TEXT AND MATERIALS 234–36 (2nd ed. 2012); Lynne L. Dallas, *The Multiple Roles of Corporate Boards*, 40 SAN DIEGO L. REV. 781, 781–83 (2003); Joseph A.

strategic goals and retain certain managerial responsibilities, which consist, above all else, of appointing and terminating senior management personnel and approving major transactions.[27] Furthermore, boards have a service and relational function in which they provide advice and guidance to management and, in particular, to the CEO.[28] This includes leveraging their contacts with a view to help "expand the company's network by providing interlocks with potential suppliers, customers, sources of finance, and other potential providers of key organizational needs."[29] It also includes the directors' role to act as a liaison with shareholders and other company stakeholders.[30]

The G20/OECD Principles of Corporate Governance provide a more detailed description of board functions. According to the Principles, there are eight key functions that corporate directors should fulfill:

> [1] Reviewing and guiding corporate strategy, major plans of action, risk management policies and procedures, annual budgets and business plans; setting performance objectives; monitoring implementation and corporate performance; and overseeing major capital expenditures, acquisitions, and divestitures . . . [2] Monitoring the effectiveness of the company's governance practices and making changes as needed . . . [3] Selecting, compensating, monitoring and, when necessary, replacing key executives and overseeing succession planning . . . [4] Aligning key executive and board remuneration with

McCahery & Erik P.M. Vermeulen, *Understanding the Board of Directors after the Financial Crisis: Some Lessons for Europe*, 41 J.L. & SOC'Y 121, 126 (2014).

27 Stephen M. Bainbridge & M. Todd Henderson, *Boards-R-Us: Reconceptualizing Corporate Boards*, 66 STAN. L. REV. 1051, 1061 (2014) (noting also that boards are required to approve mergers and related transactions, major asset sales, stock issuances, distributions of dividends, and amendments to the articles of incorporation, among others).

28 *See id*.; *see also* Dallas, *supra* note 26, at 805–07.

29 Bainbridge, *supra* note 22, at 72 (footnote omitted).

30 *Id*. at 73; *see also* Bainbridge & Henderson, *supra* note 27, at 1061–62.

> the longer term interests of the company and its shareholders . . . [5] Ensuring a formal and transparent board nomination and election process . . . [6] Monitoring and managing potential conflicts of interest of management, board members and shareholders, including misuse of corporate assets and abuse in related party transactions . . . [7] Ensuring the integrity of the corporation's accounting and financial reporting systems, including the independent audit, and that appropriate systems of control are in place, in particular, systems for risk management, financial and operational control, and compliance with the law and relevant standards . . . [8] Overseeing the process of disclosure and communications. [31]

A series of surveys conducted by the consulting firm McKinsey & Company ("McKinsey"), sheds further light from inside the board on the nature of directors' work, including where board members invest their time and, in total, how much time they dedicate to board-related work. According to the most recent iteration of the survey, directors dedicate twenty-four days per year on board matters.[32] In terms of tasks, board members spend 27% of their time on strategy; 20% on performance management; 13% on organizational structure, culture, and talent management; 12% on investments and mergers & acquisitions; 10% on core governance and compliance; 9% on risk management; and 9% on shareholder and stakeholder management.[33] The McKinsey survey also notes that the distribution of time that boards spend on these tasks has been stable over the last few

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31 OECD, G20/OECD PRINCIPLES OF CORPORATE GOVERNANCE, 47–50 (2015), https://www.oecd.org/daf/ca/Corporate-Governance-Principles-ENG.pdf [https://perma.cc/3YFV-JAPS].

32 Martin Hirt, et al., *The Board Perspective: A Collection of McKinsey Insights Focusing on Boards of Directors*, MCKINSEY & CO., Mar. 2018, at 49, https://www.mckinsey.com/~/media/McKinsey/Featured%20Insights/Leadership/The%20board%20perspective/Issue%20Number%202/2018_Board%20Perspective_Number_2.ashx [https://perma.cc/8CJM-N223].

33 *Id.*

years, with only slight changes compared to previous years.[34] Thus, strategy and performance management have been consistently ranked as areas boards spend the most time on, with respondents indicating that they would like to spend even more time on strategy in addition to organizational matters, such as structure, culture, and talent management.[35]

2. Managers

Boards' focus on high-level tasks, with a particular emphasis monitoring and strategy, can generally be contrasted with the tasks managers perform. As in the case of boards, however, the law again offers only minimal guidance on the role and tasks of managers.[36] To start, there is no legal definition of a "manager." In fact, the term is sometimes broadly used as a label for both directors and other high-level decisionmakers within corporations.[37] That is also the approach taken in later Sections of this Article, where the use of the words "managers" or "management" will normally refer to all individuals with significant leadership and decisionmaking responsibility at various levels of the corporate hierarchy. For the purposes of the present Section, however, the term "managers" only designates those individuals that have the aforementioned leadership and decisionmaking attributes but are *not* (or, *not only*) directors.[38] The term "managers" in this sense includes, but is not limited

34 *Id.*

35 *Id.*

36 As one academic observed, "[i]t is an ironic feature of Delaware law that neither its corporation statute nor its case law says very much about the responsibilities of the most influential actors . . . in corporate affairs, i.e. executive officers." Lyman Johnson, *Dominance by Inaction: Delaware's Long Silence on Corporate Officers*, *in* CAN DELAWARE BE DETHRONED?: EVALUATING DELAWARE'S DOMINANCE OF CORPORATE LAW 182, 184 (Stephen M. Bainbridge et al., eds., 2017).

37 *See, e.g.*, Robert J. Rhee, *Corporate Ethics, Agency, and the Theory of the Firm*, 3 J. BUS. & TECH. L. 309, 312 n.20 (2008) (defining managers as directors and officers).

38 Managers may of course, in addition to their managerial role, serve on the board, but there is a difference between acts taken in their directorial capacity and their managerial capacity.

to, corporate officers. For their part, the DGCL and the Model Business Corporation Act (the "MBCA") refer to officers numerous times without elaborating in any detail on their functions.[39] In essence, both simply provide that corporations shall have officers with such titles and duties as stated in the corporation's bylaws or board resolutions.[40]

The only officer role that the DGCL and MBCA specifically describe is that of the secretary, whose function consists of keeping and maintaining certain records and the minutes of directors' and shareholders' meetings.[41] In practice, of course, most corporations choose to appoint several officers. Typically, "the CEO is the top of the hierarchy; the chief operating officer is the second-in-command and in charge of general operations; and the chief financial officer is primarily responsible for finances and financial risk."[42] These are the three principal officer roles, and the MBCA defines the individuals that serve in these roles, along with "any individual in charge of a principal business unit or function," as "senior executives."[43] However, it is not uncommon for corporations to appoint additional "chief officers" in a number of other fields of their business, such as information or privacy.[44]

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39 *See, e.g.*, DEL. CODE ANN., tit. 8, § 142(a) (2019); MODEL BUS. CORP. ACT §§ 8.40–8.41 (AM. BAR ASS'N 2016). As one commentator noted, the definition of "officer" tends to be "fluid and context-specific." Verity Winship, *Jurisdiction Over Corporate Officers and the Incoherence of Implied Consent*, 2013 U. ILL. L. REV. 1171, 1195–96 (2013). It seems clear, however, that the hallmark of an officer is decision-making power that relates to important aspects of the business. *See* Matthew T. Bodie, *Holacracy and the Law*, 42 DEL. J. CORP. L. 619, 620 (2018) ("officers . . . control the actual workings of the corporation.").

40 § 142(a); §§ 8.40–8.41. While the DGCL seems to assume that corporations will have officers—referring to them no less than 167 times—its § 142(d) also provides that "[a] failure to elect officers shall not dissolve or otherwise affect the corporation." DEL. CODE ANN., tit. 8, § 142(d). A Delaware corporation could therefore operate without any officers.

41 § 142(a); § 8.40(c).

42 Bodie, *supra* note 39, at 653.

43 MODEL BUS. CORP. ACT § 13.01(8) (AM. BAR ASS'N 2016).

44 Bodie, *supra* note 39, at 653.

Despite their sparse treatment in corporate statutes, the importance of managers is of course broadly recognized. Indeed, given that officers carry out important managerial responsibilities, they have a dominant role in corporate leadership and "exert[] immense power and influence over the corporation."[45] In defining managerial leadership in terms of more specific tasks, one can still refer to Peter Drucker's classic description of the "five basic operations in the work of a manager."[46] According to Drucker, managerial work focuses on the following areas: (1) setting goals and objectives—managers decide what needs to be done to reach them, and communicates them to the people whose performance is needed to attain them; (2) organization of work—managers analyze activities, decisions, and relations; classify and divide work into manageable activities and jobs; group units and jobs into organized structures; and select people for the management of units and for the jobs to be done; (3) motivation and communication—managers make teams out of those individuals who are responsible for various jobs, using the tools of communication in horizontal and vertical relations and through "people decisions" on pay, placement, and promotion; (4) measurement—managers establish targets and yardsticks; analyze, appraise, and interpret performance, and communicate the related meaning and outcomes to employees; (5) developing people—both in relation to others and themselves.[47]

To be sure, managerial tasks differ depending on the individual's specific job description, seniority within the organization, and the size and nature of the business they work for. For example, for officers who are the highest ranking managers of a corporation, typical tasks include "entering into ordinary business transactions, devising business strategies, setting business goals, managing risks, and generally working with subordinates to '[p]lan, direct, or coordinate operational

45 Megan Wischmeier Shaner, *Officer Accountability*, 32 GA. ST. U. L. REV. 357, 367 (2016).

46 PETER F. DRUCKER, MANAGEMENT: TASKS, RESPONSIBILITIES, PRACTICES 400 (1974).

47 *Id.*

activities.'"[48] Conversely, a lower-level, non-officer manager might be in charge of managing a smaller business division or branch, organizing work schedules, or focusing on customer relations, among other responsibilities.

Nevertheless, there are general categories of tasks that apply to managers across all hierarchical levels. In 2016, Accenture surveyed 1,770 managers from fourteen countries and seventeen different industries, which usefully described these categories.[49] The survey respondents included managers across all levels, from an organization's top management group to middle managers and front-line managers.[50] According to the survey, these managers spent 54% of their time on administrative coordination and control tasks; 30% on solving problems and collaborating; 10% on work involving strategy and innovation; and 7% on tasks relating to developing people and engaging with stakeholders.[51] These results, especially the insight that managers spend substantial amounts of time on coordination and control tasks, are important to keep in mind given the issue discussed in the next Section—the significance of the distinction between administrative tasks and judgment work when it comes to AI's potential roles in corporate management.

B. AI and Corporate Leadership

Having outlined the current tasks of corporate leadership, as exercised by directors and managers, this Section moves on to explore whether AI could assume these tasks. This Section starts by looking at potential roles that AI is capable of performing, with the distinguishing element between the various roles being the differing levels of AI autonomy. Next,

48 Lyman Johnson & Robert Ricca, *Reality Check on Officer Liability*, 67 BUS. L. 75, 78–79 (2011) (alteration in original) (footnotes omitted).

49 VEGARD KOLBJØRNSRUD ET AL., ACCENTURE INST. FOR HIGH PERFORMANCE, THE PROMISE OF ARTIFICIAL INTELLIGENCE: REDEFINING MANAGEMENT IN THE WORKFORCE OF THE FUTURE 6 (2016), https://www.accenture.com/_acnmedia/pdf32/ai_in_management_report.pdf#zoom=50 [https://perma.cc/YD22-ZWCB].

50 *Id.*

51 *Id.* at 5.

it discusses the vital distinction between administrative tasks and judgment work, including how corporate leadership tasks map onto this distinction, and what it means for assessing AI's future in corporate management. While there is little doubt that so-called "administrative" tasks will be exclusively carried out by computers in the future, researchers are divided over the question of whether humans can be replaced when it comes to tasks that involve judgment and emotional intelligence.[52] Nevertheless, this Section concludes that even in these areas the rise of AI is likely and that we are steering towards a future where "management by machine" will ultimately fully replace human directors and managers as business leaders.

1. Potential Roles for AI

Before assessing whether AI could take over corporate management functions, it is helpful to establish more generally what types of managerial roles AI technology can assume. In this respect, it is helpful to think of AI roles in reference to degrees of autonomy and proactivity. A broad system of categorization, which will also be employed in the following Section, distinguishes between three different types of AI roles. These roles are: (i) assisted AI; (ii) advisory AI; and (iii) autonomous AI.[53] While the boundaries between the three categories are fluid and overlap to an extent, this classification offers a useful starting point for our discussion.

Assisted AI. The first potential role of AI is that of an assistant. In this form, AI has either a low level or no autonomy, which also means that productivity gains are more limited compared to other types of AI roles. Assisted AI applications are also examples of what can be labelled "narrow AI" or "soft AI"—that is, systems that "can do a better job on

52 *See infra* Section II.B.2.

53 KOLBJØRNSRUD ET AL., *supra* note 49, at 17; ROBERT J. THOMAS ET AL., ACCENTURE INST. FOR HIGH PERFORMANCE, A MACHINE IN THE C-SUITE 2 (2016), https:// www.accenture.com/t00010101T000000Z__w__/br-pt/_acnmedia/PDF-13/Accenture-Strategy-WotF-Machine-CSuite.pdf [https://perma.cc/7ERF-NCEX].

a very specific range of tasks than humans can" but, because of their limitations, they "would never be mistaken for a human."[54] Importantly, while assisted AI may execute tasks on behalf of humans, it does not make any decisions itself.[55]

Examples of commonly used assisted AI systems are Apple's Siri and its Android rival, the Google Assistant, which can support users by carrying out tasks such as placing calls or composing text/email messages based on voice prompts; setting reminders and alarms; keeping track of appointments and schedules; turning on lights and playing music; or looking up information on the internet. Applied in a business context, assisted AI could take notes, compile work and meeting schedules, prepare reports, maintain scorecards, or fulfill help desk and customer service functions.[56] Depending on the level of complexity of these systems, they may also be close to or overlap with the next category of advisory AI.

Advisory AI. The second potential role of AI is advisory in nature. In this demanding role, AI can provide "support in more complex problem solving and decisionmaking situations by asking and answering questions as well as building scenarios and simulations."[57] Advisory AI has a heightened level of autonomy, which leads to increased productivity compared to assisted AI. Still, decisionmaking rights either

54 VIVEK WADHWA & ALEX SALKEVER, THE DRIVER IN THE DRIVERLESS CAR 38 (2017).

55 *See* Anand Rao, *AI Everywhere & Nowhere Part 3 – AI is AAAI (Assisted-Augmented-Autonomous Intelligence)*, PWC: NEXT IN TECH (May 20, 2016), https://usblogs.pwc.com/emerging-technology/ai-everywhere-nowhere-part-3-ai-is-aaai-assisted-augmented-autonomous-intelligence/ [https://perma.cc/EU94-9ZMF].

56 KOLBJØRNSRUD ET AL., *supra* note 49, at 17. Specifically for scheduling and project management, see the tools described in NILS J. NILSSON, THE QUEST FOR ARTIFICIAL INTELLIGENCE 509 (2010). The most advanced software in this respect appears to be the Aurora system, which is marketed as "the world's leading intelligent planning and scheduling software solution that utilizes advanced artificial intelligence" and being capable of "incorporating the judgment and experience of expert human schedulers." *Aurora*, STOTTLER HENKE, https://www.stottlerhenke.com/products/aurora [https://perma.cc/ZFD7-9TG5].

57 KOLBJØRNSRUD ET AL., *supra* note 49, at 17.

remain with human users or are at most shared between humans and machines.[58] Advisory AI is sometimes called "augmented intelligence."[59] The augmentation refers to a combination of artificial and human intelligence, in which AI does not replace human intelligence, but leverages or improves it by, for example, giving information and advice that would otherwise be unavailable or more difficult and time consuming to obtain.[60] Augmentation can also mean that "humans and machines learn from each other and redefine the breadth and depth of what they do together."[61]

A particularly salient example of augmented AI is IBM's Watson platform. Among other achievements, Watson is known for repeatedly beating two human champions at the game show "Jeopardy" in 2011.[62] Watson's use, of course, goes far beyond trivia and games. It excels in different environments at a multitude of serious tasks, including medical diagnosis, wealth management and financial advice, legal due diligence, and sales coaching.[63]

Autonomous AI. The third and most advanced role of AI is that of an *actor*. AI in this category can "proactively and autonomously evaluate options—making decisions or challenging the status quo."[64] Crucially, in contrast to the previous two categories, when it comes to autonomous AI "the decision rights are with the machine."[65] Today, perhaps the most prominent example of autonomous AI is the advent of the fully autonomous vehicle, whose emergence, according to companies such as Alphabet Inc.'s subsidiary Waymo, Tesla,

58 *See* Rao, *supra* note 55.

59 *Id*.

60 *See id*.

61 *Id*.

62 John Markoff, *Computer Wins on 'Jeopardy!': Trivial, It's Not*, N.Y. TIMES (Feb. 16, 2011), https://www.nytimes.com/2011/02/17/science/17jeopardy-watson.html? [https://perma.cc/D82S-Q4B2].

63 *See id*.; Conner Forrest, *IBM Watson: What Are Companies Using It for?*, ZDNET (Sept. 1, 2015), https://www.zdnet.com/article/ibm-watson-what-are-companies-using-it-for [https://perma.cc/XQ2H-N8LN].

64 KOLBJØRNSRUD ET AL., *supra* note 49, at 17.

65 Rao, *supra* note 55.

Uber, and others, will soon become reality.[66] In the corporate management context, there are already several specific autonomous AI applications in use. They perform tasks such as autonomous robotic trading of securities and handling of loan applications.[67] The use of such systems is not yet widespread, but are, according to an Accenture study on the promise of artificial intelligence, "increasingly becoming commonplace."[68]

2. Administrative Work vs. Judgment Work

The previous Section considered the types of *roles* that AI can assume with reference to the differing types of AI and their corresponding levels of autonomy and productivity. The present Section moves to consider the types of *tasks* that may be suitable for AI. An important distinction to keep in mind when thinking about whether AI can take over corporate management is between administrative work and judgment work.[69]

The Accenture study referred to above describes administrative work in the corporate management context as consisting of "[a]dministrative and routine tasks, such as

66 *See, e.g.,* Jeb Su, *Tesla Could Have Full Self-Driving Cars on the Road by 2019, Elon Musk Says*, FORBES (Nov. 7, 2018), https://www.forbes.com/sites/jeanbaptiste/2018/11/07/tesla-could-have-full-self-driving-cars-on-the-road-by-2019-elon-musk-says [https://perma.cc/JKD2-2Y4X].

67 Examples of existing AI-based software can be found in NILSSON, *supra* note 56, at 507–13 and KOLBJØRNSRUD ET AL., *supra* note 49, at 17. Particularly interesting is the description of a business intelligence tool whose "[c]onclusions are used to communicate policy, late-breaking business opportunities, and needs for action" which can trigger "automatic actions such as ordering, sending e-mails, and so on." NILSSON, *supra* note 56, at 510–11. On algorithmic trading, see for example Gregory Scopino, *Preparing Financial Regulation for the Second Machine Age: The Need for Oversight of Digital Intermediaries in the Futures Markets,* 2015 COLUM. BUS. L. REV. 439, 439 (2015); Tom C.W. Lin, *The New Investor*, 60 UCLA L. REV. 678, 687–693 (2013).

68 KOLBJØRNSRUD ET AL., *supra* note 49, at 17.

69 *See id.* at 3–4, 11–14.

scheduling, allocation of resources, and reporting."[70] Administrative work can be broadly contrasted with judgment work. For our purposes here, judgment work may be defined as work that requires creative, analytical, and strategic skills.[71] The Accenture study defines it as "the application of human experience and expertise to critical business decisions and practices when the information available is insufficient to suggest a successful course of action or [is not] reliable enough to suggest an obvious best course of action."[72] Judgment can be individual, but will often be collective, particularly in more complex situations. It may therefore involve teamwork and "specific interpersonal skills; namely, social networking, people development and coaching, and collaboration."[73] In line with the inclusion of interpersonal skills, emotional intelligence can be treated as a subcategory of judgment.[74]

As we have seen, non-director managers indicate that they spend more than 50% of their time on administrative tasks. The remaining non-administrative tasks, as per the Accenture study's definitional framework, consists of judgment work. These tasks pertain to problem solving and collaboration, strategy and innovation, and relations with individuals and stakeholders.

The situation of managers, who clearly spend considerable time on administrative tasks, contrasts with directors' focus. The bulk of directors' work falls into the category of judgment work (as defined in the Accenture study, tasks that require decisionmaking based on human experience and expertise due to insufficient data or information). More specifically, as a rough estimate based on the above-mentioned McKinsey

70 *Id*. at 4.

71 *See id*. at 11.

72 *Id*.

73 *Id*. at 13.

74 *See* Ajay Agrawal et al., *What to Expect from Artificial Intelligence*, MIT SLOAN MGMT. REV., Spring 2017, at 23, 26, http://ilp.mit.edu/media/news_articles/smr/2017/58311.pdf [https://perma.cc/9R8K-N7KT].

survey on board tasks, judgment work appears to make up at least 75% of directors' time and workload.[75]

The importance of the distinction between administrative and judgment work lies in the likelihood of the respective tasks being assumed by AI in the future. Based on their research and broad survey of managers, the authors of the Accenture study found that "artificial intelligence will soon be able to do the administrative tasks that consume much of managers' time faster, better, and at a lower cost"[76] and concluded that "AI will put an end to administrative management work."[77] The nascent literature on AI and management does not appear to challenge the idea that administrative work will be the exclusive domain of AI in the future.[78]

While the prospect of being relieved of administrative work may come as welcome news to many managers, the question then arises as to what role AI can play in the remaining managerial tasks that consist of non-administrative work. In this area, commentators have expressed widely diverging views on the future role of AI in management.

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75 Hirt, *supra* note 32, at 49. We assume that tasks pertaining to strategy, organizational structure, culture, talent management, and shareholder and stakeholder management consist of judgment work. Further, we assume that at least half of performance management, investments and M&A, core governance and compliance, and risk management tasks are judgment work as well. Adding the time spent on these tasks together suggests that judgment work makes up approximately 72% of overall board tasks.

76 Vegard Kolbjørnsrud et al., *How Artificial Intelligence Will Redefine Management*, HARV. BUS. REV. ONLINE (Nov. 2, 2016), https://hbr.org/2016/11/how-artificial-intelligence-will-redefine-management [https://perma.cc/2DSJ-UXFH].

77 KOLBJØRNSRUD ET AL., *supra* note 49, at 3. The study mentions tasks such as note taking, scheduling, reporting, maintaining scorecards, managing shift schedules, and generating investor statements and management reports as specific examples of AI-led administrative work. *Id.* at 4, 11, 17.

78 The literature reviewed for this section of the article explicitly or implicitly accepted the idea that administrative tasks will be dominated by AI and related new technologies.

A first group of commentators sees only a limited role for AI in judgment work. For instance, the Accenture study authors suggest that, apart from a limited number of specific applications, human managers in business will generally prevail in and increasingly focus on judgment work.[79] The study suggests that in the context of judgment work the role of AI will remain advisory in nature, with machines supporting and augmenting the work of human managers, but not taking on the role of independent actors.[80] It is this type of augmentation that the study suggests holds the greatest potential for AI-driven value creation.[81]

The Accenture study provides two examples to illustrate its view that human judgment cannot be replaced by AI. First, it notes that in the context of big data marketing and sales campaigns, "analytics-driven short-term results may come at the expense of long-term brand building [and] strategies . . . which cannot easily be suggested by data."[82] It is therefore up to human marketing executives, the study suggests, to "use judgment—combining analytics with their own and others' insight and experience, and by balancing short and long-term priorities."[83] Second, the study uses the example of evaluating job applications. It argues that even if AI systems "can measure and opine on a candidate's facial expressions, mannerisms and vocal inflections, they may not be able to assess that individual's compatibility with the attitudes and history of the company's existing workforce. These decisions

79 *See* KOLBJØRNSRUD ET AL., *supra* note 49, at 13–15.

80 *See id*. at 15.

81 *Id*. As one commentator suggested, there are three possible outcomes when thinking about the impact of machines on human employment. Robots and AI will (1) take almost all of the jobs, as they are better than humans at every task; (2) take some jobs but humans will remain dominant in positions such as those that are too complex or require emotional, social, or artistic skills; or (3) take none of the jobs in the sense that while certain jobs will be eliminated others will be created at roughly the same rate. *See* BYRON REESE, THE FOURTH AGE: SMART COMPUTERS, CONSCIOUS COMPUTERS, AND THE FUTURE OF HUMANITY 85–121 (2018). Reese believes that the third outcome is the most likely scenario. *Id*. at 98.

82 KOLBJØRNSRUD ET AL., *supra* note 49, at 11.

83 *Id.* (footnote omitted).

require human awareness of the organization's context and history."[84] For this reason, the study concludes that human managers will remain the ultimate decisionmakers when it comes to managerial tasks requiring judgment.

Another study, authored by Professors Agrawal, Gans and Goldfarb, begins by emphasizing AI's superiority in data gathering and prediction tasks.[85] Prediction in this context is understood as the ability to use acquired information or facts to anticipate future events (e.g., if a customer will default on a loan) and human actions (e.g., what a human driver would do in a given situation).[86] Prediction can also relate to present conditions, such as predicting a future medical condition by evaluating currently observable symptoms.[87] While AI excels at prediction, a different question is whether on this basis, beyond identifying probable occurrences, it can reliably *initiate* appropriate actions.

According to Agrawal and his co-authors, replicating human judgment is possible, but its feasibility depends on the necessary level of judgment involved in an action and the ease of defining desired outcomes in terms of "something a machine can understand."[88] While the authors make the point that in the coming years our understanding of human judgment will improve and become subject to increasing automation,[89] they nevertheless believe that a need for human judgment will prevail in certain situations and contexts.[90] They predict as likely "that organizations will have [a] continuing demand for people who can make responsible decisions (requiring ethical

84 *Id*.

85 *See* Agrawal et al., *supra* note 74, at 23–24. Indeed, it is commonly accepted that machines are better at data gathering and analysis than humans, suggesting that these areas will be dominated by AI. *See, e.g.*, Megan Beck & Barry Libert, *The Rise of AI Makes Emotional Intelligence More Important*, HARV. BUS. REV. ONLINE (Feb. 15, 2017), https://hbr.org/2017/02/the-rise-of-ai-makes-emotional-intelligence-more-important [https://perma.cc/A8Q6-LAXE].

86 *See* Agrawal et al., *supra* note 74, at 24.

87 *See id*.

88 *Id*.

89 *Id*.

90 *Id*. at 24–25.

judgment), engage customers and employees (requiring emotional intelligence), and identify new opportunities (requiring creativity)."[91] Finally, these authors also suggest that human judgment will be required when deciding how best to apply AI.[92] This presumably includes the decision of when we should rely on judgment by AI, although this decision itself will likely be supported by AI and its insights into the benefits of using it in a given situation.

Echoing the general sentiment of the Accenture study and the work of Agrawal and his coauthors, Beck and Libert have remarked that "[t]hose who want to stay relevant in their professions will need to focus on skills and capabilities that artificial intelligence has trouble replicating—understanding, motivating, and interacting with human beings."[93] They argue that although machines may be able to diagnose complex business problems and recommend actions to improve an organization, human beings are "still best suited to jobs like spurring [a] leadership team to action, avoiding political hot buttons, and identifying savvy individuals to lead change."[94] Beck and Libert have also identified areas of decision making where they believe AI performs better than humans. They note that "[a]rtificial intelligence for both strategic decisionmaking (capital allocation) and operating decisionmaking will come to be an essential competitive advantage, just like electricity was in the industrial revolution or enterprise resource planning software (ERP) was in the information age."[95] However, in Beck and Libert's view, AI in the boardroom "is not about automating leadership

91 *Id*. at 26.

92 *Id*.

93 Beck & Libert, *supra* note 85 ("A smart machine might be able to diagnose an illness and even recommend treatment better than a doctor. It takes a person, however, to sit with a patient, understand their life situation (finances, family, quality of life, etc.), and help determine what treatment plan is optimal.").

94 *Id*.

95 Barry Libert et al., *AI in the Boardroom: The Next Realm of Corporate Governance*, MIT SLOAN MGMT. REV. (Oct. 19, 2017), https://sloanreview.mit.edu/ article/ai-in-the-boardroom-the-next-realm-of-corporate-governance [https://perma.cc/AE98-DC8R].

and governance, but rather augmenting board intelligence."[96] This corresponds to the view of AI as an assistant and advisor, rather than a replacement, for the board.

Frey and Osborne also provide support for the view that managerial judgment work is not about to be replaced by machines. In a study examining over 700 occupations and their susceptibility to computerization,[97] Frey and Osborne found that around forty-seven percent of total US employment is in the high-risk category and "could be automated relatively soon, perhaps over the next decade or two."[98] The study suggests that generalist occupations requiring knowledge of human heuristics and specialist occupations involving the development of novel ideas and artifacts are the least susceptible to computerization.[99]

Specifically with regard to managers, Frey and Osborne noted that chief executives represent "a prototypical example of generalist work requiring a high degree of social intelligence," as evidenced by tasks such as "conferring with board members, organization officials, or staff members to discuss issues, coordinate activities, or resolve problems" and "negotiating or approving contracts or agreements."[100] Frey and Osborne thus predict "that most management, business, and finance occupations, which are intensive in generalist tasks requiring social intelligence" are at a low risk of being automated.[101] However, it is notable that Frey and Osborne's contemplated timeline is relatively short. They note that "occupations that involve complex perception and manipulation tasks, creative intelligence tasks, and social intelligence tasks are unlikely to be substituted by computer

96 *Id*.

97 *See* Carl Benedikt Frey & Michael A. Osborne, *The Future of Employment: How Susceptible Are Jobs to Computerisation?*, 114 TECHNOLOGICAL FORECASTING & SOC. CHANGE 254, 254 (2017).

98 *Id*. at 268.

99 *Id*. at 266.

100 *Id*.

101 *Id*.

capital *over the next decade or two*."[102] This suggests that beyond this timeframe their study does not exclude the possibility of such jobs, including management roles, becoming automated as well.

A contrast to the view that human judgment, including emotional intelligence, is at its core irreplaceable—leading to a future where AI and human managers would work together—is the vision of AI's complete replacement of management. The Accenture study notes that some managers are already questioning "whether the manager role as we know it will survive," with a large UK financial institution's Chief Information Officer recently opining that advances in technology may lead to a world where "we may not need managers."[103] Similarly, in a chapter on the rise of "robo-directors" and their corporate law implications, one academic opined that "technology will probably soon offer the possibility of artificial intelligence not only supporting directors, but even replacing them."[104]

Relevant work to our question of AI's potential future role in corporate management has also been produced by authors that specialize more generally in predictions about the future of humanity.[105] Some of these authors challenge the idea that there are certain areas or tasks at which humans will always outperform machines. In particular, several commentators believe that machines can be better than humans (or in some instances already are better) when it comes to judgment work.

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102 *Id*. at 262 (emphasis added). They note that it is in principle also possible to automate creative tasks, especially outside of the artistic-creative sector but rather in, for example, designing statistical data models. *See id*.; *see also* WADHWA & SALKEVER, *supra* note 54, at 38–39 (describing creative capabilities of AI in the areas of writing, music, poetry, and art).

103 KOLBJØRNSRUD ET AL., *supra* note 49, at 4.

104 Florian Möslein, *Robots in the Boardroom: Artificial Intelligence and Corporate Law*, *in* RESEARCH HANDBOOK ON THE LAW OF ARTIFICIAL INTELLIGENCE 649 (Woodrow Barfield & Ugo Pagallo eds., 2018).

105 For an overview of various high-profile thinkers' stance on the future of AI in general (beyond management and judgment work), see Spyros Makridakis, *The Forthcoming Artificial Intelligence (AI) Revolution: Its Impact on Society and Firms*, 90 FUTURES 46, 50–53 (2017) (distinguishing between optimists, pessimists, pragmatists, and doubters).

They predict the rise of emotionally intelligent AI, arguing that emotional intelligence is a function of "biological algorithms" that machines will be able to replicate.[106] Some commentators also expect the emergence of artificial general intelligence ("general AI"), which will match the intelligence of humans in all areas, or even superintelligent AI, which will far exceed human intelligence.[107]

Nick Bostrom, for instance, writes that for advanced forms of AI, all intellectual abilities will be within a system's reach, including cognitive modules and skills such as "empathy, political acumen, and any other powers stereotypically wanting in computer-like personalities."[108] Indeed, a "superintelligent" machine, a concept that Bostrom sees as potentially emerging in the future, would not only excel at typical computer skills, but also at tasks including strategizing (strategic planning, forecasting, prioritizing, analysis to optimize the chance of achieving distant goals), social manipulation (social and psychological modeling, manipulation, rhetoric persuasion), and economic activity.[109] These skills are of course also essential for corporate management and, if replicated by machines, would allow for the creation of autonomous artificial directors and managers.

106 *See* YUVAL NOAH HARARI, HOMO DEUS: A BRIEF HISTORY OF TOMORROW 83–86 (HarperCollins 2017) (2015).

107 On the concepts of artificial general intelligence and more advanced forms, see NICK BOSTROM, SUPERINTELLIGENCE: PATHS, DANGERS, STRATEGIES 22–29, 52–61 (2014).

108 *Id.* at 92. Tegmark similarly believes that intuition and creativity will be—and to some extent already have been—mastered by machines. MAX TEGMARK, LIFE 3.0: BEING HUMAN IN THE AGE OF ARTIFICIAL INTELLIGENCE 87–89 (2017). Nevertheless, Tegmark suggests that in the future, jobs requiring personal interactions, social intelligence, and creativity will likely be safer than others from being taken over by machines. *Id.* at 121–22.

109 *See* BOSTROM, *supra* note 107, at 94. Bostrom explores different possible paths to reach superintelligence—AI, whole brain emulation, biological cognition, and human-machine interfaces—and finds that "[the] existence of multiple paths increases the probability that the destination can be reached via at least one of them." *Id.* at 22.

Similarly, Michio Kaku suggests that the creation of "true automatons, robots that have the ability to make their own decisions requiring only minimal human intervention" is the next step in the evolution of AI and robotic technology.[110] While he notes that the state of automatons today is "primitive,"[111] he predicts that by the end of the century there will be self-aware robots, and even sooner, machines with innovative learning capabilities.[112] A subsequent phase, Kaku speculates, will bring "self-replicating automatons . . . and quantum-fueled conscious machines."[113]

Finally, Richard and Daniel Susskind argue that "people, practices, and institutions" belonging to what they refer to as "the professions" will be largely replaced in the future.[114] Although they do not comment specifically on managers, which are outside of their discrete definition of "a profession," they include "management consultants" as part of their analysis.[115] Nevertheless, their conclusion that AI, big data, robotics, and other technological developments will replace even highly qualified human professionals because machines will be able to carry out the full range of tasks of these roles[116] can be applied to the case of corporate managers as well.

Susskind and Susskind also describe the emerging field of affective computing, which allows sensor-equipped machines to detect, react to, and express human emotions.[117] As they explain, machines are already capable of performing these tasks and work in the field is only advancing.[118] In this vein,

110 MICHIO KAKU, THE FUTURE OF HUMANITY: OUR DESTINY IN THE UNIVERSE 114 (2018).

111 *Id*. at 136.

112 *Id*.

113 *Id*.

114 RICHARD SUSSKIND & DANIEL SUSSKIND, THE FUTURE OF THE PROFESSIONS: HOW TECHNOLOGY WILL TRANSFORM THE WORK OF HUMAN EXPERTS 18 (2015).

115 *See id.* at 15–16, 78–84. The other professions (or professionals) forming the authors' main focal point are doctors, lawyers, teachers, accountants, tax advisers, architects, journalists, and the clergy. *Id*. at 1.

116 *See id.* at 159–72.

117 *See id.* at 170–72.

118 *See id.*

Susskind and Susskind suggest that machines will be in a position to exhibit empathy, thus countering the views of those commentators that perceive the lack of such qualities as a major hurdle to the replacement of professionals by machines.[119] Susskind and Susskind posit that while cognitive tasks, affective tasks, and moral judgment will be more difficult to automize than other tasks, machines will master them in the long run, leaving little space for human professionals.[120] In several decades, these authors conclude, the mastery of judgment work by machines will erode the number of jobs available to human professionals. The final result of this, they suggest, will be "technological unemployment" in the professions.[121]

C. Assessment

Will AI be able to take over the tasks of human corporate directors and managers? It seems uncontroversial to answer this question in the positive with reference to administrative tasks, an area where, based on our daily experiences with virtual assistants, many people will have little difficulty imagining software in control. If administration remained the only area in which machines took over, we would see human managers and AI work together, with AI ultimately improving human productivity and decisionmaking quality. Nobody can predict with certainty, however, whether AI's involvement in the future will also extend to the crucial area of judgment work. If AI is able to dominate that domain as well, it could lead to a world where machines, not humans, dominate corporate management.

While acknowledging the uncertainties in making predictions, it is more difficult to believe that humans will always maintain their superiority in completing judgment work than imagining a future in which machines excel at these tasks as well. Eventually, AI—coupled with big data, increasingly powerful computing devices that will soon exceed

119 *See id.* at 251–52.

120 *See id.* at 279–81.

121 *Id.* at 290–92.

human brain power,[122] and technologies such as voice, facial expression, and gesture recognition—will appear to have all the tools in place to become much better at managing and manipulating human responses than humans themselves.[123]

In contexts like emerging self-driving car technology, we already see AI judgment at work. The autonomous vehicle's decision to break or not, for example, combines data gathering and analysis, prediction, judgment, and action.[124] Of course, even this seemingly less complex judgment task can be difficult and even involve philosophical and legal conundrums, such as what course of action the machine should take when every possible option involves the loss of lives or other harmful consequences to third parties.[125] Still, as algorithms can be fed any and all information that is available to humans, they should be able to exercise judgment that at least matches, and likely even exceeds, human judgment.

If AI masters judgment work, it will also be able to engage in the various non-administrative tasks currently performed by corporate directors and managers. Although it seems alien to us, the literature outlined above indicates that the hurdles in realizing AI capable of performing judgment work are not insurmountable. AI that effectively interacts with employees and external stakeholders, including investors, governments, suppliers, customers, and communities, will, if these hurdles are cleared, become reality. While we may intuitively assume that machines are worse at such judgment-related tasks than

122 Researchers project that silicon-based computer chips in laptops will match the power of a human brain in the early 2020s and that by 2023 even smartphones will have more computing power than our brains. *See* WADHWA & SALKEVER, *supra* note 54, at 15–16.

123 *See* Mikko Alasaarela, *The Rise of Emotionally Intelligent AI*, MACHINE LEARNINGS (October 9, 2017), https://machinelearnings.co/the-rise-of-emotionally-intelligent-ai-fb9a814a630e [https://perma.cc/V8HV-BGJB].

124 *See* Agrawal et al., *supra* note 74, at 24.

125 *See, e.g.*, Amy Maxmen, *Self-Driving Car Dilemmas Reveal that Moral Choices Are Not Universal*, NATURE (Oct. 24, 2018), https://www.nature.com/articles/d41586-018-07135-0 [https://perma.cc/84RH-A8N4].

humans, there is support for the notion that machines will eventually exceed human capabilities in areas requiring "soft skills."[126]

It is further incorrect to assume that replacing managerial jobs is necessarily more difficult than lower paid jobs that are thought to require a more basic skillset. While that hypothesis may be true generally, it is not always the case. One author has provided an illustrative example to support this point. "From a robot's point of view," Byron Reese queried, "which of these jobs requires more skill: a waiter or a highly trained cardiologist who interprets CT scans?" [127] The answer is that the waiter's job is more challenging for robots. The waiter has to master "hundreds of skills, from spotting rancid meat to cleaning up baby vomit. But because we take all those things for granted, we don't think they are all that hard. To a robot, the radiologist job is by comparison a cakewalk. It is just data in, probabilities out."[128] Using a variation of Reese's example, we could ask: what is more difficult for a machine, assuming the role of a waiter, or a corporate manager? If we follow Reese's logic, managerial tasks, which also often involve data analysis, might well be easier to automate.

To be sure, the emergence of general AI and, as a next step, perhaps even superintelligent AI, is far from imminent and may not be achieved at all. However, neither type is the level of AI that is necessarily needed for effective corporate management by machines. In several specific areas AI already outperforms human intelligence, and a combination of different systems currently in use, appropriately improved, could be enough to replace managers and directors before the advent of general AI.

Even if more advanced AI systems are a precondition for corporate management by machines, the emergence of such technologies may be much closer than we assume. According to Tegmark, leading AI experts are divided on the timeframe for an emergence of superhuman artificial general

126 *See supra* notes 106–21 and accompanying text.

127 REESE, *supra* note 81, at 107.

128 *Id*.

intelligence, with "most of them making estimates ranging from decades to centuries[,] and some even guessing [it will] never [emerge]."[129] Bostrom notes that "today, futurists who concern themselves with the possibility of artificial general intelligence still often believe that intelligent machines are a couple of decades away."[130] However, in a striking account, Bostrom and Müller relate the results of a 2013 survey conducted among 170 industry experts. In this survey, "[t]he median estimate of respondents was for a one in two chance that high-level machine intelligence will be developed around 2040-2050, rising to a nine in ten chance by 2075."[131] Further, the survey showed that "[e]xperts expect that systems will move on to superintelligence in less than 30 years thereafter."[132] If these experts are correct, highly advanced AI could be a reality in 20 to 30 years, and enormous changes would thereby soon be upon us.

III. CONSEQUENCES OF AI MANAGEMENT

The previous Part has argued that "management by machine" is possible—that is, a future in which AI will be capable of and will be used for carrying out the tasks that today are entrusted to human directors and managers. To be sure, there are many uncertainties: in addition to technological issues outlined above, it is not clear whether legislators will allow "AI management," or whether human corporate promoters will be willing to appoint machines to managerial positions. Nevertheless, this Part proceeds on the assumption that AI management will indeed become a reality and, on this basis, explores the potential corporate governance consequences thereof. In doing so, the following Sections will focus on the governance/leadership structures within

129 TEGMARK, *supra* note 108, at 130.

130 BOSTROM, *supra* note 107, at 4 (footnote omitted).

131 Vincent C. Müller & Nick Bostrom, *Future Progress in Artificial Intelligence: A Survey of Expert Opinion*, *in* FUNDAMENTAL ISSUES OF ARTIFICIAL INTELLIGENCE 1 (Vincent C. Müller, ed., 2016).

132 *Id*. For a summary of similar surveys, see also Makridakis, *supra* note 105, at 52.

corporations; the impact of AI on directors' and officers' personal liability; AI-related consequences pertaining to the corporate purpose; and the emergence of algorithmic and leaderless entities. The discussion hypothesizes that a radically different framework of corporate management lies ahead.

A. Corporate Boards

1. Boards Today

A fundamental feature of today's board is its prevailing structure as a governance entity consisting of (1) *individual* human actors (as opposed to legal entities) that (2) work as a *collective* body or team. Both elements are, as the subsequent Section will show, in contradiction to what boards will likely look like in a future dominated by AI.

The first fundamental feature of modern boards is a result of the fact that corporate laws typically preclude non-human actors from sitting on boards. Only natural persons are allowed to serve as directors of a corporation in all U.S. states and "most other major capitalist economies."[133] For their part, both the DGCL and the MBCA provide that every director needs to be a "natural person,"[134] which precludes artificial persons from serving as board members.[135] This long-standing restriction is aimed specifically at preventing legal entities and business associations from acting as board members.[136] An exception to this general rule was traditionally found in U.K. company law, which allowed legal entities to use

133 Bainbridge, *supra* note 22, at 67 (providing references to other U.S. states and Australia, Canada, and New Zealand, which all ban non-natural persons from serving as directors).

134 DEL. CODE ANN., tit. 8, § 141(a) (2018); MODEL BUS. CORP. ACT § 8.03(a) (AM. BAR ASS'N 2016).

135 Bainbridge, *supra* note 22, at 67 n.3.

136 *See* Shawn J. Bayern, *The Implications of Modern Business Entity Law for the Regulation of Autonomous Systems*, 19 STAN. TECH. L. REV. 93, 98 (2015) (noting that the restriction probably stems from an interest to provide "clarity in decision making and of corporate structure").

"corporate directors," the British term for legal person directors, alongside at least one human director.[137] However, this exception is set to disappear, with the U.K. set to join the U.S. and other jurisdictions in barring non-natural persons from board service.[138]

In contrast to the requirement that boards consist of humans, the second element characterizing today's boards, that corporate powers are conferred upon a group, is a matter of choice and practice—not necessarily a legal requirement. Both Delaware law and the MBCA now provide that boards may consist of one or more members, thereby leaving open the possibility of one-person boards.[139] In contrast, corporate law in the United Kingdom requires public companies to have at least two directors.[140] Legal requirements notwithstanding, however, larger companies in both the U.S. and U.K. normally choose to have multi-member boards, which, in turn, also form various multi-member committees. The assumption that boards are comprised of several members is also reflected in stock exchange rules, such as the NYSE Listed Company Manual, which are specifically geared towards large boards.[141]

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137 Section 155(1) of the UK Companies Act 2006 provides that "[a] company must have at least one director who is a natural person." Companies Act 2006, c. 46, § 155(1) (UK). On this, see Bainbridge, *supra* note 22, at 69–70 (noting also that in view of stock exchange listing rules the use of corporate directors under this provision of the Act seems to be limited to non-public, small companies).

138 A new (but not yet effective) statute provides that, subject to certain exceptions, as a general rule directors must be natural persons. *See* Small Business Enterprise and Employment Act 2015, c. 26, § 87(4) (UK). For further background on the enactment of this provision, see Bainbridge, *supra* note 22, at 70–71. At the time of writing, it was not clear when the new U.K. rules on corporate directors might enter into force.

139 *See* DEL. CODE ANN., tit. 8, § 141(b); *see also* § 8.03. Previously, statutory requirements mandating a minimum of three directors were common, but these have today largely disappeared today. *See* Stephen M. Bainbridge, *Why a Board? Group Decision Making in Corporate Governance*, 55 VAND. L. REV. 1, 42 (2002).

140 *See* Companies Act 2006, c. 46 § 154 (UK).

141 As Bainbridge and Henderson note, U.S. stock exchange rules and federal law such as rules implemented by the Sarbanes-Oxley Act and the

To be sure, using a one-person board, with just one decisionmaker, would offer a number of advantages. Giving a single individual ultimate power over a company would offer enhanced decisionmaking efficiency compared to consensus-based processes; circumvent difficulties in monitoring the performance of individual directors and their contributions in multi-member boards; and eradicate potential problems stemming from group dynamics between individual team members.[142]

Yet the preference in practice for collective corporate boards is justified.[143] There are various reasons dictating the superiority of collective boards and why a team structure will, on balance, tend to result in more rational, higher quality decisions. First, an important cause is the enhanced access to information by groups, which also translates into an improved ability to overcome impediments to optimal decisionmaking due to cognitive and other human limitations ("bounded rationality").[144] That is, when forced to make decisions under complex and uncertain conditions, groups especially benefit from the combined inputs of their members in terms of knowledge and skills, which also has the positive effect of reducing individual biases.[145] Further, the collective board model is useful for addressing agency costs within a board, as a team of directors can monitor each other and their internal decisionmaking.[146] Finally, having multiple board members and the option to delegate tasks to specific members or specialized board committees is suitable for dealing with the

Dodd Frank Act implicitly assume that directors are natural persons. *See* Bainbridge & Henderson, *supra* note 27, at 1100–01.

142 *See* Bainbridge, *supra* note 139, at 12–41.

143 *See id.* (providing a detailed account of advantages of group decision-making).

144 *See id.* at 19–26 (explaining that humans have limited memory, computational skills, and other mental skills resulting in "bounded rationality").

145 *See id.* at 21 (arguing that group decisionmaking is an adaptive response to "bounded rationality").

146 *See id.* at 32–41.

complex challenges and increasing workload faced by today's directors.[147]

While collective boards are overall more beneficial than relying on a sole actor/director, it is also true that decisionmaking processes by human collectives create certain negative dynamics. Putting a group in charge of a company, as opposed to a single individual, may lead to difficulties in monitoring and measuring individual team members' performance, can cause problems that flow from the complexities of interpersonal team dynamics, and creates a potential for free-riding on the efforts of others by certain group members.[148] Moreover, a particular concern related to decisionmaking in teams is the social-psychological problem of "groupthink," where a collective's preference for maintaining harmony and conformity within its group leads to irrational or dysfunctional decisions.[149]

In light of these challenges to the model of the collective board, countervailing board governance practices have been developed. Two particularly significant of these measures are the independent director model and—more recently—a focus on board diversity. Indeed, the currently prevailing monitoring board model favors *independent* directors as a way to improve oversight and reduce agency costs.[150] Independent directors are expected to be better suited to act as impartial monitors as compared to insiders who may be conflicted or simply lacking an objective view of the companies they are an

147 *See id*. at 12–41.

148 *See id*. at 28, 40.

149 *Id*. at 32 (footnote omitted) ("Highly cohesive groups . . . value consensus more than they do a realistic appraisal of alternatives. In such groups, groupthink is an adaptive response to the stresses generated by challenges to group solidarity. To avoid those stresses, groups may strive for unanimity even at the expense of quality decision making.").

150 *See generally* Jeffrey N. Gordon, *The Rise of Independent Directors in the United States, 1950-2005: Of Shareholder Value and Stock Market Prices*, 59 STAN. L. REV. 1465 (2007). Independent directors are individuals that have no employment status or personal and other affiliations to the corporation. *See* Sanjai Bhagat & Bernard Black, *The Uncertain Relationship Between Board Composition and Firm Performance*, 54 BUS. L. 921, 923 (1999).

insider of.[151] U.S. listed companies are now required to have a majority of independent directors on their boards and need to establish certain committees that are comprised only of independent directors.[152] Similar rules apply in the U.K., where the Corporate Governance Code provides that "[t]he board should include an appropriate combination of executive and non-executive (and, in particular, independent non-executive) directors, such that no one individual or small group of individuals dominates the board's decision-making"[153] and requires that "at least half the board, excluding the chair, should be non-executive directors that the board regards as independent."[154]

In addition to the independence of a board's directors, another factor to consider is the diversity of its members. The value of board diversity is thought to be supported by the idea that different leadership experiences and variations in gender, ethnicity, race, nationality and socio-economic backgrounds can provide effective means to tackle complacency, generate new ideas, and result in better risk management.[155] This suggests that the reason for advancing board diversity is—as in the case of board independence—primarily economic in nature, as better decisionmaking will lead to better financial outcomes for companies. Indeed, this "business case" has been the main argument advanced by policymakers in support of increased diversity, although diversity initiatives may also serve non-financial interests,

151 *See generally* Gordon, *supra* note 150, at 1471.

152 *See* NYSE Listed Company Manual, §§ 303A.01–303A.07 (2002).

153 FINANCIAL REPORTING COUNCIL, THE UK CORPORATE GOVERNANCE CODE 6 (July 2018), https://www.frc.org.uk/getattachment/88bd8c45-50ea-4841-95b0-d2f4f48069a2/2018-UK-Corporate-Governance-Code-FINAL.PDF [https://perma.cc/6EFM-Q2CW] (citing to Principle 2(G) and Provision 9).

154 *Id*. at 9 (quoting Principle 2, Provision 11). Further provisions of the UK Corporate Governance Code call for fully independent or majority independent board committees.

155 *See* MOORE & PETRIN, *supra* note 21, at 189.

including concerns surrounding societal equality.[156] While recent regulatory initiatives have tended to focus on one specific aspect of diversity, namely, female board representation,[157] some policies have targeted diversity more broadly. For example, the UK Corporate Governance Code provides that board appointments and succession plans should, among other considerations, promote gender diversity, as well as diversity of social and ethnic backgrounds.[158]

2. Boards Tomorrow

The previous Section outlined the familiar characteristics of today's boards that vest ultimate monitoring responsibilities and decisionmaking powers in a human collective with certain built-in checks designed to mitigate agency costs and weaknesses of team decisionmaking. Still, the board's traditional structure will likely become superfluous in an age of AI dominated corporate governance. First, the multi-member board is set to vanish once AI is able to replicate the benefits of group decisionmaking by humans and exceed both the speed and quality of decisions made by human teams. Presumably, this development will in due course steer policymakers towards introducing legal reforms concerning board composition and appointments, allowing businesses to shift to AI boards and management.

With the advent of advanced AI capable of assuming board functions, we should first expect to see boards shrink in size. Second, we should expect to see what can be called "fused

156 *See* Barnali Choudhury, *New Rationales for Women on Boards*, 34 OXFORD J. LEGAL STUD. 511, 512 (2014) (arguing that board diversity is supported on both economic/business and equality grounds).

157 In the U.K., for instance, following amendments influenced by EU requirements, boards of companies are generally required to compile a strategic report that contains information including the female representation on the board and other hierarchical levels within the company. *See* The Companies Act 2006 (Strategic Report and Directors' Report) Regulations 2013, SI 2013/1970, § 414C (UK).

158 *See* FINANCIAL REPORTING COUNCIL, *supra* note 153, at 8 (referencing Principle 3(J)).

boards." The term "fused" indicates that the characteristics of multiple members will be merged in and offered by a single entity, the "AI director." Thus, the combined knowledge and skills, benefits of group-decisionmaking, and characteristics such as diversity and independence, which previously could only be offered by a collective, will be replicated in fused boards through an algorithm's coding features. This AI director software could still be selected and "appointed" by shareholders, with an option to switch to another software system at regular intervals.

Recall that boards consisting of groups are, overall, beneficial because group structures improve access to information, mitigate the effects of bounded rationality, and counter individual biases. Groups are also thought to be useful as its members can monitor each other and reduce agency costs within the board itself. Finally, groups allow for the delegation of responsibilities and help alleviate excessive workloads on individual directors.[159] These reasons for adherence to the collective model of boards will, however, likely cease with the advent of sufficiently advanced AI.

First, given the prevalence of online information, access to publicly available information will be comprehensive and virtually instant for AI systems. Indeed, information for today's boards is already often collected and made available using IT systems—namely through internet portals, intranet solutions, electronic communication, and customized executive information systems.[160] Thus, the next step towards creating direct feeds of this information to an artificial director seems natural. While such information feeds would cover publicly available information and non-public intra-company information, it remains a question as to how an artificial director could gain access to non-public external information or knowledge that human directors may gather

159 *See supra* Section II.A.1.

160 W. Bradley Zehner II, *What Directors Need to Know*, GRAZIADIO BUS. REV., Aug. 2010, at 1, 4, https://gbr.pepperdine.edu/2010/08/what-directors-need-to-know [https://perma.cc/J2UZ-BHLZ] ("A carefully designed [web] portal can become the primary information source for a director or executive.").

through their work on other boards or personal contacts. Although it may be difficult to gain access to such information for non-humans, it is not impossible. If AI software by leading providers could be used by (or "sit" on) a large number of boards, there would be scope allowing for arrangements that grant the software permission to cross-use certain data between different businesses. Similar to human directors with their own networks and sources of information, an AI director could then leverage the insights gained from "working" at multiple firms—perhaps tens of thousands of them as opposed to just a few in the case of a human director.

Indeed, a future in which AI director/AI management software will be offered by large commercial providers could help harness and amplify the advantages described by Professors Bainbridge and Henderson of allowing specialized entities to act as directors.[161] In their model, companies would replace individual directors with a single Board Service Provider ("BSP"), an entity which would then carry out all corporate board functions.[162] These BSPs would arguably be well placed to avoid problems typically affecting individual directors, including time constraints, biases and cognitive limitations, group think, bounded rationality, lack of specialized knowledge, and motivational issues.[163] A similar reasoning can be applied to AI directors. AI software could work around the clock, efficiently process information made available to it, recall and utilize this information almost instantly, and exercise its functions without asking to be

161 *See* Bainbridge & Henderson, *supra* note 27, at 1056.

162 *Id*.; *see also* Stephen M. Bainbridge & M. Todd Henderson, OUTSOURCING THE BOARD 193 (2018) (further detailing and developing the BSP model).

163 Bainbridge & Henderson, *supra* note 27, at 1064–68 (describing these issues); Bainbridge & Henderson, *supra* note 162, at 190–202 (discussing the "post-monitoring" board and the idea of the "thickly informed board," that is, the notion that modern boards should be far more informed than it is the case today in order to better exercise its functions). On the thickly informed board, see Ronald J. Gilson & Jeffrey N. Gordon, *Board 3.0—An Introduction*, 74 BUS. L. 351, 361–63 (2019) (making the case for a new model of highly informed, more motivated, and better resourced directors).

personally compensated (although its services would not be free). Further, presuming that AI will operate without self-interest, there is also no need to have multiple directors monitor each other in order to mitigate the effects of conflicted human behavior.

At least theoretically, AI software could also be free from biases. Frey and Osborne have noted that "[c]omputerisation of cognitive tasks is . . . aided by another core comparative advantage of algorithms: their absence of some human biases" and suggested "that many roles involving decisionmaking will benefit from impartial algorithmic solutions."[164] As they explain, occupations that require "subtle judgement" are increasingly susceptible to computerization as "the unbiased decision making of an algorithm represents a comparative advantage over human operators."[165] Given these qualities, Frey and Osborne suggest that in addition to simply providing algorithmic recommendations to human operators, eventually "algorithms will themselves be responsible for appropriate decisionmaking."[166]

Yet, AI is only as good as its inputs and programming. As long as software is programmed by humans, it is vulnerable to our inherent biases.[167] Indeed, recent developments in areas ranging from computerized hiring processes to the selection of neighborhoods for same day retail delivery and decisions on Medicaid payments have highlighted the problem of biased AI decisions.[168] Thus, biases and other limitations

164 Frey & Osborne, *supra* note 97, at 259.

165 *Id*. at 260.

166 *Id*.

167 *See, e.g*., Anjanette H. Raymond et al., *Building a Better Hal 9000: Algorithms, the Market, and the Need to Prevent the Engraining of Bias*, 15 NW. J. TECH. & INTELL. PROP. 215, 223 (2018) (discussing various types of algorithmic biases and their impacts).

168 *See* Madhumita Murgia, *How to Stop Computers Being Biased*, FIN. TIMES (Feb. 13, 2019), https://www.ft.com/content/12dcd0f4-2ec8-11e9-8744-e7016697f225 (on file with the *Columbia Business Law Review*) (discussing a discontinued pilot program for hiring at Amazon and Idaho's failed Medicaid computer program); *see also* Sian Bradley, *All The Creepy, Crazy and Amazing Things That Happened in AI in 2017*, WIRED (Dec. 20, 2017), https://www.wired.co.uk/article/what-happened-in-ai-in-2017

observed in humans will not automatically be eradicated through the use of AI in corporate management. Nevertheless, AI undeniably has the potential to reduce biases. As noted above, AI offers a promising potential in that it could be designed to be completely unbiased and lead to increased objectivity in decisionmaking.[169]

B. Corporate Management

Fused boards may be the beginning, but they will hardly be the last step in the evolution of corporate leadership. AI will likely also lead to the "fused management" of companies.

[https://perma.cc/3A5A-LFL3] (providing examples of bias in AI); Tim Hartford, *Expect Mischief as Algorithms Proliferate*, FIN. TIMES (Feb. 22, 2019), https://www.ft.com/content/3b9977a0-35c5-11e9-bb0c-42459962a81 (on file with *Columbia Business Law Review*) (discussing how algorithms can magnify human errors and even be "conspiring against us").

169 *See* Assaf Hamdani et al., *Technological Progress and the Future of the Corporation*, 6 J. BRITISH ACAD. 215, 229 (2018) (opining that "AI algorithms may become better on average at making governance decisions than individuals due to their superior ability to process information, freedom from biases, and lack of side interests"); *see also* John Armour & Horst Eidenmüller, *Self-Driving Corporations?* 6, 25–28 (Eur. Corp. Governance Inst., Law Working Paper No. 475/2019, 2019), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3442447 [https://perma.cc/AT24-9GJD] (suggesting that future AI technology may permit humans to be replaced at the apex of corporate decision-making and that this will happen first in subsidiaries that perform limited corporate functions); Christopher M. Bruner, Distributed Ledgers, Artificial Intelligence, and the Purpose of the Corporation 10–11 (2019) (unpublished manuscript) (on file with the *Columbia Business Law Review*) (stating that new technologies may reduce the need for human decision-making for a wide range of board-level tasks); *but see* Luca Enriques & Dirk A. Zetsche, *Corporate Technologies and the Tech Nirvana Fallacy* 30 (Eur. Corp. Governance Inst., Law Working Paper No. 457, 2019), https://ssrn.com/abstract=3392321[https://perma.cc/4UJF-L5ES] (arguing that it is unlikely that new technologies will replace existing corporate governance mechanisms). Specifically on AI-management, Enriques and Zetsche opine that "[i]n sharp contrast with tech proponents' predictions . . . the idea that CorpTech can make better board-level decisions than humanpopulated boards rests on an optimistic assessment of what technology can do and an overly simplistic view of a board's functions." *Id.* at 30.

This second type of fusion refers to the amalgamation of boards and managers, resulting in the abolishment of the two-tiered structure of governance of the modern corporation. In its place, an all encompassing "corporate management" body could emerge. This body would assume all of the functions of today's directors and managers below the board level, but would operate without the separation between these two groups.

The reasons supporting the likely emergence of fused management are principally that properly programmed corporate management AI software will entail no or drastically reduced agency costs,[170] thus making one of the board's main functions—to monitor or supervise managers—far less important or completely obsolete. In addition, AI will not be subject to time restrictions, enabling it to carry out both boards' traditional functions *and* the day-to-day managerial tasks that boards now delegate to managers. AI software will also not need to liaise with or appoint and terminate itself (as boards currently do with members of the management team) if it, as a single unit, is in charge of managing the business.

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170 *See* John Armour et al., *Putting Technology to Good Use for Society: The Role of Corporate, Competition and Tax Law*, 6 J. BRITISH ACAD. 285, 298 (2018) ("Digitalisation will permit more effective monitoring via a wider range of employee and manager performance measurement tools. In the medium to long run, the deployment of artificial intelligence raises the prospect of a significant reduction in agency costs within firms." (internal quotation marks omitted)); *see also* Hamdani et al., *supra* note 169, at 229 (noting that machine learning and other new technologies may result in greatly reduced corporate agency costs); Akshaya Kamalnath, *The Perennial Quest for Board Independence–Artificial Intelligence to the Rescue?* ALBANY L. REV. (forthcoming), https://ssrn.com/abstract=3360349 [https://perma.cc/9DYK-Q265] (discussing AI's potential to enhance board independence by reducing agency costs). *But cf.* Enriques & Zetsche, *supra* note 169, at 58 (arguing that technology will not resolve intracorporate agency problems as long as—potentially conflicted—humans control its usage); Alan J. Dignam, *Artificial Intelligence: The Very Human Dangers of Dysfunctional Design and Autocratic Corporate Governance* 3 (Queen Mary Sch. of Law, Legal Studies Research Paper No. 314, 2019), https://ssrn.com/abstract=3382342 [https://perma.cc/E6ZN-3QHY] (discussing problems related to flawed human design and implementation of AI in corporate decisionmaking).

With fused corporate management, functions including today's appointment of directors, hiring and firing of management, and voice on executive remuneration would be broadly mirrored in the shareholders' powers to choose a suitable AI management software package for their company. In doing so, shareholders would have to take into account the software's features, its managerial characteristics, and the overall pricing associated with the package. In this respect, different types of and different options for AI management software could emerge, perhaps delineated in terms of their risk-aversion and the corporate purpose(s) that the software is designed to pursue.[171]

C. Directors' and Officers' Liability

1. Liability Today

Individual duties are the basis for today's personal liability regime for those in charge of corporate leadership. Directors owe their company and, secondarily, their shareholders, the fiduciary duties of care and loyalty in discharging their functions.[172] In essence, this means that directors are required to act in a competent manner and be loyal to their company. Corporate fiduciary duties often tend to be discussed with specific reference to directors (an approach that this Section will also mostly adhere to), as opposed to officers. Nevertheless, the duties of corporate officers are said to be identical with,[173] or at least very similar to, those of directors,

171 For more on the corporate purpose, see *infra* Section IV.D.

172 *See* Mills Acquisition Co. v. Macmillan, Inc., 559 A.2d 1261, 1280 (Del. 1989). On the content of these duties, see, for example, 1 R. FRANKLIN BALOTTI & JESSE A. FINKELSTEIN, DELAWARE LAW OF CORPORATIONS & BUSINESS ORGANIZATIONS §§ 4.14–4.16 (3d ed. 2019).

173 *See* Gantler v. Stephens, 965 A.2d 695, 708–09 (Del. 2009) (en banc) (clarifying that the fiduciary duties of officers of Delaware corporations are the same as those of directors); Amalgamated Bank v. Yahoo! Inc., 132 A.3d 752, 780 (Del. Ch. 2016). For further background, see Michael Follett, Gantler v. Stephens*: Big Epiphany or Big Failure? A Look at the Current State of Officers' Fiduciary Duties and Advice for Potential Protection*, 35 DEL. J. CORP. L. 563 (2010); MARK A. SARGENT & DENNIS R. HONABACH, D&O

albeit they are generally considered to be more particularized. Officers are also subject to certain additional duties stemming from the general law of agency.[174] In addition to the system of corporate fiduciary duties, officers can also be held personally liable for their misconduct through the channel of securities fraud litigation.[175] This Section, however, will focus solely on fiduciary duty liability.

The *duty of care* applies to two broad categories – the process of decision making and in boards' exercise of their duties. In the words of Balotti and Finkelstein, "[f]irst, directors must exercise the requisite degree of care in the process of decision-making and act on an informed basis. Second, directors must also exercise due care in the other aspects of their responsibilities, including their delegation functions."[176] The traditional approach to describing the standard of care expected from directors is by way of reference to behavior displayed by other individuals in their position. For example, the Delaware Chancery Court has stated that "directors of a corporation in managing the corporate affairs are bound to use that amount of care which ordinarily careful and prudent men would use in similar circumstances."[177] In Delaware, however, only conduct that amounts to "gross negligence" will give rise to a violation of the duty of care.[178]

It is also helpful to examine the standard of care applicable to directors in conjunction with the business judgment rule. Although the business judgment rule is more convincingly

LIABILITY HANDBOOK § I:15 (2018) (summarizing officers' liability for fiduciary duty breaches and the applicability of the business judgment rule to their actions).

174 *See* Deborah A. DeMott, *Corporate Officers as Agents*, 74 WASH. & LEE L. REV. 847, 848 (2017).

175 *See, e.g.,* Robert B. Thompson & Hillary A. Sale, *Securities Fraud as Corporate Governance: Reflections upon Federalism*, 56 VAND. L. REV. 859, 860–61 (2003).

176 BALOTTI & FINKELSTEIN, *supra* note 172, at § 4.15 (footnote omitted).

177 Graham v. Allis-Chambers Mfg. Co., 188 A.2d 125, 130 (Del. Ch. 1963).

178 *See* Stone v. Ritter, 911 A.2d 362, 369 (Del. 2006); *see also* McMullin v. Beran, 765 A.2d 910, 921 (Del. 2000) ("Director liability for breaching the duty of care 'is predicated upon concepts of gross negligence.'").

viewed as a standard of judicial review rather than a standard of care,[179] the rule is, in practice, inextricably linked to what courts perceive as proper directorial conduct. That is, in making a business decision directors need to act "on an informed basis, in good faith, and in the honest belief that the action taken was in the best interests of the company."[180] Boards also need to allow sufficient time to prepare and engage critically with the information made available to them.[181] Nevertheless, as a Delaware law treatise notes, in formulating the standard of care expected from directors "[t]here are no hornbook bright lines or litmus tests to make counseling easy. Each case will depend on the procedural setting and all the facts."[182]

The *duty of loyalty* addresses and seeks to mitigate the problem of diverging interests between shareholders and those who manage the company.[183] It requires corporate leaders to adhere to a standard of behavior that Judge Cardozo once artfully described as the "punctilio of an honor the most sensitive."[184] Loyalty, in practice, is relevant to a variety of specific contexts, including interested-director transactions, corporate opportunities, insider transactions, and other situations that involve a potential conflict of interest or heightened risk of unduly advancing managers'

179 *See* Stephen M. Bainbridge, *The Business Judgment Rule as Abstention Doctrine*, 57 VAND. L. REV. 83, 87, 109–29 (2004); *see also* Moran v. Household Int'l, Inc., 490 A.2d 1059, 1076 (Del. Ch. 1985) ("[T]he business judgment rule is primarily a tool of judicial review and only indirectly a [managerial] standard of conduct . . . ."), *aff'd*, 500 A.2d 1346 (Del. 1985).

180 Aronson v. Lewis, 473 A.2d 805, 812 (Del. 1984) (noting that "[t]he business judgment rule is an acknowledgment of the managerial prerogatives of Delaware directors").

181 The seminal case on this is Smith v. Van Gorkom, 488 A.2d 858, 872 (Del. 1985).

182 BALOTTI & FINKELSTEIN, *supra* note 172, at § 4.15(A) (footnote omitted).

183 *See* Guth v. Loft, Inc., 5 A.2d 503, 510 (Del. 1939) (A classic case in which the court stated that the duty of loyalty "demands that there shall be no conflict between duty and self-interest").

184 Meinhard v. Salmon, 164 N.E. 545, 546 (N.Y. 1928).

personal interests at the expense of the corporation.[185] Notably, the board's liability for failures to exercise proper oversight is, under Delaware law, also subsumed under the duty of loyalty and its requirement that directors act in good faith.[186]

The system for sanctioning alleged breaches of corporate directors' and officers' fiduciary duties is somewhat peculiar. In most cases, shareholders cannot bring direct claims against these individuals in their own name. Absent rare situations where there are injuries that directly affect certain shareholders in their individual capacities, breaches of fiduciary duties will be pursued either by the corporation (acting through the board) or—given the board's likely reluctance to initiate such claims—via derivative actions that shareholders bring in the name and on behalf of the corporation.[187] However, shareholders willing to pursue derivative suits face an uphill battle on numerous fronts. They have to overcome both procedural and substantive hurdles, which to a large degree work to insulate corporate directors and officers from personal liability.[188]

Directors, in particular, benefit from various protections that considerably limit their personal exposure. With regard to assessing the existence of a breach of duty, corporate laws usually provide that directors may rely on information or

185 *See* BALOTTI & FINKELSTEIN, *supra* note 172, at § 4.16.

186 *See* Stone v. Ritter, 911 A.2d 362, 370–72 (Del. 2006); Martin Petrin, *Assessing Delaware's Oversight Jurisprudence: A Policy and Theory Perspective*, 5 VA. L. & BUS. REV. 433 (2011) (discussing liability standards pertaining to oversight liability).

187 *See, e.g.*, Rabkin v. Philip A. Hunt Chem. Corp., 547 A.2d 963, 969 (Del. Ch. 1986) (applying principle that where an alleged wrong does not injure either the corporation or its majority shareholders, but only affects the minority shareholders, the claim is direct instead of derivative). Additionally, managers can be held accountable by non-shareholder third parties based on tort law principles. *See* Martin Petrin, *The Curious Case of Directors' and Officers' Liability for Supervision and Management: Exploring the Intersection of Corporate and Tort Law*, 59 AM. U. L. REV. 1661, 1714 (2010).

188 *See* Petrin, *supra* note 187, at 1693–94 (describing various protective mechanisms).

advice received from others, and that such reliance is, within certain limitations, permissible and will not expose the director to personal liability.[189] More broadly, board decisions can be protected by the business judgment rule, which provides that courts will not second-guess directors' actions as long as their decision making process meets certain criteria.[190] Delaware law even permits shareholders to adopt exculpatory provisions in their company's certificate of incorporation to limit or eliminate directors' personal liability for duty of care (but not loyalty) violations.[191] These limitations, coupled with corporate indemnification arrangements and D&O liability insurance, have become so pronounced that the prospect of liability, especially that involving out-of-pocket payments by directors, has become unlikely.[192] Officers are exposed to higher potential liability than directors, given that they are more deeply involved in daily management.[193] Nevertheless, fiduciary duty lawsuits against officers have been rare and the

189 Under the DGCL, directors may under specified conditions rely upon corporate records and information, opinions, reports, or statements presented to the corporation by officers, employees, board committees, or other persons. DEL. CODE ANN. tit. 8, § 141(e) (2019). *See also* MODEL BUS. CORP. ACT §§ 8.30(e)–(f) (AM. BAR ASS'N 2016).

190 *See, e.g.*, Brehm v. Eisner, 746 A.2d 244, 264 n.66 (Del. 2000).

191 DEL. CODE ANN. tit. 8, § 102(b)(7) (2019). Note that § 102(b)(7) does not permit eliminating personal liability for breaches of the duty of care if the underlying acts or omissions were not in good faith. *Id.* at § 102(b)(7)(ii).

192 *See, e.g.*, Lisa L. Casey, *Twenty-Eight Words: Enforcing Corporate Fiduciary Duties through Criminal Prosecution of Honest Services Fraud*, 35 DEL. J. CORP. L. 1, 17 (2010) ("[D]irectors and officers seldom face civil liability for breaching their fiduciary duties, regardless of the forum in which shareholders bring suit and despite corporate law rhetoric emphasizing the importance of executives' fiduciary responsibilities."); Bernard Black et al., *Outside Director Liability*, 58 STAN. L. REV. 1055, 1140 (2006) (suggesting that out of pocket payments by directors are as infrequent as an "occasional lightning strike").

193 Exculpatory charter provisions, at least under Delaware law, do not apply to officers and the question whether officers are protected by the business judgment rule remains unsettled. *See* Johnson, *supra* note 36, at 182–84; DeMott, *supra* note 174, at 863 n.86; Follett, *supra* note 173, at 565–66. Officers may however be statutorily entitled to indemnification and their corporation may have insurance in place to protect them from out of pocket payments.

chances of being held personally liable are low for them as well.[194]

2. Liability Tomorrow

As the overview above shows, the current system of managerial liability is first and foremost geared towards limiting personal transgressions—that is, misconduct by individuals that is careless or otherwise acts against the corporation's and shareholders' interests for selfish reasons. As a counterweight to managerial power, shareholder fiduciary duty litigation is meant to serve the goals of ex ante deterrence and, to a lesser degree, ex post compensation.[195] Thus, from a corporate governance perspective, derivative actions can be described as the counterweight to managerial power and a mitigation device against agency costs.[196]

The current system's characteristics raise questions about its suitability for a future shift from human to AI corporate management. Today's framework is fundamentally based on the notion of personal accountability in holding corporate leaders that breach their fiduciary duties individually liable. Naturally, in the absence of human managers, this type of personal liability is bound to disappear.

In the early stages of the gradual pathway towards AI dominated management we should expect AI to only take on certain roles—acting mostly as a supportive mechanism for human directors—which may itself lead to a reduction in the number of human managers. As a consequence, during this early phase, personal liability lawsuits would be increasingly

194 *See* Lyman P.Q. Johnson & David Millon, *Recalling Why Corporate Officers are Fiduciaries*, 46 WM. & MARY L. REV. 1597, 1609 (2004); *see also* Shaner, *supra* note 45, at 367 (confirming empirically the low number of fiduciary duty lawsuits against officers).

195 *See, e.g.*, 2 AM. LAW INST., PRINCIPLES OF CORPORATE GOVERNANCE: ANALYSIS AND RECOMMENDATIONS, 12 (1994); John C. Coffee, Jr. & Donald E. Schwartz, *The Survival of the Derivative Suit: An Evaluation and a Proposal for Legislative Reform*, 81 COLUM. L. REV. 261, 302–05 (1981).

196 *See, e.g.*, DAVID KERSHAW, COMPANY LAW IN CONTEXT: TEXT AND MATERIALS 314 (2nd ed. 2012) (noting that fiduciary duties may "allow the agency cost to be drained away").

concentrated on fewer individuals, namely those humans that still remain in managerial positions, which in turn heightens their potential exposure.

This stage raises difficult questions regarding the extent to which human managers may delegate tasks to and rely on advice given by AI (in the sense of there being relief from liability) and, relatedly, the extent to which they can and should monitor AI. Whether reliance and delegation of tasks to AI is permissible depends on the wording and interpretation of applicable statutory provisions and corporate documents.[197] Typically, corporate law requires directors to monitor delegees and does not allow boards to delegate away the core duty to manage and supervise the company.[198] Thus, under the current framework, a complete delegation of tasks to AI would not be allowed. Partial delegation would be possible, but would require the board to oversee the managerial activities of AI. Accordingly, a commentator has noted that directors would be required to "at least generally oversee the selection and activities of robots, algorithms and artificial intelligence devices" and "have a basic understanding of how these devices operate."[199] While directors may "not understand their coding in every detail,

197 *See* Möslein, *supra* note 104, at 656–60; *see also* Petrin, *supra* note 187, at 1693–94.

198 *See* Möslein, *supra* note 104, at 659.

199 *Id*. at 660. Möslein also considers the questions whether directors could become obliged to use or delegate tasks to AI as part of their duty act on an informed basis, concluding that it is possible that such a duty might develop in the near future, along with the more general board task of exercising "governance of artificial intelligence." *Id*. at 660–62; *see also* Shani R. Else & Francis G.X. Pileggi, *Corporate Directors Must Consider Impact of Artificial Intelligence for Effective Corporate Governance*, BUS. L. TODAY (Feb. 12, 2019), https://businesslawtoday.org/2019/02/corporate-directors-must-consider-impact-artificial-intelligence-effective-corporate-governance [https://perma.cc/UZ84-E36Y] ("[I]t is crucial that the board does not delegate its essential management functions and rely solely upon AI in making decisions for the corporation. Doing so would be a prohibited delegation of its duties.").

they should at least be able to understand the technical guidelines that drive these machines."[200]

Following a phase of co-existence of human and AI managers, a subsequent phase will likely see machines fully take over corporate management. At this point, humans could no longer be sued for breaching their fiduciary duties. This could lead to three possible new approaches to *managerial* liability: (1) artificial entities acting as managers could become potential defendants and be sued; (2) the system of managerial liability will be abolished and not replaced; or (3) those responsible for creating, distributing, or selling artificial managers (in the form of AI software and hardware) will replace managers as possible defendants.[201]

Under the first possibility, AI systems could be made available as defendants in shareholder and/or third-party lawsuits. This approach could consist of actions against AI operating either in the form of familiar types of organizational legal entities (such as a corporation or LLC where AI acts as a management/board service provider), or AI that in the future might itself be bestowed with a novel legal personality.[202] In both cases, from the perspective of plaintiffs,

200 Möslein, *supra* note 104, at 660.

201 Note that the following does not relate to the corporation's own liability (direct or vicarious) vis-à-vis third parties for harm caused by its algorithmic decisionmaking. While I do not wish to exclude this option, see *supra* note 192 and accompanying text, a more detailed discussion of this kind of liability is beyond the scope of this article's focus on managers' individual responsibility. On the entity's own liability for AI, see Armour & Eidenmüller, *supra* note 169, at 31–33.

202 On the idea of creating a legal status for artificial persons, see generally Matthew U. Scherer, *Of Wild Beasts and Digital Analogues: The Legal Status of Autonomous Systems*, 19 NEV. L.J. 259, 260 (2018); Gunther Teubner, *Digital Personhood? The Status of Autonomous Software Agents in Private Law,* 2018 ANCILLA IURIS 107, 112–13 (2018); Robert van den Hoven van Genderen, *Legal Personhood in the Age of Artificially Intelligent Robots*, *in* RESEARCH HANDBOOK ON THE LAW OF ARTIFICIAL INTELLIGENCE 213 (Woodrow Barfield & Ugo Pagallo eds., 2018); Lawrence B. Solum, *Legal Personhood for Artificial Intelligences*, 70 N.C. L. REV. 1231, 1234 (1992). On the European Parliament's recent proposals regarding digital personhood, see Committee on Legal Affairs, Draft Report with Recommendations to the Commission on Civil Law Rules on Robotics 2015/2103 (INL), 5, 12 (May 31,

the main difference as compared to today's system is that their claims would be directed against a non-human, although still a legally recognized entity. In terms of the potential for plaintiffs' financial recovery, the difference would depend on two factors. First, whether these new entities would enjoy similar legal protections as human managers, in the familiar forms of liability insulating corporate law norms or other, new legal protections. While today's exculpatory provisions could be quite easily adapted to machines or AI, the business judgment rule would have to be reformulated. Second, recovery by plaintiffs would also be influenced and potentially limited by these entities' financial resources (or, rather, likely lack thereof). Thus, how to define and monitor applicable standards of behavior (consisting essentially of ex ante coding standards for AI management software) will be difficult questions in the context of liability for AI entities.[203]

The second option would be completely abolishing personal liability for corporate managers. This loss of the possibility of holding managers liable could have a number of consequences. First, there is the question as to whether the absence of potential personal liability and the corresponding lack of deterrence would make managers less careful. However, deterrence would arguably be difficult, if not impossible, to achieve for AI entities. It would likely also be unnecessary for a properly programmed artificial entity, which can be instructed to always adhere to the required legal norms. Second, plaintiffs would lose a class of potential defendants, and hence a potential pool of assets that could help compensate shareholders and/or their companies in cases

2016), https://www.europarl.europa.eu/doceo/document/JURI-PR-582443_EN.pdf [https://perma.cc/N9DQ-KC2D]; Directorate-General for Internal Policies, European Civil Law Rules in Robotics, PE 571.379, 14 (Oct. 2016), https://www.europarl.europa.eu/RegData/etudes/STUD/2016/571379/IPOL_STU(2016)571379_EN.pdf [https://perma.cc/7P7Q-8H5R].

203 Möslein has suggested that governmental control of algorithms and new enforcement mechanisms may be needed "because the control of algorithms requires a comprehensive technical know-how that can neither be expected from shareholders, nomination committees or supervisory boards, nor from courts . . . ." Möslein, *supra* note 104, at 667.

of damages. Yet, given the already low success rate of lawsuits against managers,[204] such a loss of personal liability would be limited in its impact, at least in the case of public companies. Furthermore, companies which use AI management systems would still have the option to bring direct actions against third-party AI software providers based on contractual claims. Contrary to today's problem that boards may be reluctant to bring actions against fellow directors or managers,[205] boards would face no such concern when it comes to third parties that provided an allegedly faulty product or service. This may lead to more lawsuits and financial recovery. The biggest change in liability exposure, however, would likely be felt in non-shareholder third party claims against the corporation, particularly those based on torts or criminal and regulatory offenses. In these cases, all liability would necessarily have to be channeled to the corporate entity itself as its managers would be unavailable as (exclusive, or, together with the entity, joint) defendants.[206]

The third option for a future corporate liability framework is that the creators, distributors, sellers, or other providers of managerial AI software (the "AI providers") would become the primary potential defendants in cases of claims previously directed towards managers.[207] In addition to exposure to claims brought by corporations using their AI software, novel rules could allow shareholders and potentially third parties to sue AI providers directly or derivatively. Such a system may even impose a new fiduciary status for software developers, as

204 *See supra* notes 192–194 and accompanying text.

205 *See, e.g.*, Claire A. Hill & Brett H. McDonnell, Disney, *Good Faith, and Structural Bias*, 32 J. CORP. L. 833, 839 (2007) (discussing demand requirements in derivative suits).

206 The same is true for (rare) instances of direct claims by shareholders against directors.

207 This would be in addition to claims that corporations that use their AI management systems users might bring against them, based on contractual or extra-contractual grounds and in cases where due to faults in the system the corporation suffered direct or indirect harm. On potential problems with this approach, see Armour & Eidenmüller, *supra* note 169, at 34 n.88.

one commentator has recently suggested.[208] These claims would not focus on whether an individual was in breach of his or her duties, as they currently do, but rather whether the relevant software was properly designed and programmed. This suggests that, under this model, liability for corporate management will evolve akin to today's system of products liability, especially as it currently applies to software programs. Thus, liability could be based on theories of implied warranty, negligence, "programming malpractice," or even strict liability.[209] Again, as for direct claims against AI-management entities, this third option necessitates clarity on the appropriate standards for AI management.[210]

D. Corporate Purpose

For decades, scholars, judges, and policymakers have grappled with defining the corporation's proper purpose and objectives.[211] In essence, the main question over which there is disagreement concerns the extent to which businesses should pursue or take into account the interests of non-

208 *See* Angela Walch, *In Code(rs) We Trust: Software Developers as Fiduciaries in Public Blockchains*, *in* REGULATING BLOCKCHAIN: TECHNO-SOCIAL AND LEGAL CHALLENGES 58, 59 (Philipp Hacker et al., eds., 2019).

209 For a comprehensive overview of theories of liability in traditional products liability law, see CHARLES J. NAGY, AMERICAN LAW OF PRODUCTS LIABILITY §§ 1:9–1:20 (3d ed. 2019).

210 As mentioned above, the rise of artificial managers might coincide with the rise of large commercial providers of corporate management software, given the advantages of scale in terms of data collection. However, size may also be beneficial from a liability perspective. Large, deeply capitalized providers with a widely used product will be in a better position to avoid liability though better services but also to withstand financial strains in the case of liability payouts, including through external insurance solutions.

211 Particularly well known is the debate between Merrick Dodd and Adolf Berle in the twenty-seven pages of the Harvard Law Review in 1932. *See generally* E. Merrick Dodd, Jr., *For Whom are Corporate Managers Trustees?*, 45 HARV. L. REV. 1145, 1160–61 (1932); A. A. Berle, Jr., *For Whom Corporate Managers are Trustees: A Note*, 45 HARV. L. REV. 1365, 1367, 1372 (1932).

shareholder third parties and the public in discharging their corporate duties.

Contemporary debates "tend to revolve around two schools of thought: shareholder wealth maximization, which is often linked to the . . . nexus of contracts model, and the stakeholder model."[212] The nexus of contracts theory provides that the corporate purpose is exclusively geared towards shareholders' financial interests, whereas considerations of extraneous interests are subordinated as matters that should be regulated through non-corporate laws.[213] In this view, the default position is that corporate managers have an obligation to maximize shareholder wealth.[214] Shareholders, under this model, are in a privileged position because they provide the business capital that is at risk.

In contrast to the shareholder primacy view, the stakeholder model and other pluralist perspectives on corporations focus on the idea that businesses have responsibilities not only to shareholders, but also to a variety of other constituents.[215] These constituencies, which include groups such as employees, communities, and governments, are regarded under this theory as corporate stakeholders. It is contended by pluralists' that the resources and various investments of these different types of corporate stakeholders in the corporation, financial or non-financial in nature, deserve to be protected to the same extent as shareholder interests.[216] The corporate purpose is thus widened and corporate managers' are thought to owe duties to both shareholders and non-shareholders. Indeed, because the focus on shareholder value is relaxed or abandoned under this theory, even corporate decisions or actions that may run

212 BARNALI CHOUDHURY & MARTIN PETRIN, CORPORATE DUTIES TO THE PUBLIC 37–46 (2019) (discussing the diverging views).

213 *Id*. at 39.

214 *See, e.g.*, Stephen M. Bainbridge, *Director Primacy: The Means and Ends of Corporate Governance,* 97 NW. U. L. REV. 547, 548 (2003); FRANK H. EASTERBROOK & DANIEL R. FISCHEL, THE ECONOMIC STRUCTURE OF CORPORATE LAW 36–39, 92–93 (1991).

215 *See* CHOUDHURY & PETRIN, *supra* note 212, at 41–43.

216 *See id*. at 42.

against shareholder interests may be allowed to some extent.[217]

The traditional, entrenched position in Anglo-American law is that corporations serve the overarching aim of maximizing, or at least enhancing in the long term, shareholder wealth as measured by the price of its shares.[218] Nevertheless, the corporate purpose debate has never been conclusively settled and continues on to today, with some commentators noting that apart from the normative debates, even the corporate law "on the books" is ambiguous on the question of the corporate purpose.[219] The recent wave of anti-corporate sentiment and political upheaval suggests that the corporate purposes debate appears to be at a watershed moment, and more clarifications and changes geared towards regaining public trust in business appear necessary to ensure the continued success of the corporate model.[220]

The need for more definitive answers may become even more pressing in a world with AI corporate management. After all, in order to function autonomously, AI will need clearly defined goals and outcomes.[221] Non-committal statements about corporate missions or divides between public messaging and internal actions will be more difficult to sustain if the corporate purpose is made explicit in the algorithms of an organization's managerial software. Stakeholders and the public at large may also become even more focused on, and more critical of, the behavior and underlying purpose of corporations once the human element in their leadership disappears and is replaced by AI. Machine-managed corporations of the future will have to do even more

217 *Id*. at 42.

218 *Id*. at 38.

219 *See id*. at 49–51.

220 *See id*. at 18–21.

221 *See also* Armour & Horst Eidenmüller, *supra* note 169, at 29 (emphasizing the increased need for corporate goal specification and goal setting in AI-managed companies).

to gain the trust and confidence of the public to sustain its "social contract" with members of society more generally. [222]

On the positive side, AI managers will have a significant advantage over today's managers: AI can process and consider a much higher volume of complex information than humans. This is relevant in light of a line of reasoning in corporate scholarship that posits that it is best to let managers focus on a singular goal—shareholder wealth maximization—instead of requiring managers to simultaneously pursue other stakeholders' interests. Management, it is argued, cannot and should not be forced to serve two or more masters. Profit maximization as a singular goal, some commentators have opined, limits managers' discretion to further their own self-interests, provides clear aims for them to pursue, and eliminates the distractions and costs associated with having to reconcile conflicting interests.[223]

However, unlike human managers, AI would be able to work towards multiple goals, weakening the argument for letting managers focus on only one group's interests. With AI in charge of management, the idea that businesses should "optimize within constraints" and focus simultaneously on multiple performance objectives—for instance, certain levels of profit and revenue growth, employee satisfaction, etc.—will become achievable.[224] The need to consider multiple and

222 On the idea that corporations holds a license, in the form of a social contract, from the public, see for example THOMAS DONALDSON, CORPORATIONS AND MORALITY 37 (1982). For a discussion of the impact of technologies on the corporate purpose, see also Bruner, *supra* note 169, at 14–19.

223 *See, e.g.,* Michael C. Jensen, *Value Maximization, Stakeholder Theory, and the Corporate Objective Function*, 14 J. APPLIED CORP. FIN., 8, 10–11 (2001); Frank H. Easterbrook & Daniel R. Fischel, *The Proper Role of a Target's Management in Responding to a Tender Offer*, 94 HARV. L. REV. 1161, 1191–1192 (1981); Jonathan R. Macey, *An Economic Analysis of the Various Rationales for Making Shareholders the Exclusive Beneficiaries of Corporate Fiduciary Duties*, 21 STETSON L. REV. 23, 32 (1991); Stephen M. Bainbridge, *The Bishops and the Corporate Stakeholder Debate*, 4 VILL. J. L. & INV. MGMT. 3, 12 (2002).

224 *See* Lynn Stout, *The Corporation and the Question of Time*, *in* UNDERSTANDING THE COMPANY 306–10 (Barnali Choudhury & Martin Petrin, eds., 2017); Tamara Belinfanti & Lynn Stout, *Contested Visions: The*

varied interests in corporate decision-making could be incorporated and precisely specified, to some extent even quantified, in the relevant algorithms. To facilitate monitoring, and potentially also legal claims, shareholders and other interested parties could even be given access to data and logs that show if and how these considerations have influenced a decision. At a more basic level, corporate conduct and "responsible corporate behaviour" could also be improved through simpler coding features. For instance, AI software could be given the task to learn and comply with all applicable laws. This delegation would prevent the occurrence of accounting and similar scandals involving deliberate misfeasance that peaked around the turn of the millennium.[225]

E. Legal Entity Innovation

In the previous Part, the Article described the consequences of AI management still based on the underlying assumption that ultimate control of AI-led businesses would remain with human shareholders. Some commentators have, however, recently drawn our attention to another possibility—the emergence of businesses that might operate without any ongoing human involvement, namely the phenomenon of algorithmic entities and leaderless entities. These two concepts will be discussed in turn in the following Sections.

1. Algorithmic Entities

There are already algorithms that, once programmed and released, can act and survive autonomously, with computer

Value of Systems Theory for Corporate Law, 166 U. PA. L. REV. 579, 605–11 (2018) (both applying insights from systems theory to the corporate purpose debate and arguing that corporations can be viewed as a system pursuing multiple goals).

225 *See, e.g.*, Elizabeth A. Nowicki, *Director Inattention and Director Protection under Delaware General Corporation Law Section 102(b)(7): A Proposal for Legislative Reform*, 33 DEL. J. CORP. L. 695, 695–96 (2008) (discussing various high-profile corporate scandals).

viruses being a familiar example.[226] It is also conceivable that advanced forms of such algorithms could conduct business. An algorithm "could roam the Internet with its own wallet and its own capacity to learn and adapt, in pursuit of its goals determined by a creator, purchasing the resources it requires to survive like computer power, all the while selling services to other entities."[227] Still, algorithms are not legal entities, which limits their practical use and ability to transact business. Legal scholars have, however, explored a sophisticated and particularly intriguing variant of the autonomous algorithm in considering so-called Algorithmic Entities,[228] which combine algorithms with legal entities.

AEs are comprised of a legal entity that provides the shell for a software/algorithm that controls the entity without any human participation.[229] The importance of an algorithm's ability to control a legal entity is that it creates legal rights for the algorithm and enables and legitimizes its ability to transact in the "real world." As LoPucki has noted, the legal entity's rights effectively become the algorithm's rights.[230] An AE could therefore enjoy rights such as the right to privacy, to own property, to enter into contracts, to be represented by counsel, to be free from unreasonable search and seizure, to equal protection of the laws, to speak freely, and to spend money on political campaigns.[231] Possessing these rights would allow an AE to "participate effectively in legitimate economic and political activity" and "engage in business, accumulate wealth, or deal with people in the above-ground

226 *See* DON TAPSCOTT & ALEX TAPSCOTT, BLOCKCHAIN REVOLUTION 122 (2016).

227 *Id*. (referring to this type of algorithm as an "autonomous agent").

228 *See* Lynn M. LoPucki, *Algorithmic Entities*, 95 WASH. U. L. REV. 887, 890–91 (2018); *see also* Shawn Bayern, *The Implications of Modern Business-Entity Law for the Regulation of Autonomous Systems*, 19 STAN. TECH. L. REV. 93 (2015).

229 *See* LoPucki, *supra* note 228, at 897.

230 *Id*. at 890.

231 *Id*. at 890–91 (footnotes omitted).

economy."[232] This opens up entirely new opportunities for AEs.

From a practical standpoint, self-managed AEs are already conceivable when it comes to relatively simple commercial applications. That is, today's algorithms, commentators have opined, could autonomously and self-sufficiently run profitable businesses.[233] It is possible to imagine that this could be quite easily achieved for a number of activities similar to those already identified as possible activities for algorithmic entities: cloud storage, bike rental, online gambling, vending machine operation, and services similar to those of Uber and Airbnb.[234] As AI evolves, more complex ventures will be within reach. New generations of algorithms will likely be able to upgrade their own software, adapt to new business models, and discover and enter new industries.[235]

From a legal standpoint, hurdles remain. Among others, the current prevalence of corporate laws that restrict board membership to natural persons would seem to contradict AEs. Of course, there could be legal reform, however, scholars have shown how AEs may already be conceivable under existing legal frameworks in the U.S., U.K., and Germany.[236] For instance, LoPucki concluded that "formation of AEs is probably possible under the LLC statutes of all, or nearly all, U.S. jurisdictions" and "the formation of AEs is probably possible under the Delaware General Corporation Law, the Model Business Corporation Act, the Uniform Limited Partnership Act, the Uniform Limited Liability Company Act, and the Revised Uniform Partnership Act."[237] Nevertheless, there is considerable uncertainty regarding the legality of AEs

232 *Id*. at 902.

233 *Id*. at 891.

234 *See id*.

235 TAPSCOTT & TAPSCOTT, *supra* note 226, at 123.

236 *See* LoPucki, *supra* note 228. *See also* Bayern, *supra* note 228; Shawn Bayern et al., *Company Law and Autonomous Systems: A Blueprint for Lawyers, Entrepreneurs, and Regulators*, 9 HASTINGS SCI. & TECH. L.J. 135, 136, 139, 149 (2017).

237 LoPucki, *supra* note 228, at 906.

since to date neither legislatures nor courts in the U.S. seem to have considered or condoned them.

The possible consequences of AEs and their activities are also uncertain. On the positive side, AEs could be initiated to support and provide benefits to specific groups or causes, or to otherwise pursue beneficial impacts.[238] However, LoPucki has expressed fear that because of AE's ability to replicate, absence of human compassion, and difficulties in locating and punishing them, "AEs' greatest comparative advantage would be in criminal enterprise."[239] It is therefore possible that AEs will be used for illegal or otherwise highly undesirable activities including terrorism, harassment, malicious acts, political manipulation, and liability avoidance.[240] In the face of these potential threats, LoPucki has argued in favor of drastic legal reform measures, specifically in the form of increased regulation and an end to the system of state competition for corporate chartering, which may contribute to weaker regulatory regimes pertaining to legal entities.[241]

2. Leaderless Entities

Finally, a discussion of the management of future firms should also consider whether the very concept of corporate management will survive at all. A challenge to the current conception of management is brought about by the idea of new business entities that purportedly function without leadership in the traditional sense. These are referred to as Distributed Autonomous Enterprises ("DAEs") or Distributed Autonomous Organizations ("DAOs"), and are often examined in the context of blockchain and AI technologies.[242] Blockchain is thought to be able to provide the basic architecture to render centralized management unnecessary through self-executing smart contracts, information and transparency,

238 *See id*. at 891.

239 *Id*. at 891–92.

240 *Id*.

241 *Id*. at 951–53.

242 *See*, *e.g.*, Usha Rodrigues, *Law and the Blockchain*, 104 IOWA L. REV. 679, 679 (2019).

security, and other attributes that facilitate coordination between different parties.[243]

Several commentators have emphasized the positive characteristics of DAEs. Yochai Benkler, for example, has expressed sympathies for blockchain technology that "can enable people to function together with the persistence and stability of an organization, but without the hierarchy."[244] Similarly, authors Don and Alex Tapscott have outlined the advantages of entities that are "powered by blockchain technology and cryptocurrencies, where autonomous agents can self-aggregate into radically new models of the enterprise."[245] Such an entity could be "a corporation without executives, only shareholders, money, and software. Code and algorithms could replace a layer of representatives (i.e., the executive board), with shareholders exerting control over that code."[246] As Tapscott and Tapscott further write:

> This organization could have shareholders, possibly millions of them who participated in a crowdfunding campaign. The shareholders provide a missions statement, say, to maximize profit lawfully, while treating all stakeholders with integrity. Shareholders could also vote as required to govern the entity. As opposed to traditional organizations, where humans make all decisions, in the ultimate distributed organization much of the day-to-day decision making can be programmed into clever code. In theory, at least, these entities can run with minimal or no traditional management structure, as everything and

243 *See* Laila Metjahic, *Deconstructing the DAO: The Need for Legal Recognition and the Application of Securities Laws to Decentralized Organizations,* 39 CARDOZO L. REV. 1533, 1537–46 (2018) (explaining that "[a] decentralized organization operates under the same basic concepts of a corporation but has a decentralized management structure—eliminating the board of directors, for example").

244 TAPSCOTT & TAPSCOTT, *supra* note 226, at 107 (citing interview with Yochai Benkler, Faculty Co-Director, Berkman Klein Center for Internet and Society, Harvard Law School).

245 *Id*. at 127.

246 *Id*.

> everyone works according to specific rules and procedures coded in smart contracts.[247]

There are already some examples of DAEs in practice. One of them is ConsenSys, a software development company specializing principally in applications for Ethereum, a blockchain based platform.[248] ConsenSys describes its organizational approach as "decentralized[,]" and "collaborative rather than hierarchical[,]"—and inspired by the principles of holacracy.[249] Elements of this approach include "distributed, not delegated authority;" an overarching plan that has been developed and agreed on by all employees or members; dynamic roles that do not need to adhere to traditional job descriptions; project-based work organized around smaller teams that communicate and collaborate with each other; and flexible forms of compensation (such as bounties for completion of tasks, annual salaries, or performance based compensation schemes).[250] As a co-founder of ConsenSys explained, his main operational role is limited to that of an advisor that suggests directions and priorities.[251] Only occasionally is there a need to "suggest that a certain thing really needs to get done" and potentially hire external third parties or incentivize internal employees to do it.[252]

Another widely known example of a DAE, Slock.it, suffered from fatal flaws and ultimately failed.[253] Although its demise was due to other reasons—exploitation of a weakness in the

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247 *Id*. at 126.

248 *See* CONSENSYS, https://consensys.net/solutions [https://perma.cc/DA2J-TAU9] (last visited Sept. 18, 2019).

249 *See* Sean Tahery, *The Decentralized Org Structure*, CONSENSYS COLLEGE CONSORTIUM (Sept. 4, 2018), https://medium.com/@consensys_uni/the-decentralized-org-structure-376bee0544cf [https://perma.cc/M62K-PLNG]; *see also* TAPSCOTT & TAPSCOTT, *supra* note 226, at 88; Bodie, *supra* note 39 (generally on holocracy as a corporate governance system).

250 TAPSCOTT & TAPSCOTT, *supra* note 226, at 88–90 (citing co-founder Joe Lubin).

251 *See id*. at 89.

252 *Id*. at 90.

253 *See* Rodrigues, *supra* note 242, at 697–706.

entity's coding by a user—even one of its founders noted that the enterprise's leaderless structure did not work well in practice.[254] To be sure, DAEs can implement any governance structure that its members see fit, and future autonomous entities would not need to adopt Slock.it's decisionmaking mechanisms, which were quite rudimentary.[255]

Slock.it's failure is by itself not the final word on DAEs, but it highlights some of the potential risks and shortcomings of business entities that operate without centralized managerial structures. Indeed, leaderless or self-managed collectives are unlikely to prevail in the future, at least on a broad scale apart from certain niche areas where ultra-flat hierarchies could be useful—specifically software and other internet-based work and projects. Overall, despite the superior capabilities of machines, it seems likely that larger business organizations will generally continue to benefit from centralized control and that shareholders will normally tend to remain almost completely passive, their role reduced to providers of capital and recipients of dividend streams.

This is not to say that centralized, hierarchical governance structures are without flaws and should not be further tweaked and improved.[256] However, only if technology can drastically reduce the limitations that make self-governance of business entities unfeasible today—including apathy, information asymmetries, and collective action problems—can DAEs become viable as widespread alternative organizational models or even replace centrally managed entities. Even commentators like Tapscott and Tapscott, who are generally enthusiastic about DAEs, acknowledge that completely distributed enterprises would be challenging and perhaps not even practical, unless a way to implement appropriate decision-making and consensus driving mechanisms can be found.[257] Currently, it seems more likely

254 *See* Christoph Jentzsch, *The History of the DAO and Lessons Learned*, SLOCK.IT BLOG (Aug. 24, 2016), https://blog.slock.it/the-history-of-the-dao-and-lessons-learned-d06740f8cfa5 [https://perma.cc/VQW7-DV6E].

255 *See id*.

256 *See* TAPSCOTT & TAPSCOTT, *supra* note 226, at 106–07.

257 *Id*. at 127–28. *See also* Bruner, *supra* note 169, at 16.

that technology will revolutionize and improve corporate management rather than lead to its demise.

IV. CONCLUSION

A future in which AI takes over corporate management is possible. Recent developments and news stories show that there is an effort underway to develop, and an interest to pursue further, machine-led corporate leadership. Because AI management will presumably at some point be both better and more cost-effective than the use of human managers, "management by machine" seems inevitable. Well known commentators have warned of the dangers of AI, with the late Stephen Hawking predicting that full AI could lead to the end of mankind.[258] In comparison, this Article's premise that AI will replace corporate management is far more modest.

Based on the assumption that AI management will eventually indeed materialize, the Article has hypothesized about its consequences for corporate governance. With software and machines in charge, the need for a collective board will vanish, which will be replaced with a single "fused" corporate management function. The shift from human to AI-based management will equally necessitate changes to the system of managerial liability. In this area, we could see a system akin to products liability replace the framework of fiduciary and other personal duties. The fundamental purpose of corporations could also be influenced by AI management, which will allow more complex and precise calibrations of corporate objectives, along with the potential for increased clarity and transparency surrounding their pursuit of corporate objectives. Finally, the emergence of algorithmic entities, legal entities that operate without any human input whatsoever, seems plausible, if not limited in their practicality.

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258 Joao Medeiros, *Stephen Hawking: 'I fear AI May Replace Humans Altogether'*, WIRED (Nov. 28, 2017), https://www.wired.co.uk/article/stephen-hawking-interview-alien-life-climate-change-donald-trump [https://perma.cc/QWX6-4CS3].

While this Article has not taken a normative stance, but focused on describing current and possible future developments of corporate governance structures in response to the rise of AI, it seems clear that there will be a need for legal reform to accommodate changes brought about by new technologies. These reforms should be both enabling—facilitating the efficiencies and other beneficial effects of AI management—but also restrictive, protecting society from potential negative impacts, loss of employment, and other harmful actions by rogue AI entities. From a broader corporate governance perspective, it seems clear that the future of corporate management will be heavily intertwined with the consideration of business analytics, big data, and programming.

The prospect of AI management also suggests the likelihood of change in the study of agency costs as an important theoretical underpinning of corporate governance theory. Agency costs between shareholders and management, this Article suggests, could be solved with AI management. However, the development of ex ante standards for designing, controlling, and holding accountable algorithms instead will likely take center stage. This can be thought of as a novel type of agency costs, now between humans and machines, which may come to the fore.[259] On all counts, AI management seems set to initiate a new chapter for corporate law and governance.

[259] *See* BOSTROM, *supra* note 107, at 127–29. *See also* Armour & Horst Eidenmüller, *supra* note 169, at 7 (arguing that machines on corporate boards will lead to a "fundamental shift in focus, from controlling internal costs . . . to the design of appropriate strategies for controlling the costs that corporate activity imposes on persons external to the endeavor").