

Technology vs Ideology: How Far will Artificial Intelligence and Distributed Ledger Technology Transform Corporate Governance and Business?

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INTRODUCTION

Disruptive technologies, such as Artificial Intelligence (AI) and Distributed Ledger Technology (DLT), are poised to introduce marked changes to the corporate world. Companies are already implementing AI and DLT—often referred to as the new “Corporate Technologies” or “CorpTech”¹—into essential corporate roles.² As the corporate world begins to incorporate AI and DLT, we are closely monitoring how far the potential for change reaches. Specifically, we are watching the extent to which the organization, structures, processes, and institutions of economic life, especially those under the aegises of corporations, may shift in response to the advent of AI and DLT. We also consider if such shifts warrant responses from the law. Although we discuss AI and DLT as different domains of technological advancements, they interface at certain points; the different treatment given to AI and DLT in this discussion is essential, since each has a different impact on changes to corporate governance and business. We will use CorpTech as an umbrella term for both AI and DLT in our theoretical treatment of how technological change impacts institutions and corporate law more generally.

1. Luca Enriques & Dirk A. Zetsche, *Corporate Technologies and the Tech Nirvana Fallacy*, (Eur. Corp. Governance Inst., Law Working Paper No. 457/2019, 2019), http://ssrn.com/abstract_id=3392321.

2. For example, a Hong Kong venture capital company has appointed VITAL, a robot programmed with AI, to its Board as a voting director. *See* Rob Wile, *A Venture Capital Firm Just Named an Algorithm to its Board of Directors*, BUSINESS INSIDER (May 14, 2014, 1:19AM), www.businessinsider.com.au/money-markets. Additionally, several stock exchanges encourage listed companies to adopt DLT to conduct their annual meetings between Boards and shareholders. *See, e.g.*, Christoph Van der Elst & Anne LaFarre, *Blockchain and Smart Contracting for the Shareholder Community*, 20 EUR. BUS. ORG. & L. REV. 111 (2019); *ICJ and Broadridge Execute the First Blockchain-based Interoperable Proxy Voting Process in Japan*, BROADRIDGE (Jan. 14, 2019), <https://www.broadridge.com/press-release/2019/icj-and-broadridge-execute-the-proxy-voting-process>; *Santander shows potential of blockchain in company votes*, FINANCIAL TIMES (May 16, 2018), <https://www.ft.com/content/c03b699e-5918-11e8-bdb7-f6677d2e1ce8> [hereinafter *Santander*]; *NSE to Test E-voting Using Blockchain*, EXPRESS COMPUTER (Sep. 27, 2018), <https://www.expresscomputer.in/news/nse-to-test-e-voting-using-blockchain/28977/> (discussing the Indian Stock Exchange’s rollout of e-voting for listed companies’ general meetings) [hereinafter EXPRESS COMPUTER].

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We make two distinct but interrelated contributions to the literature on CorpTech. First, to promote a nuanced understanding of the development of AI and DLT and their effects on business processes, organization and management, particularly on corporate governance, we advance a three-level analytical framework: “incremental/facilitative,” “radical/disruptive,” and “fundamental/structural.”

Second, after providing a critical overview of AI and DLT and their effects on business practices and corporate governance through this three-level framework, we develop a theoretical framework of how CorpTech will shape corporate law and governance by examining the drivers for institutional change, and corporate law and governance. We argue that CorpTech is unlikely to radically alter the power structures and incentive mechanisms of shareholders, directors and managers, and hence, any fundamental/structural changes to corporate governance are not likely in the near future.

We demonstrate that the major power groups influencing corporate law and governance norms are likely to mobilize old ideology with technological spins, in order to achieve incremental institutional changes aligned with their incentives and interests. Hence, it is unlikely that there will be fundamental or structural changes to corporate governance from CorpTech in the near future.

The structure of this article is as follows. Section I provides a primer on AI and DLT and puts forward the three-part analytical framework of “incremental/facilitative,” “radical/disruptive,” and “fundamental/structural” transformation by technology. Section II examines the theoretical drivers for institutional change in response to technological developments and then analyses the theoretical drivers for changes in corporate governance. Section III applies the combined insights from both institutional and corporate governance theories to the three-level framework and makes three predictions on the extent of institutional change, at least in the foreseeable future, and concludes that institutional change will be incremental, with futuristic visions such as the replacement of the board in full, or the complete overhaul of enfranchisement in corporate governance, not likely to occur except in small and experimental situations. Complete reconfiguration would not be easily wrought, as there would certainly be an ideological struggle. Although it may be relatively easy to see business process changes, such as in customer service chatbots³ and supply chain management,⁴ the advent of a decentralized “prosumer” economy, where mass production under the aegis of corporations is no longer the norm,⁵ is yet far.

3. Andreas Kaplan & Michael Haenlein, *Siri, Siri, In My Hand: Who's the Fairest in the Land? On the Interpretations, Illustrations, and Implications of Artificial Intelligence*, 62 BUS. HORIZONS 15 (2019).

4. See, e.g., Kaplan & Haenlein, *supra* note 3, at 15; Adam Sulkowski, *Blockchain, Business Supply Chains, Sustainability, and Law: The Future of Governance, Legal Frameworks, and Lawyers*, 43 DEL. J. CORP. L. 303 (2019); Jan Mendling et al., *Blockchains for Business Process Management – Challenges and Opportunities*, 9 ACM TRANSACTIONS ON MGMT. INFO, SYS. 4 (2018).

5. Vatroslav Zovko, *Management in the Year 2050*, 16 INTERDISC. DESCRIPTION OF COMPLEX SYS. 417 (2018).

The advent of AI is challenged by social and political questions regarding the relevance of human agency, from the lowest-skilled up to the boardroom. DLT powers the rise of bottom-up enterprise and an alternative economic ethos, while corporatization and corporate globalization are buffeted by social and political headwinds.⁶ Although workplaces are starting to undergo major change during the Covid-19 pandemic,⁷ the embrace of technological replacement of human capital is sharply controversial at a time of heightened unemployment.⁸ Hence, the result cannot be functionally determined. We argue that the inexorable logic and pace of AI and DLT will only be mediated and moderated within an institutional paradigm, within which our theoretically-informed three-level framework sits.

I. THREE LEVELS OF CHANGE WROUGHT BY CORPTECH

In this Section, we first provide a short primer on the rise of AI and DLT in business and corporate processes before providing accounts of the three different types of change that AI and DLT could bring, respectively. These accounts are then followed by reflective sections on their implications for current legal institutions and policy choices. Distilling the implications does not mean that policy choices have to be made in favor of reform, as mapping out such implications provides us only with navigational routes. We will argue for the choice of particular routes in Section II of this paper, based on a multi-faceted institutional theory.

A. Short Primer on AI and its Development

Scientific research and development of AI can be traced back to the 1950s, when the pinnacle achievement for AI was declared to be its passing of the Turing test.⁹ The elusive achievement by computers in relation to this standard

6. See JOEL BAKAN, *THE CORPORATION: THE PATHOLOGICAL PURSUIT OF PROFIT AND POWER* (2005) (describing some of the irresponsible practices of the global multinational corporation).

7. Carl B. Frey, *Covid-19 will only Increase Automation Anxiety*, FINANCIAL TIMES (Apr. 21, 2020), <https://www.ft.com/content/817228a2-82e1-11ea-b6e9-a94cfd1d9bf>; Alana Semuels, *Millions of Americans Have Lost Jobs in the Pandemic – And Robots and AI Are Replacing Them Faster Than Ever*, TIME (Aug. 6, 2020), <https://time.com/5876604/machines-jobs-coronavirus/>.

8. Delphine Strauss & George Parker, *UK sheds nearly 750,000 jobs during coronavirus crisis*, FINANCIAL TIMES (Aug. 11, 2020), <https://www.ft.com/content/c8ef84bf-0539-4281-b353-d5b840d10b5e>; Dominic Rushe, *US weekly unemployment claims rise to 1.4m after four months of decline*, THE GUARDIAN (July 23, 2020), <https://www.theguardian.com/business/2020/jul/23/us-unemployment-july-coronavirus-covid-reopening>; Zoe Thomas, *Coronavirus: Will Covid-19 speed up the use of robots to replace human workers?*, BBC (Apr. 18, 2020), <https://www.bbc.co.uk/news/technology-52340651>.

9. Alan Turing stipulated that, if a human and machine were in conversation in different physical locations where the human cannot see the machine, the machine would pass the Turing test of being intelligent (on par with humans) if the human could not, after five minutes of conversation, clearly tell 30 percent of the time whether it was a machine or human. Alan M. Turing, *Computing Machinery and Intelligence*, 59 MIND 433 (1950); Alex Hern, *What is the Turing Test?*, THE GUARDIAN (June 9, 2014), <https://www.theguardian.com/technology/2014/jun/09/what-is-the-alan-turing-test>. So far only one computer program that simulates a 13-yearold Ukrainian boy has passed the Turing test (this program was

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to date shows that “super intelligence”¹⁰—the term used to describe AI that is able to replicate human intelligence—is still somewhat away. The development of AI is often discussed in three stages: narrow AI, general AI, and super AI.

Narrow AI refers to the ability of computers to undertake specific tasks, such as making astronomical calculations, operating a self-service drink vending machine, and learning the rules of a game such as chess in order to play it.¹¹ Narrow AI has developed from being programmed with rules (sometimes complex rules) and the execution of those rules (generally in a systematic, consistent and impeccable manner) to machine learning, which is a more advanced form of narrow AI. Machine learning takes narrow AI to the next step, as the machine is trained to devise the rules needed for it to achieve the outcomes predefined by its designer. Machine learning occurs by feeding the machine voluminous amounts of relevant data matched with outcomes, in order for the machine to recognize patterns.¹² Machine learning is being refined at a dynamic pace — it can automate certain evaluative processes that may have exclusively relied on human judgment before, achieving various benefits such as greater accuracy of outcomes and wider and speedier access to certain services.¹³

developed by the University of Reading and was run in the Royal Society of London in 2014). *Computer AI passes Turing Test in ‘world first’*, BBC (June 9, 2014), <https://www.bbc.co.uk/news/technology-27762088>.

10. Kaplan & Haenlein, *supra* note 3, at 2.

11. L. Thorne McCarty, *Finding the right balance in artificial intelligence and law*, in RSCH. HANDBOOK ON L. A.I. 55, 55 (Woodrow Barfield & Ugo Pagallo eds., 2018).

12. Yanqing Duan et al., *Artificial Intelligence for Decision Making in the Era of Big Data – Evolution, Challenges and Research Agenda*, 48 INT’L J. OF INFO. MGMT. 63 (2019).

13. Recent research exposed at conference proceedings shows how decision trees have been refined to make pattern recognition more accurate and precise through the employment of sophisticated linguistic, statistical and probabilistic methods, such as artificial neural networks, natural language processing, fuzzy logic, decision trees, and the use of expert systems. See, e.g., Ahmed J. Aljaaf et al., *A Study of Data Classification and Selection Techniques for Medical Decision Support Systems*, in INT’L CONF. ON INTELLIGENT COMPUTING 135 (D. S. Huang et al. eds., 2014); Zeeshan A. Rana et al., *Impact of Using Information Gain in Software Defect Prediction Models*, in INT’L CONF. ON INTELLIGENT COMPUTING 637 (D. S. Huang et al. eds., 2014) (discussing techniques to mitigate errors in refining the decision tree); Mohammed A. Kadhim et al., *A Multi-Intelligent Agent for Knowledge Discovery in Database (MIAKDD): Cooperative Approach with Domain Expert for Rules Extraction*, in INT’L CONF. ON INTELLIGENT COMPUTING 602 (D. S. Huang et al. eds., 2014); Paulius Čerka et al., *Liability for Damages Caused by Artificial Intelligence*, 31 COMPUT. L. & SEC. REV. 316 (2015); Fu H. Chen et al., *Using Rough Set Theory and Decision Trees to Diagnose Enterprise Distress – Consideration of Corporate Governance Variables*, in INT’L CONF. ON INTELLIGENT COMPUTING 199 (D. S. Huang et al. eds., 2014).

Astounding machine learning developments have been made in the realm of computer games, oncological diagnosis, and automatic evaluations of various situations, such as student learning in a virtual environment, helping an online customer (assisted by chatbots), and credit scoring for financial institution lending decisions. See, e.g., Maude Lavanchy & Amit Joshi, *An AI Taught itself to Play a Video Game for the first time it is beating humans*, THE CONVERSATION (May 30, 2019), <https://theconversation.com/an-ai-taught-itself-to-play-a-video-game-for-the-first-time-its-beating-humans-118028>; DATA, ANALYTICS & AI ARE HELPING TO TRANSFORM CANCER CARE 4; Michelle L. F. Cheong et al., *An Intelligent Platform with Automatic Assessment and Engagement Features for Active Online Discussions*, in ADVANCES & TRENDS IN A.I. FROM THEORY TO PRACTICE 730 (2019); Zhenyu Wu et al., *Quantifying the Evolutions of Social Interactions*, in INT’L CONF. ON INTELLIGENT COMPUTING 162 (D. S. Huang et al. eds., 2014) (discussing earlier development in evaluation of “chat quality”); Kaplan & Haenlein, *supra* note 3; Tadatsugu Shimazu, *Fujitsu takes on Fintech by Developing Credit Scoring Tool for Banks*, NIKKEI ASIA (Aug. 26, 2019), <https://asia.nikkei.com/Business/Technology/Fujitsu-takes-on-fintech-with-AI-credit-scoring-tool-for-banks>.

Fundamentally, the deployment of AI changes the structure of human agency. Narrow AI is often described as able to free the need for human agency in repetitive and chore-some tasks, such as by replacing the many supermarket checkout lanes with self-service machines.¹⁴ Increasingly, the use of chatbots and automated lending or investment services¹⁵ may be used to keep businesses open 24/7, promoting access without the need for human customer service agents, and therefore facilitating access in a more cost-effective manner. Such use is aimed at supplementing human resource capacity. Robots, such as IBM's Watson¹⁶, provide facilitative support for complex decisions where many factors and a dense volume of information need to be considered by an expert human or a group. Bounded rationality on the part of human beings means that human imperfections could render a decision inaccurate, and the help of logical processing by a machine can act as a useful check on an otherwise exclusively human judgment. Looking at narrow AI in this manner does not mean that human agency is necessarily inferior or replaceable.¹⁷ The increasing sophistication of narrow AI means that human agency changes would come about,¹⁸ and the ground for contest is crucially over the human-machine mix in relation to tasks and who determines the mix as a matter of policy.¹⁹

At a more advanced level, research and development is underway on General AI. General AI is more ambitious, as it relates to machines with more "holistic" or integrated capacity, simulating human reasoning that is more multi-faceted in nature.²⁰ General AI that is able to achieve complex and composite tasks attains a form of human resemblance, which poses a greater challenge to the nature of human agency than does narrow AI. The requirements of human agency in economic life could change markedly, impacting how education and training should be reconfigured. However, recent research exposed in conference proceedings shows there is only incremental development towards building

14. See SABRINA PAXTON, *ARTIFICIAL INTELLIGENCE AND THE IMPACT ON THE COMPANY SECRETARY* (2018).

15. Such as robo-advice. See Iris HY Chiu, *Transforming the Financial Advice Market - The Roles of Robo-advice, Financial Regulation and Public Governance in the UK*, 35 *BANKING & FIN. L. REV.* 9 (2019).

16. Doctors experimenting with IBM's Watson found that the recommendations it yielded were sometimes regarded as unsafe. Angela Chen, *IBM's Watson Gave Unsafe Recommendations for Treating Cancer*, *THE VERGE* (July 26, 2018, 4:29PM), <https://theverge.com/2018/7/26/17619382/ibms-watson-cancer-ai-healthcare-science>.

17. Barry Eichengreen, *Two Myths About Automation*, *BARRON'S* (Dec. 18, 2017), <https://www.barrons.com/articles/two-myths-about-automation-and-jobs-1513384286>.

18. Humans can be deployed into more purposeful work, such as managing the new dynamics between humans and robots. Kathleen Wilburn & Ralph Wilburn, *Challenges for Managing Business with 21st Century Technology*, 9 *REV. OF BUSINESS & FIN. STUD.* 13, 13 (2018).

19. Eichengreen, *supra* note 17.

20. Human reasoning is often based on an integration of rationality, memory, contextual knowledge and behavioural shortcuts or heuristics, as well as communal, not individualistic factors such as social conditioning. Philip N. Johnson-Laird, *Mental Models and Human Reasoning*, 107 *Proc. Nat'l Acad. Sci.* 18243 (2010). The holistic and integrated nature of human reasoning is distinguished from AI whose processing falls short. See, e.g., Harry Surden, *Machine Learning and Law*, 89 *WASH. L. REV.* 87 (2014).

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general AI.²¹ Recent developments in communications robotics show that²² general AI seems to be rudimentary, and may be based on machine learning for expanded purposes.²³

An area of much-hyped development in general AI is that of self-driving cars.²⁴ Self-driving encompasses a number of different functions that constitute the act of “driving” or being in control of a motor vehicle, when taken together. However, a plethora of errors and hazards (such as fatalities) caused by self-driving cars must be dealt with in developing this general AI.²⁵ Because of the potential errors and hazards, the line of judgment for general AI to be deployed in a mainstream manner is highly uncertain: would its deployment be a risk-based judgment,²⁶ or would it be precautionary in nature?²⁷

Until such policy choices can be resolved, it is uncertain how general AI can develop into super AI in accordance with the ‘singularity’ phenomenon described by Kurzweil where non-biological machines would not be distinguishable from humans.²⁸ Super AI refers to AI that is indistinguishable from human sentience and capacity, and presumably passes the Turing test with ease. Again, fiction provides us with a glimpse of what super AI looks like, in

21. It is painfully challenging to teach AI to learn a new language. *See, e.g.,* Alex Glushchenko et al., *Unsupervised Language Learning in OpenCog*, in *ARTIFICIAL GEN. INTEL.* 109 (Matthew Iklé et al. eds., 2018). However, there may be more significant breakthroughs in enabling AIs to design. Andreas M. Hein & Hélène Condat, *Can Machines Design? An Artificial General Intelligence Approach*, in *ARTIFICIAL GEN. INTEL.* 87 (Matthew Iklé et al. eds., 2018).

22. Kotaro Hayashi et al., *An Experimental Study of the Use of Multiple Humanoid Robots as a Social Communication Medium*, in *UNIVERSAL ACCESS IN HUM.-COMPUT. INTERACTION* 32, 34 (Constantine Stephanides ed., 2011) (showing that AI can master passive but not interactive conversation). Learning in communications is based on simulation of human gestures and behaviour. Masahide Yuasa & Naoki Mukawa, *Building of Turn-Taking Avatars that Express Utterance Attitudes*, in *UNIVERSAL ACCESS IN HUM.-COMPUT. INTERACTION* 101, 106 (Constantine Stephanides ed., 2011).

23. *See* Mark Wernsdorfer, *How Failure Facilitates Success*, in *ARTIFICIAL GEN. INTEL.* 292, 292 (2018) (discussing techniques in reducing errors); *see also* Kristinn R. Thórisson & Arthur Talbot, *Cumulative Learning with Causal-Relational Models*, in *ARTIFICIAL GEN. INTEL.* 227, 227 (Matthew Iklé et al. eds., 2018) (stimulating broader, contextual considerations or lateral thinking); Rafik Hadfi, *Solving Tree Problems with Category Theory*, in *ARTIFICIAL GEN. INTEL.* 62, 62 (Matthew Iklé et al. eds., 2018).

24. For example Google’s subsidiary Waymo has launched a small self-driving taxi fleet in Phoenix, Arizona. *Waymo Launches First US Commercial Self-driving Taxi Service*, *THE INDEPENDENT* (Dec. 5, 2018), <https://www.independent.co.uk/life-style/gadgets-and-tech/news/waymo-self-driving-taxi-service-google-alphabet-uber-robotaxi-launch-us-a8669466.html>.

25. *Uber’s Fatal Self-Driving Crash*, *THE VERGE* (May 2019), <https://www.theverge.com/2018/3/28/17174636/uber-self-driving-crash-fatal-arizona-update>; *Tesla’s Model 3 autopilot mode was activated seconds before a fatal crash*, *MIT TECHNOLOGY REVIEW* (May 17, 2019), <https://www.technologyreview.com/f/613549/teslas-model-3-autopilot-mode-was-activated-seconds-before-a-fatal-crash/>.

26. Meaning that judgment for permissive or regulative policies is likely to be based on an assessment of risk and the costs and benefits of introducing governance or regulation. *See generally* CHRISTOPHER HOOD ET AL., *THE GOVERNMENT OF RISK: UNDERSTANDING RISK REGULATION REGIMES 3* (2001) (on the assessment of risk as forming the basis for regulation).

27. May be invoked on the basis of scientifically evaluated potential harm. *See The precautionary principle*, *EUR LEX* (Nov. 30, 2016), <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=LEGISSUM%3A132042> (describing EU guidance on such regulation in relation to environmental protection).

28. RAY KURZWEIL, *THE SINGULARITY IS NEAR: WHEN HUMANS TRANSCEND BIOLOGY* 30 (Duckworth 2005).

the form of Ava in *Ex Machina*,²⁹ or a more benign version in the Japanese animation *Time of Eve*.³⁰ Super AI and humans would live side by side and be almost indistinguishable except for the laws of robotics that govern android behavior, thus safeguarding the superiority of humans. As fiction uncannily shows, developments toward super AI would necessarily be underpinned by policy choices involving law, governance, ethics, and social considerations such as inclusion and cohesion.

B. Short Primer on DLT and its Development

This primer sets out a brief context for the ultimate importance of the institutional paradigms within which technological change would be navigated. DLT was first introduced as part of the innovation for bitcoin, the cryptocurrency touted to offer an alternative private currency to sovereign-backed fiat currencies.³¹ The bitcoin blockchain was first developed to solve the Byzantine Generals Coordination Problem, which relates to how consensus or concerted action can be attained despite a lack of trust amongst actors. A network can be built up for the credible adoption of the new private currency at scale, without the tyranny of centralized control or power. Bitcoin is designed to be created, transferred, and recorded on a blockchain, which is a ledger sustained by a network of participants or nodes. Nodes collectively are responsible for maintaining the credibility of the ledger by preventing double spending, but this is achieved by individual and uncoordinated efforts. Nodes are supposed to verify blocks of transaction information and then irreversibly add these verified blocks to the chain, forming a complete and immutable record for the entire network. Nodes are incentivized to verify blocks through rewards of the native currency of the chain, and the verification can be carried out by proof-of-work.³² In this manner, although the network is decentralized, the work of verifiers, called “mining,” ensures the alignment of individual incentives of participants with the collective good of the network.³³

29. EX MACHINA (Universal Pictures 2014).

30. TIME OF EVE (Studio Rikka 2010). The laws of robotics are commonly derived from Isaac Asimov. *Isaac Asimov's Three Laws of Robotics*, AUBURN (2008), <http://webhome.auburn.edu/~vestmon/robotics.html>.

31. Satoshi Nakamoto, *Bitcoin: A Peer-to-Peer Electronic Cash System*, BITCOIN (2008), <https://bitcoin.org/bitcoin.pdf>.

32. Proof of work involves solving a cryptographic puzzle to identify matching hashes unique to the transaction and then broadcasting this work to gain consensual support in the network. Other forms of verification protocols have since been developed for other blockchains, such as proof-of-stake, involving validators staking a certain sum of their cryptocurrency in order to be selected to verify transactions. See Ameer Rosic, *Proof of Work vs Proof of Stake: Basic Mining Guide*, BLOCKGEEKS, <https://blockgeeks.com/guides/proof-of-work-vs-proof-of-stake/>.

33. The distributed ledger is a concept whereby all nodes maintain the same copy of transactions and last-done status of the ledger, so that all records are immutable, indelible and cannot be arbitrarily adjusted. This is described as “trustless trust.” But see Kevin Werbach, *Trust, But Verify: Why the Blockchain Needs the Law*, 33 BERKELEY TECH. L.J. 489, 502-05 (2018) (discussing limitations).

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The development of the ethereum blockchain³⁴ is the next significant and crucial step for the revolutionizing potential of DLT. The ethereum blockchain is an infrastructural blockchain which can support a variety of economic activity that is more complex than the initially dominant activity of payment transfer. It allows smart contracts³⁵ to be coded and executed on the ledger to exchange data, execute transactions, and record transfers and balances. The ethereum blockchain has inspired new innovations such as Tezos, EON, and Tron. All of these innovations offer protocol or “infrastructural” layers for smart-contract-based business applications to be constructed on top of them. New business applications can be developed for new enterprises that sell virtual goods such as “CryptoKitties.”³⁶ Blockchain-based businesses are a step beyond the platform economy, which have already been regarded as a revolution in structuring business.³⁷ The blockchain-based business model provides peer-to-peer platforms with direct transactions in new forms of commodification,³⁸ which creates alternatives to the corporate economy of centralized mass production and distribution and new markets for novel goods or services. For example, iungo provides a disintermediated platform that links up individual wi-fi services to form a global wireless internet network.³⁹ Golem’s business model allows access to individual computers’ idle power for a fee⁴⁰ and brings together a network of computers willing to share their “excess capacities,” and peer-to-peer energy trading platforms disrupt and challenge existing oligopolistic energy markets. Decentralizing technologies offer opportunities for flattening economic structures,⁴¹ galvanizing new economic actor-hood, wealth creation and activity, and weakening the stranglehold by corporate economies on access to economic opportunities.

The development of new blockchain-based businesses has given rise to the “initial coin offering” (ICO).⁴² To fund blockchain-based development projects,

34. *Ethereum 101*, COINDESK (MAR. 30, 2017), <https://www.coindesk.com/information/who-created-ethereum>.

35. Programmed code or algorithms designed to execute commands if certain conditions are met, resulting in the execution or formation of legal obligations, hence “smart contracts.” See Nick Szabo, *Smart Contracts: Building Blocks for Digital Markets*, UNIVERSITY OF AMSTERDAM (1996), http://www.fon.hum.uva.nl/rob/Courses/InformationInSpeech/CDROM/Literature/LOTwinterschool2006/szabo.best.vwh.net/smart_contracts_2.html, and layman’s version at <https://www.coindesk.com/information/ethereum-smart-contracts-work>.

36. CRYPTOKITTIES, <https://www.cryptokitties.co> (last visited Oct. 12, 2020).

37. Martin Kenney & John Zysman, *The Rise of the Platform Economy*, ISSUES IN SCI. & TECH., Spring 2016, at 61-66 (stating that digital platforms as offering new business models).

38. The trend of new commodification that has been made possible by digitalisation. Miriam A. Cherry, *Cyber Commodification*, 72 MD. L. REV. 381 (2013).

39. IUNGO, <https://iungo.network/> (last visited Oct. 12, 2020).

40. GOLEM, <https://golem.network/> (last visited Oct. 12, 2020).

41. THOMAS L. FRIEDMAN, THE WORLD IS FLAT 51 nn.3 & 10 (Farrar et al. eds., 2005) (discussing how internet technologies brought about a form of globalisation and connection that ultimately allowed new ‘flat’ economic structures to be constructed).

42. See Saman Adhami et al., *Why do Businesses Go Crypto? An Empirical Analysis of Initial Coin Offerings*, 100 J. OF ECON. & BUS. 64 (2018); Dirk A. Zetsche et al., *The ICO Gold Rush: It’s a Scam, It’s a Bubble, It’s a Super Challenge for Regulators*, 60 HARV. INT’L L.J. 267 (2017).

developers typically offer “tokens” in return for cryptocurrency, such as bitcoin or ether, from supporters of the project. These tokens are standardized pieces of code embodying an entitlement to future goods or services that would be generated in the business, as well as a unit of value for future transactions on the blockchain.⁴³ An ICO involves the pre-selling of tokens whose use is only realized when the business becomes live. However, secondary markets have arisen for people to trade their tokens even before DLT-based businesses become live.⁴⁴ These tokens therefore gain “asset value” in secondary markets, besides being functional smart contracts and units of value for the relevant blockchain-based business.

The multi-character nature of tokens is causing legal and regulatory confusion, particularly as to whether tokens are within the scope of many jurisdictions’ securities and investment regulatory regimes. The legal grey areas of the ICO movement reflect the extent of disruption that decentralizing technologies can bring to established ways of doing things and the need to make policy choices in response. This continues to be an emerging area in policy determination, as there is no global convergence in sight.⁴⁵

Blockchain can also be used in commercial and non-commercial contexts to improve efficiencies and reliability in disparate recording and management systems for data and processes or networks.⁴⁶ In a radical case, the blockchain itself can become the domain of management, fully decentralized and without any “managing” authority, for predefined purposes in relation to auto-execution of smart contracts.⁴⁷ However, the lack of centralized monitoring or authority can result in the usurpation of majority power in the network by rogue coordination, referred to as “51% attacks.”⁴⁸

43. Bastien Buchwalter, *Decrypting Crypto-assets: Introduction to an Emerging Asset Class* (SSRN Working Paper, Paper 3271641, 2019), <https://ssrn.com/abstract=3271641>.

44. *Why is Secondary Market an important part after fundraising completion*, ESPAY (Oct. 12, 2020), <http://blog.espay.exchange/secondary-market-important-part-fundraising-completion/>.

45. More detail on the indeterminacy of the nature of tokens and regulators’ responses is found in the discussion below. *See infra* Section II.

46. Discussed in relation to a variety of areas such as clearing and settlement. *See, e.g.*, EUROPEAN SECURITIES AND MARKETS AUTHORITIES, *THE DISTRIBUTED LEDGER TECHNOLOGY APPLIED TO SECURITIES MARKETS*, 5 (June 2016); ANDREA PINNA & WIEBE RUTTENBERG, *DISTRIBUTED LEDGER TECHNOLOGIES IN SECURITIES POST-TRADING*, 23-27 (2016); Van der Elst & LaFarre, *supra* note 2, at 20 (discussing shareholder voting); Kari Korpela et al., *Digital Supply Chain Transformation toward Blockchain Integration*, in *PROC. OF THE 50TH HAW. INT’L CONF. ON SYS. SCIENCES* 4182, 4182-83 (2017) (discussing management supply chains). DLT can be used to create records in order to prevent tampering, such as in relation to food aid distribution in Africa. Anna Baydakova, *UN Food Program to Expand Blockchain Testing to African Supply Chain*, COINDESK (Sep. 26, 2018, 5:00AM), <https://www.coindesk.com/un-food-program-to-expand-blockchain-testing-to-african-supply-chain>.

47. The “Decentralized Autonomous Organization”, a set-up for participants to pay funds into a common pool and receive tokens in return. The tokens are smart contract protocols that allow participants to vote on investment options. The smart contract protocols would allocate funds to the majority voted investment opportunity or return funds where conditions for investment are not met. *See Ethereum 101*, *supra* note 34.

48. *See infra* Section I; *see also* Alyssa Hertig, *Blockchain’s Once-Feared 51% Attack Is Now Becoming Regular*, COINDESK (June 7, 2018), <https://www.coindesk.com/blockchains-feared-51-attack-now-becoming-regular>; Samuel Haig, *51% Attack Bleeds More Than \$5M From Ethereum Classic*

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Reyes proposes that the attributes of blockchain, as a species of DLT, are “consensus, validity, uniqueness, immutability, and authentication.”⁴⁹ Blockchains bring about coordination in dispersed environments where inherent cohesion is not high. The consensus protocols are highly logical and commensurate with incentives, and the immutable single common record which is underpinned by authentication and validity protocols acts as the ultimate reference point. Zachariadis and colleagues also enumerate DLT’s properties to be “distributed, transparent, irreversible, peer-to-peer and run on computational logic.”⁵⁰ Organizing economic activity using the DLT can lead to new configurations of economic power. Old power institutions based on hierarchy, information, or roles of validation can be rendered obsolete by the force of the computational logic that applies equally to all actors and sustains all activity on the ledger. However, DLT properties can be exploited to different extents. They can be used incrementally in relation to supporting existing business or management processes,⁵¹ without fundamentally disturbing power institutions and structures.

C. Three Levels of Changes brought about by CorpTech

We next turn to the different extents of CorpTech changes involving AI and DLT at the three levels of “incremental/facilitative,” “radical/disruptive,” and “fundamental/structural.”

The existing literature speculates on the impact CorpTech will have on business practices in general, and corporate governance in particular, but does not apply a systematic framework for analyzing CorpTech’s impact. Our three-level framework fills this gap in the literature by distilling the key features of technological change to map them to relevant legal and ideological concepts for the purpose of informing law and policy thinking.

The first level, “incremental/facilitative” means that technological change largely facilitates well-accepted business purposes, such as growth, cost-savings, and other efficiencies. Even if the magnitude of change is pronounced, such as the replacement of jobs by technology, there is primarily an economic driver and rationality that underpins such change. From this perspective, incremental/facilitative change does not challenge the ideology underlying economic structures and corporate organizations in the U.S. and U.K. — namely the free market economy and shareholder primacy.⁵²

COINTELEGRAPH (Aug. 6, 2020), <https://cointelegraph.com/news/51-attack-bleeds-more-than-5m-from-ethereum-classic>.

49. Carla L. Reyes, *Cryptolaw for Distributed Ledger Technologies: A Jurisprudential Framework*, 58 JURIMETRICS J. 283 (2018).

50. Markos Zachariadis et al., *Governance and Control in Distributed Ledgers: Understanding the Challenges Facing Blockchain Technology in Financial Services*, 29 INFO. & ORG. 105 (2019).

51. See discussion *infra* Section I.

52. Andrew Keay, *Shareholder Primacy in Corporate Law: Can it Survive? Should it Survive?*, 7 EUR. CO. & FIN. L. REV. 369 (2010). At the global level, shareholder primacy is argued to be the dominant

The second level of the framework we propose, “radical/disruptive” change, begins with technological change as a “challenger” that attains a “substitutive” character as suggested by Bower and Christensen’s analysis of “disruptive innovation” in product markets.⁵³ “Disruptive innovation” refers to the creation of new markets and value networks that eventually disrupt existing ones, displacing established market leaders and alliances. This framework may be more specifically understood as the development of innovation that first takes place at the low end of the market and does not immediately threaten incumbents, as it is a weak substitute. The innovation, however, distinguishes itself by offering new performance criteria to the market, such as convenience and portability, lower price, or ease of use. The gradual uptake by the market and development of economies of scale steadily allows for the innovation to become dominant in due course, disrupting and replacing incumbents.⁵⁴

In this manner, we characterize “radical/disruptive” change as a marked manner of change in organizing and conducting economic life, where such change develops from an emerging “new way of doing things” that becomes a challenger to, and eventually substitute for, the conventional “way of doing things.” We also regard radical/disruptive change as likely to give rise to questions regarding institutional or paradigm change, *i.e.*, whether existing institutions in the law can allow for such a change, and whether existing paradigms have shifted, or need to shift, in response. For example, if the appointment of a voting robot as a director on a corporate board becomes the norm in industry practice, such a change gives rise to questions as to the status of such a robot director in relation to its human counterparts and the status of its vote. These questions would be of a policy nature; for example, choosing to regard robot directors on par with human directors would give rise to issues such as how legal personality and liability should be structured, and choosing not to consider robot directors on par with human directors would give rise to questions of attribution of agency and liability instead.⁵⁵ In sum, radical/disruptive change ultimately provokes thinking about policy change, impacting legal and regulatory institutions.

model of the corporate economy. See Henry Hansmann & Reiner Kraakman, *The End of History for Corporate Law*, 89 GEO. L.J. 439, 439 (2000).

53. Joseph L. Bower & Clayton M. Christensen, *Disruptive Technologies: Catching the Wave*, HARV. BUS. REV., Jan.–Feb. 1995, at 43-53; CLAYTON M. CHRISTENSEN & MICHAEL E. RAYNOR, *THE INNOVATOR’S SOLUTION* (2003).

54. Some commentators have sought to broaden the concept of “disruptive innovation” because some innovations product disruption by introducing novelty and displacing incumbents in different ways, but each the same end result. Larry Downes & Paul Nunes, *Big Bang Disruption*, HARV. BUS. REV., Mar. 2013, at 45; David Ahlstrom, *Innovation and Growth: How Business Contributes to Society* 24 ACAD. OF MGMT. PERSPECTIVES 11 (2010).

55. Robert van den Hoven van Genderen, *Legal Personhood in the Age of Artificially Intelligent Robots*, in RSCH. HANDBOOK ON L. A.I. (Woodrow Barfield & Ugo Pagallo eds., 2018); Jans-Erik Schirmer, *Artificial Intelligence and Legal Personality: Teilrechtsfähigkeit: A Partial Legal Status Made in Germany*, in REGULATING A.I.123 (2018).

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Finally, we introduce the third level of our framework, “fundamental/structural” change, which refers to completely new and eradicated ways of organizing or conducting economic life, such that conventional structures and institutions are largely replaced, much like how urbanization replaces and therefore eradicates old rural ways of life in a geographical area. Board replacement (human by AI)⁵⁶ or the advent of “platform governance”⁵⁷ are examples of such fundamental/structural changes that could render the conventional organization and conduct of economic life largely unrecognizable. Such nature of change necessitates rethinking the ideology and paradigms of the organization and institutions of economic life and would profoundly impact corporate law and governance.

1. Incremental/facilitative AI

In 1989, Anderson introduced “Executive Support Systems” to help chief executives make fully-informed strategic decisions and touted the system’s forecasting abilities, thanks to its integration of comprehensive amounts of information for the firm.⁵⁸ The use of machine-assisted decision-making and automation has evolved over many decades in business and corporate processes.⁵⁹ Automation has been widely developed to replace repetitive and “low-level” work. Examples of this type of work include manufacturing, food/drink vending machines, automated teller machines, and 24-hour supermarket checkout lanes. However, the move of AI into executive and high-level corporate work can be attributed to current bursts of developments in machine learning which foray into making more executive level and qualitative judgments.⁶⁰ Thus, why should AI be regarded as particularly novel today?

The use of machine learning in compliance-driven work, such as in preventing money laundering at banks,⁶¹ or generating compliant financial reports for securities markets,⁶² is now widespread. However, it remains to be

56. See Martin Petrin, *Corporate Management in the Age of AI*, Colum. Bus. L. Rev. (forthcoming 2019).

57. Mark Fenwick & Erik P.M. Vermeulen, *Technology and Corporate Governance: Blockchain, Crypto, and Artificial Intelligence* 1–26 (Eur. Corp. Governance Inst., Working Paper, No. 424/2018, 2018); Mark Fenwick et al., *The End of Corporate Governance: Hello Platform Governance* 1–28 (Eur. Corp. Governance Inst., Working Paper, No. 424/2018, 2018).

58. Gary Anderson, *The ESS Revolution: Decision Support Software Reaches the Boardroom*, 7 INDUSTRIAL MGMT. & DATA SYS. 3 (1989).

59. Rick Butler, *Front of Mind: AI in manufacturing*, CONTROL ENGINEERING (Nov. 14, 2018) <https://www.controleng.com/articles/front-of-mind-ai-in-manufacturing/>.

60. Compare Fritz Bastarz & Patrick Halek, *Seeing the Wood for the Trees Again! SMART - A Holistic Way of Corporate Governance Offering a Solution Ready to Use*, in UNIVERSAL ACCESS IN HUM.-COMPUT. INTERACTION 187-194 (Constantine Stephanides ed., 2011) (describing executive-level decision making in a contextualized and integrated manner).

61. Kim S. Nash, *Deutsche Bank Deploys AI to Help Meet Needs of Regulatory Compliance*, WALL STREET JOURNAL (Apr. 18, 2017), <https://www.wsj.com/articles/BL-CIOB-11882>.

62. *Wolters Kluwer and Chartis Research to Explore Benefits of AI for Managing Regulatory Change*, BUSINESSWIRE (May 2, 2019), <https://www.businesswire.com/news/home/20190502005173/en/Wolters-Kluwer-Chartis-Research->

seen if such machines can completely supplant legal and compliance departments.⁶³ Corporate compliance work, which can require the processing of much information and tasks, can benefit from the efficiencies offered by artificial intelligence⁶⁴ While machines seem to be serving at the administrative and straightforward ends of the work spectrum, corporate secretaries' human judgment is still keenly needed in interpreting the needs of legal compliance.⁶⁵

Machine learning is also deployed in evaluative work, where such evaluation is made on the basis of data-driven learning and pattern recognition. As envisioned by Kinetic Consulting, AI can be used in key business processes in the travel, medical, insurance, credit, and sales sectors, and would be relevant to board functions in relation to strategy and risk management.⁶⁶

AI's evaluative properties are also useful to the highest echelons in corporations, in relation to corporate governance structures and practices. Findings made by AI as to correlations between good governance practices and firm performance, based on multitudes of data, can inform corporate governance practices.⁶⁷ Crucially, investors can use these to monitor for signs of danger or distress at investee firms.⁶⁸ AI has also been experimented with in board recruitment. A machine is fed volumes of data of the attributes of board members that have been reappointed to other firms, with reappointment being used as a proxy indicator for desirability of the board members' attributes. The machine can then be consulted to determine if candidates before a board possess similarly

Explore-Benefits-Artificial; Michelle Quah, *Smart Data could be Key to Help Restore Trust in Corporate Reporting*, BUSINESS TIMES (6 Mar. 6. 2019) <https://www.businesstimes.com.sg/companies-markets/smart-data-could-be-key-to-help-restore-trust-in-corporate-reporting-ey>.

63. See McCarty, *supra* note 11 (querying to what extent legal reasoning can be performed by artificial intelligence); see also Frank Pasquale, *A Rule of Persons, Not Machines: The Limits of Legal Automation*, 87 GEO. WASH. L. REV. 1, 1 (2018) (arguing that legal interpretation is a human task based on responsible articulation and communication, needing flexibility and understanding of context, and cannot be automated by machines).

64. *A Robot in the Boardroom: is the role of the company secretary about to change?*, FRESH BUSINESS THINKING (2018), <https://www.freshbusinesstinking.com/a-robot-in-the-boardroom-is-the-role-of-the-company-secretary-about-to-change/>; see *Machine learning: What every risk and compliance professional needs to know*, PWC (2019), <https://www.pwc.com/us/en/services/forensics/pdf/pwc-machine-learning-for-risk-and-compliance-professionals.pdf> (suggesting some aspects of corporate compliance can be effectively performed by artificial intelligence systems).

65. Paxton, *supra* note 14.

66. *AI Guide for CEOs and Directors*, KINETIC CONSULTING (2017), www.kineticcs.com/wp-content/uploads/2017/06/A.I.-Guide-for-CEOs-and-Board-Directors_Kinetic-Consulting-Services.pdf.

67. Chen, *supra* note 13 at 199-202 (discussing how data on certain corporate governance aspects such as earnings management can be processed by AI to predict enterprise distress signals); Darie Moldovan & Simona Mutu, *Learning the Relationship Between Corporate Governance and Company Performance Using Data Mining*, in MACH. LEARNING & DATA MINING IN PATTERN RECOGNITION 368-380 (Petra Pernert ed., 2015).

68. Sining Zhao & Hamido Fujita, *Predicting the Listing Status of Chinese Listed Companies Using Twin Multi-class Classification Support Vector Machine*, in ADVANCES AND TRENDS IN A.I. FROM THEORY TO PRACTICE 50-62 (Franz Wotawa et al. eds., 2019); Ruibin Geng et al., *Prediction of Financial Distress: An Empirical Study of Listed Chinese Companies Using Data Mining*, 241 Eur. J. of Operational Rsch. 236 (2015).

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desirable attributes.⁶⁹ Further, AI can be used to evaluate the quality of board meetings⁷⁰ and to assist with board evaluation, using data related to quality indicators such as attentiveness to risk management.⁷¹ In sum, machine learning assists human judgement by overcoming information asymmetry. The use of such machine learning in corporate processes and governance is not arguably paradigm-challenging, as the deployment of AI is consistent with and merely enhances existing corporate governance roles, whether it be shareholder monitoring⁷² or board decision-making.⁷³ The division of powers in the respective corporate governance organs remains the same.

However, it is unclear whether the use of AI changes the relational nature in corporate governance. Where investors use AI to monitor companies' financial and non-financial information and corporate governance practices, we query whether they may increasingly converge on certain providers or suppliers of such software.⁷⁴ Would investors using the same AI programs be steered towards homogenous value judgments about their investments? Can such investor behavior be regarded as coherent with stewardship norms, which require thoughtful engagement by investors? It may be argued that this is no different from investors' reliance on proxy advisers today, and investors would owe a similar fiduciary duty to their beneficiaries to consider their vote and engage with them carefully, whether they are assisted by proxy advisers or AI.⁷⁵

More fundamentally, the use of AI may pander to humans' behavioral heuristic of deference,⁷⁶ as human recipients may readily accept AI's evaluation in an unquestioning manner. This causes blind reliance without sufficient interrogation into the information completeness and diversity processed by the AI.⁷⁷ This is problematic because machine learning is automated, but as yet there

69. Isil Erel et al., *Could Machine Learning Help Companies Select Better Boards?*, HBR (Apr. 9, 2018) <https://hbr.org/2018/04/research-could-machine-learning-help-companies-select-better-board-directors>.

70. Kieran Moynihan, *What Will the Board of the Future Look Like?*, ACCOUNTANCY IRELAND (2018) <https://www.charteredaccountants.ie/Accountancy-Ireland/Articles2/ethics-and-governance/Latest-News/what-will-the-board-of-the-future-look-like>.

71. Akshaya Kalmanath, *The Perennial Quest for Board Independence - Artificial Intelligence to the Rescue?*, 83 ALBANY L. REV. 43 (2019).

72. Theoretically based and justified upon the agency model of corporate governance. See Michael C. Jensen & William H. Meckling, *Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure*, 3 J. OF FIN. ECON. 305, 308, 351-52 (1976).

73. UK REGULATIONS FOR MODEL ARTICLES OF PRIV. AND PUB. COMPANIES art. III & IV. Theoretical support is found in the economic model for the structure of corporate law. See FRANK H. EASTERBROOK & DANIEL R. FISCHEL, *THE ECONOMIC STRUCTURE OF CORPORATE LAW* (Harvard University Press 1991).

74. Martin Carpenter & Ser-Huang Poon, *Lessons Learned from AI Prototype Designed for Corporate AGM Voting Decisions*, SSRN (2018), http://ssrn.com/abstract_id=3244160 (discussing Castlefield as a supplier of such software).

75. See Commission Guidance Regarding Proxy Voting Responsibilities of Investment Advisers, Release No. IA-5325; IC-33605 (2019).

76. Alan Dignam, *Artificial Intelligence: The Very Human Dangers of Dysfunctional Design and Autocratic Corporate Governance*, (Queen Mary Univ. of London, Working Paper No. 314/2019, 2019).

77. *Id.*

is no explanation for AI's evaluations.⁷⁸ The lack of explanation raises two questions for corporate governance. First, would AI paradoxically worsen the problem of shareholder passivity in dispersed ownership jurisdictions? Second, how should conflicts of interests be addressed? For example, the supplier from whom the board buys the AI software to augment board decision-making process may also be the provider of AI proxy advisory services to shareholders.

The increased use of machine learning in making higher-level, executive and qualitative judgments may not yet pose a challenge to principles or ideology, such as shareholder primacy or directors' duties and accountability in law, but it may have implications for the nature of work replacement, *i.e.*, job loss, or human agency changes in the corporate workplace.⁷⁹ In this manner, incremental legal or regulatory shifts may be called for, and corporate leaders may come under pressure to demonstrate sensitivity to changes that affect other constituents. Boards of investor and investee firms may need to demonstrate greater governance oversight of technology use,⁸⁰ as well as set strategic agendas for stimulating and governing innovation.⁸¹ Suppliers of machine learning software may also need to be appropriately governed in terms of the development, accountability and explainability of AI functions.⁸² Hence, although there may be no radical or fundamental paradigm changes, such as in firms' purposes, corporate governance roles, or corporate ideology, the use of "incremental/facilitative AI" may call for norms to be considered in relation to technology and the corporate workplace. More on such legal reform is discussed in Section II.

78. *Id.*

79. Commentators pay particular attention to the human ability to consider social or other-centred impacts of their decisions, whereas machines are not usually programmed with rules on empathy, if such can indeed be coded. See Čerka, *supra* note 13 at 316. Further, humans often have an intuitive judgment which represents an integrated reasoning/decision based on many aspects. This is highly valuable for qualitative judgment. Mohammad H. Jarrahi, *Artificial Intelligence and the Future of Work: Human-AI Symbiosis in Organizational Decision Making*, 61 BUSINESS HORIZONS 577 (2018).

80. Eve Tahmincioglu, *The Board's Role in Setting Up AI's Ethical "Guardrails"*, DIRECTORS & BOARDS, <https://www.directorsandboards.com/articles/singleboard%E2%80%99s-role-setting-ai%E2%80%99s-ethical-%E2%80%98guardrails%E2%80%99> (last visited Oct. 12, 2020); Andrea Bonine-Blanc, *Technology, Trust and Ethics: An Actionable Governance Toolkit for a Disruptive Time*, CARRIER MANAGEMENT (Sep 2018), <https://www.carriermanagement.com/features/2018/10/11/185226.htm>.

81. Colin Coulson-Thomas, *Board Leadership of Innovation in Contemporary Circumstances*, XXII BD. LEADERSHIP OF INNOVATION IN CONTEMP. CIRCUMSTANCES, EFFECTIVE EXEC. 26 (2019); Roger M. Barker & Iris H-Y Chiu, *From Value Protection to Value Creation: Rethinking Corporate Governance for Promoting Firm Innovation*, FORDHAM J. OF CORP. & FIN. L. 437 (2018).

82. The governance of AI is championed in Dignam, *supra* note 76; see John Frank Weaver, *Regulation of artificial intelligence in the United States*, in RESEARCH HANDBOOK ON L. A.I.154 (Woodrow Barfield & Ugo Pagallo eds., 2018).

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2. Incremental/Facilitative DLT

DLT may be attractive for businesses where coordination costs need to be lowered amongst various actors, such as in supply chain management,⁸³ trade finance,⁸⁴ settlement and clearing of financial transactions,⁸⁵ and situations where multiple parties are involved, as well as where there are needs for verification and checking at a number of intermediate levels. These efficiencies, driven by the operation of computational logic on a single ledger and the transparency of the ledger to all participants, can augur greater changes at the executive and corporate governance levels.

Murray and colleagues explore how DLT's coordinative properties can be applied to the agency-based paradigm in corporate governance.⁸⁶ The contemporaneous transparency of the DLT potentially allows corporate information to be shared for monitoring purposes.⁸⁷ DLT's flattened structure for participation offers the possibility to reconsider the hierarchical structures in corporate governance, such as board monitoring of senior executives⁸⁸ and shareholder monitoring of boards.⁸⁹ Further, such flatter structures for participation open up possibilities for rethinking whether corporate governance should be confined to its traditional organs of the board and shareholders.⁹⁰

At an incremental level, DLT seems to be heartily adopted as a new means for conducting shareholders' general meetings to overcome the limitations of traditional physical meetings.⁹¹ The Australian and Indian Stock Exchanges are

83. Sulkowski, *supra* note 4 at 303 (such as in relation to ESG certifications); Mendling et al., *supra* note 4 at 4; Xiongfeng Pan et al., *Blockchain Technology and Enterprise Operational Capabilities: An Empirical Test*, 52 INT'L J. INFO. MGMT. 1 (2020).

84. Vedat Akgiray, *The Potential for Blockchain Technology in Corporate Governance*, (OECD Corporate Governance Working Papers, No. 21, 2019).

85. Joseph Lee, *Distributed Ledger Technologies (Blockchain) in Capital Markets: Risk and Governance*, SSRN (2018), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3180553; Emiliios Avgouleas & Aggelos Kiaiyas, *The Promise of Blockchain Technology for Global Securities and Derivatives Markets: The New Financial Ecosystem and the "Holy Grail" of Systemic Risk Containment*, 20 EUR. BUS. ORGANISATIONS L. REV. 81 (2019).

86. Alex Murray et al., *Contracting in the Smart Era: The Implications of Blockchain and Decentralized Autonomous Organizations for Contracting and Corporate Governance*, ACAD. MGMT. PERSPECTIVES (forthcoming 2020).

87. Such as real-time accounting. See Murray et al., *supra* note 86; Akgiray, *supra* note 84; David Yermack, *Corporate Governance and Blockchains*, 21 REV. FIN. 1 (2017).

88. Commentators have different visions as to how this pans out. Petrin takes the view that there is no longer a need for this hierarchical layer and that fused Boards that include management capability will develop as Board functions become automated by AI. Petrin, *supra* note 56. Enriques and Zetzsche take a different view: that the monitoring Board makes value judgments and cannot be automated or fused with management. Enriques & Zetzsche, *supra* note 1.

89. Radical visions include shareholder real-time monitoring. See Murray et al., *supra* note 86. However, Enriques and Zetzsche doubt that shareholders are incentivised to do so. See Enriques & Zetzsche, *supra* note 1. Boards may become redundant as decision-making can revert to the general meeting. See Murray et al., *supra* note 86.

90. Perhaps to allow stakeholder participation. See Pam Ly, *Blockchain Technology: Its Ability to Transform Corporations' Corporate Social Responsibility Practices*, 22 INT'L TRADE & BUS. L. REV. 1 (2018). A more fundamental change such as platform governance will be discussed below.

91. Companies Act 2006, c. 3, § 303 (UK); European Shareholder Rights Directive (2007).

promoting electronic meetings (“e-meetings”) conducted using DLT,⁹² while the Delaware General Corporation Law has been amended to allow corporations to use DLT to maintain stock ledgers and communicate with shareholders.⁹³ Companies may voluntarily take up DLT to facilitate general meetings as the ease of access and facilitation of voting can be seen to be shareholder-friendly in nature.⁹⁴

However, Nord warns that managers can also use DLT meetings to “divide and conquer” shareholders,⁹⁵ as shareholders may not perceive the need, nor have the time, to work together to put pressure on boards. This may reduce informal shareholder engagement with boards. Further, DLT-enabled voting can potentially speed up voting processes and reinforce shareholders’ tendency towards least resistance by voting with management. This may paradoxically result in less monitoring by shareholders in jurisdictions with dispersed ownership and an entrenchment of controllers’ powers in jurisdictions with concentrated ownership. We will further elaborate this point in Section II.

In one sense, the use of DLT for general meetings may be regarded as incremental, as it changes the forum of meetings. In another sense, despite DLT, fundamental legal principles relating to how information is disclosed, how resolutions are put on the agenda, how voting is carried out and counted, and how decisions are made remain. The use of DLT does not *per se* change the paradigm for the legal principles of the general meeting or for shareholders’ rights.

If the use of DLT is able to penetrate the layers of the investment chain to identify share ownership and allocate shareholder rights to beneficiaries, there may be potential for DLT to change the institutional shareholder stranglehold on corporate governance. Van der Elst and LaFarre, writing in the European context,⁹⁶ and Geis, writing in the U.S. context,⁹⁷ crucially argue that the identity of the shareholder can be contested. Individuals who purchase shares in a company frequently have these shares registered in the name of the custodian of the electronic scrips of ownership — usually a bank — entitling the custodian to legal rights of share ownership such as participating in general meetings and voting. There is usually no coordination attempted on the part of custodians to enable beneficial owners to exercise corporate governance rights, nor do custodians necessarily vote their shares or engage in corporate governance. Where individuals purchase units in a fund that invests in corporate equities, such

92. India’s exchange to pilot listed cos using blockchain to conduct shareholder voting. EXPRESS COMPUTER, *supra* note 2; Van der Elst & LaFarre, *supra* note 2 at 111.

93. J. Travis Laster & Marcel T. Rosner, *Distributed Stock Ledgers and Delaware Law*, 73 THE BUS. LAW. 319 (2018).

94. *Santander*, *supra* note 2.

95. Spencer J. Nord, *Blockchain Plumbing: A Potential Solution for Shareholder Voting?*, 21 U. PA. J. BUS. L. 706 (2019).

96. Van der Elst & LaFarre, *supra* note 2.

97. *George S. Geis, Traceable Shares and Corporate Law*, 113 NW. U. L. REV. 227 (2018).

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funds are legal owners of company shares and corporate governance rights.⁹⁸ They can account for beneficiaries' wishes in relation to investee companies,⁹⁹ but this is not explicitly required nor are beneficiaries necessarily knowledgeable or incentivized enough to provide such instructions. Beneficiaries' legal entitlements regarding corporate governance are highly questionable because of the interposition of fund structures for investment, which cannot be said to confer equitable ownership of particular shares on beneficiaries who are part of a common pool of investees.¹⁰⁰

Further, funds that own shares and are entitled to corporate governance rights may delegate their proxy voting rights to asset managers. The implications of the investment chain for corporate governance are voting apathy and a general lack of engagement by asset managers and funds in their investee companies.¹⁰¹ In this light, policy makers have urged institutional shareholders to assume the mantle of stewardship,¹⁰² so as to plug a monitoring vacuum that contributes to corporate scandals and disasters.¹⁰³ As such, there is potential for DLT to change the state of the institutional shareholder stranglehold on corporate governance, if the use of DLT is able to penetrate the layers of the investment chain to identify share ownership and allocate shareholder rights to beneficiaries.

Where the individual beneficial owner is obscured by the financial institution custodian that holds the legal right to shares, DLT can be used to record levels of intermediated securities ownership, ultimately identifying and empowering beneficial share owners to exercise corporate governance rights.¹⁰⁴ It is less clear that DLT can be used to identify and allocate shareholder rights to beneficiaries in funds that invest in corporate equities, as these beneficiaries' property can only be traced to units in funds and not to particular shares. Nevertheless,

98. These issues are discussed in *Exploring the Intermediated Securities Holding Model* (Dept. Bus. & Innovation, Research Paper No. 261, 2016), https://www.uksa.org.uk/sites/default/files/BIS_RP261.pdf; *Intermediated Securities:- Call for Evidence*, LAW COMMISSION (2019), https://s3-eu-west-2.amazonaws.com/lawcom-prod-storage-11jxou24uy7q/uploads/2019/08/6.5925_LC_Intermediated-securities-call-for-evidence-web.pdf.

99. Ewan McGaughey, *Does Corporate Governance Exclude the Ultimate Investor?*, 16 J. CORP. L. STUD. 221 (2016).

100. John Morley, *The Separation of Funds and Managers: A Theory of Investment Fund Structure and Regulation*, 123 YALE L. J. 1231 (2014).

101. PAUL MYNERS, INSTITUTIONAL INVESTMENT IN THE UK: A REVIEW (2001); see David Walker, *A Review of Corporate Governance in Banks and Financial Institutions*, HARVARD LAW SCHOOL FORUM ON CORPORATE GOVERNANCE (2009), <https://corpgov.law.harvard.edu/2009/12/26/a-review-of-corporate-governance-in-uk-banks-and-other-financial-industry-entities/>. The apathy of shareholders was especially critiqued in the wake of the 2007-09 global financial crisis. See Jennifer Hughes, *FSA Chief Lambasts Uncritical Investors*, FINANCIAL TIMES (Mar. 11, 2009), <https://www.ft.com/content/9edc7548-0e8d-11de-b099-0000779fd2ac>; Kate Burgess, *Myners lashes out at landlord shareholders*, FINANCIAL TIMES (Apr. 21, 2009), <https://www.ft.com/content/c0217c20-2eaf-11de-b7d3-00144feabdc0>.

102. Iris H-Y Chiu, *Institutional shareholders as Stewards: Towards a New Conception of Corporate Governance*, 6 BROOK. J. CORP. FIN. & COM. L. 387 (2012).

103. David Walker, *A Review of Corporate Governance in UK Banks and other Financial Industry Entities*, HARVARD LAW SCHOOL FORUM ON CORPORATE GOVERNANCE (Dec. 26, 2009), <https://corpgov.law.harvard.edu/2009/12/26/a-review-of-corporate-governance-in-uk-banks-and-other-financial-industry-entities/>.

104. Van der Elst & LaFarre, *supra* note 2; Yermack, *supra* note 87; Akgiray, *supra* note 84.

commentators take the view that a new cadre of beneficial owners can be brought into the corporate governance landscape and corporate governance can become relevant to those outside the institutional sector.¹⁰⁵

However, the magnitude of corporate governance change is questionable. Savers in Europe and the U.K. save in banks or through funds instead of investing directly in the stock market.¹⁰⁶ It is also unclear if the new cadre of shareholders would be incentivized to exercise their rights.¹⁰⁷ Indeed, even if beneficiaries can be identified and even if they do vote, it is far from clear that they will vote in a manner that effectively acts as a check on management, and, in fact, it is entirely possible that they will vote with management. It is doubtful that these beneficial shareholders will voluntarily incur time, effort and money to conduct their own due diligence so as to vote in an informed manner, in view of the free rider problem and coordination costs. Further, although DLT can theoretically host corporate information for beneficial shareholders to view, such information is likely to be raw data not organized in terms of complex cost-benefit analyses relevant to proposed resolutions that a reasonable investor would want to know.

Changes in the transparency of share ownership would also entail rethinking current regulation of shareholding transparency and disclosure in securities markets. The U.S. rule requiring intentions-based disclosure at 5 percent of share ownership and the U.K. rule that compels disclosure of stake-building from 3 percent onwards are designed to strike a balance between market freedom and transparency for markets to anticipate behavior. The DLT's capacity for real-time transparency brings about a choice for policy. If transparency benefits efficient markets,¹⁰⁸ one may argue there is little reason not to support real-time transparency.¹⁰⁹

105. Van der Elst & LaFarre, *supra* note 2; Véronique Magnier & Patrick Barban, *The Potential Impact of Blockchains on Corporate Governance: A Survey on Shareholders' Rights in the Digital Era*, 5 JOURNAL INT'L & EUR. L. 189 (2018).

106. Tobias Buck, *Germans reluctantly switch to stock market in search of returns*, FINANCIAL TIMES (Apr 19, 2019) <https://www.ft.com/content/a94e51e8-55ec-11e9-91f9-b6515a54c5b1>. UK individuals make up about 13.5% of the ownership of quoted company shares, according to the Office of National Statistics in 2018. *Ownership of UK quoted shares: 2018*, OFFICE FOR NATIONAL STATISTICS, <https://www.ons.gov.uk/economy/investmentspensionsandtrusts/bulletins/ownershipofukquotedshares/2018> (last visited Oct. 12, 2020).

107. Enriques and Zetzsche doubt this. Enriques & Zetzsche, *supra* note 1.

108. The efficient capital markets hypothesis. See Eugene Fama, *Efficient Capital Markets: A Review of Theory and Empirical Work*, 25 J. FIN. 383 (1970).

109. Note that, despite DLT's potential benefits, commentators are of the view that that incorporating DLT would impact shareholder conduct that is meant to be strategically opaque within the parameters of current disclosure requirements, such as hedge fund activist strategies of building stakes secretly until disclosure thresholds are triggered. Yermack, *supra* note 87; Akgiray, *supra* note 84. Detering or undermining hedge fund activism is not necessarily a good thing, if one takes the view that hedge fund activism has the capacity to monitor and discipline managers in a dispersed ownership jurisdiction and control shareholders in a concentrated ownership jurisdiction. As technology is not deterministic of policy choice, real-time transparency is still a policy choice that has to be made. See discussions *infra* Sections II, III.

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3. *Radical/Disruptive AI*

At a radical/disruptive level, the key characteristic of AI is arguably the replacement or displacement of human agency in roles traditionally thought to be incapable of robot assumption—not the sales assistant but the lawyer or the judge;¹¹⁰ not the administrative secretary but the directors on the corporate board.¹¹¹ At this level, we examine the equivalence in the perception of capability between humans and robots. Specifically, we examine tasks that require composite skills, such as the “mediating,”¹¹² “monitoring,”¹¹³ and judgment-based tasks¹¹⁴ of directors. Moreover, we examine competition between humans and robots in the same spheres of discretionary or qualitative judgments and skills.

Many legal issues arise at the radical/disruptive level, and will not be functionally determined. This is because radical/disruptive applications of AI affect core corporate law and governance norms, as discussed below, and compel policy decisions. The key issues are enumerated as follows:

a. Who bears the responsibility or liability for harm?

In March 2018, Uber’s self-driving taxi struck a pedestrian in Tempe, Arizona while the back-up driver was watching *The Voice* on video streaming app Hulu.¹¹⁵ The Yavapai County Attorney determined that Uber Corporation would not be charged with a crime, although it remains unclear if the back-up driver would be personally charged.

This example raises two questions. First, is it clearly the negligence of the back-up driver, *i.e.*, is there personal liability? Second, should the software provider entail responsibility or liability for the AI’s failure, *i.e.*, is there a form of product liability?

On the first question, if the back-up driver is regarded as a “driver,” then failure to stop before hitting a pedestrian amounts to negligence, even if the pedestrian was contributorily negligent. However, if we regard the back-up driver’s job as not to drive but to monitor the AI for errors, then we must ask what reasonable standard of care is required in monitoring and not in driving.¹¹⁶

110. Suggested in Richard Susskind & Daniel Susskind, *The Future of the Professions*, 162 PROC. AM. PHIL. PROC. 125 (2017).

111. Petrin, *supra* note 56; Florian Möslin, *Robots in the Boardroom: Artificial Intelligence and Corporate Law*, in RSCH. HANDBOOK ON L. A.I. (Woodrow Barfield & Ugo Pagallo eds., 2018).

112. Enriques & Zetzsche, *supra* note 1.

113. *Id.*

114. Petrin, *supra* note 56.

115. Sean Hollister, *Uber won't be charged with fatal self-driving, says prosecutor*, THE VERGE (Mar. 5, 2019) <https://www.theverge.com/2019/3/5/18252423/uber-wont-be-charged-with-fatal-self-driving-crash-says-prosecutor>.

116. See Curtis E.A. Karnow, *The Application of Traditional Tort Theory to Embodied Machine Intelligence*, in ROBOT LAW (Ryan Calo et al. eds., 2016) (arguing that the standard of care must evolve according to what reasonable standards of behaviour are expected where human agents work alongside or monitor robots and learn the patterns of robots’ behaviour).

Such a standard of care could in part depend on human expectations of AI performance, which could be unpredictable, since machine learning is inherently unpredictable.¹¹⁷ In the alternative, if one makes an analogy with airplane piloting—which always requires two pilots to be on board, even if autopilot technology is deployed for much of all flights¹¹⁸—is Uber negligent for removing the second back-up driver?¹¹⁹ Should the same standard of care for corporate systems and procedures be applied to airplane piloting as to self-driving cars? For example, where a corporation has been grossly negligent by failing to take reasonable steps in its systems and procedures to prevent a breach of duty of care, it can be criminally liable under the U.K. Corporate Homicide and Manslaughter Act.¹²⁰ The inquiry above reflects the need for new interpretations of the negligence thresholds in relation to new forms of human agency alongside the robot that performs certain primary tasks.

On the second question, product liability for software has been a tricky legal question for a long time. It is not yet clear if software is a “product” subject to strict product liability rules¹²¹ regarding defects,¹²² or if software is provided as a service. Where the latter applies, the legal responsibility for software bugs is based on the tort of negligence, which requires finding that the software provider has fallen below the reasonable man’s standard of care.¹²³ This standard is difficult to prove, as software bugs are inherently impossible to completely fix before release.¹²⁴ One can appreciate that an application of a strict or stricter liability standard would likely provide the necessary incentive to make software

117. Arno R. Lodder, *Algorithms: what, how, and particularly why?*, in LSE LAW POLICY BRIEFING SERIES (2019).

118. Tom Harris, *How Airline Crews Work*, HOWSTUFFWORKS, <https://science.howstuffworks.com/transport/flight/modern/airline-crew1.htm> (last visited Oct. 12, 2020).

119. Although it was reported that Uber had lined up two back-up drivers and made a policy decision to remove one before the occurrence of the March 2018 fatality. Hollister, *supra* note 115.

120. The Act allows corporations to be found guilty of manslaughter if gross negligence is involved in the breach of a duty of care by the corporate legal person. Corporate Homicide and Manslaughter Act, §§ 1–3 (UK); *but see* R. v. Cotswold Geotechnical Holdings Ltd. [2011] EWCA Crim 1337 R. v Cornish (Errol) [2016] EWHC 779 (QB) (exposing the difficulties in making a corporation responsible if the chain of command is long and systems of governance are in place).

121. EU product liability rules are stricter compared to the negligence and balancing standards upheld in the US. *See* PRODUCT LIABILITY 13 (Duncan Fairgrieve & Richard S. Goldberg eds., 2019). But in the latter case, the complexity of robot design and the interrelation of parts and software may make it difficult to apply traditional doctrines of defects and standards of care. F. Patrick Hubbard, *Allocating the Risk of Physical Injury from “Sophisticated Robots”: Efficiency, Fairness, and Innovation*, in ROBOT LAW 25 (Ryan Calo et al. eds., 2016).

122. Computer Associates UK Ltd. v. The Software Incubator Ltd., determined that “goods” are tangible and moveable property and software does not constitute goods, but the Supreme Court is referring the case to the Court of Justice of the EU to determine if the strict liability laws under European Directive for product liability should cover software. [2018] EWCA Civ 5181.X

123. Karen M. Goetzel, *Legal Liability for Bad Software*, 29 CROSSTALK 23 (2016).

124. Bryan H. Choi, *Crashworthy Code*, 94 WASH. L. REV. 39 (2019).

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development more conservative,¹²⁵ but how this may affect the incentive to innovate should be investigated.¹²⁶

That said, the issue of strict or stricter product liability assumes that the AI software producer should be liable. This may not be the case. Consider again the self-driving car example. When an accident occurs, should responsibility lie with the carmaker, the designer of the self-driving system, the developer of the sensing software, or perhaps the passenger himself?¹²⁷ Further, product liability for AI software assumes that product defects are caused by the original AI programming, and that the end users or consumers do not play any role in the functioning of the software. However, where proper AI functioning requires input from consumers, *i.e.*, feeding appropriate data into the AI machine, it is not clear if the consumer should be exempted from responsibility. Yet, it is not clear that liability should be restricted only to the producers of AI software.

Consider a scenario where radical/disruptive AI is adopted, such as AI being appointed to have equivalent status as a human board director or board member—the two issues discussed above similarly arise. In this scenario, will personal or product liability arise where a poor directorial decision is made that results in corporate loss? Petrin posits that only product liability is relevant, as there is no further relevance for personal liability.¹²⁸ If shareholders appoint AI to be the management organ, shareholders would not sue themselves for being negligent principals. Möslein also posits that, where the *ex post* accountability of an AI director is irrelevant, as there is no capacity to account nor compensate, AI directors have to be *ex ante* programmed to discharge directors' duties.¹²⁹ However, he questions how such duties can be “internalized” by machine learning. Can we really fuse the requirements of corporate law into product liability law? In this respect, a number of commentators have opined that a regulatory agency¹³⁰ that sets *ex ante* governance standards may be optimal, particularly with respect to software standards and entailing the liability of software providers. However, the implications of such a conclusion are stark and disturbing—is entrepreneurial leadership capable of being codified and standardized? Are regulatory agencies for corporate governance standards well-placed to govern AI development for the purposes of conducting economic

125. David C. Vladeck, *Machines Without Principals: Liability Rules and Artificial Intelligence*, 89 Wash. L. Rev. 117 (2014) (proposing a standard of strict liability for software providers).

126. Choi, *supra* note 124; Brandon W. Jackson, *Artificial Intelligence and the Fog of Innovation: A Deep-Dive on Governance and the Liability of Autonomous Systems*, 35 Santa Clara Tech. L. J. 35 (2019) (arguing that strict liability rules put a brake on innovation but to shield corporations from this may also over-subsidise their activities, leading to an incentive to oversupply hazardous activities); see Gerhard Wagner, *Robot Liability*, SSRN (2018), <http://ssrn.com/abstract=3198764>.

127. Andrew Austin, *Product Liability in the AI Age*, FRESHFIELD BRUCKAUS DERINGER, <https://www.freshfields.com/en-gb/our-thinking/campaigns/digital/artificial-intelligence/product-liability-in-the-ai-age/> (last visited Oct. 12, 2020).

128. Petrin, *supra* note 56.

129. Möslein, *supra* note 111.

130. Jackson, *supra* note 126 (discussing the roles of legislators, regulators and courts); Weaver, *supra* note 82.

activity, wealth creation and distribution? These challenges in adopting policy choices would likely affect the extent to which AI is allowed to effect radical/disruptive changes in corporate law and governance.

We next turn to whether AI should be regarded as a legal person, by virtue of its capabilities in performing autonomous acts, and what the implications would be.

b. Should AI be treated as a legal person?

It has been opined that, as we have created artificial legal persons in the form of corporations, there is no stopping the law from recognising AI as legal persons executing autonomously determined tasks.¹³¹ However, corporate personhood, whether dating back to Roman cities or to the modern corporation, is essentially human—corporations showcase collective human agency and give rise to a need for a legal personality in order to distinguish themselves from individual human agency, as well as to secure a communitarian commitment.¹³² Further, the relevance of legal personhood is not merely conceptual but instrumental in nature—what purposes are served by conferring legal personhood? The instrumental perspective¹³³ is not wrong: since the industrial revolution, modern corporations' legal personhood has been seen as a policy choice to facilitate progress and development.¹³⁴

If AI has legal personhood, can it be held liable for harms caused by it? Such liability may have little real consequence if the AI can neither compensate victims of harm¹³⁵ nor be made to suffer and realize the import of punishment. Imposing liability on AI may have the consequence of insulating corporations or other principals that deploy AI, as well as AI software providers, from liability. This may promote irresponsible economic conduct or corporate behavior.

On the other hand, it can be argued that corporations should not be crippled by penalties for experimenting with innovation.¹³⁶ Also, it can be argued that the legal personhood of AI—which interrupts the attribution of liability to

131. Shawn Bayern, *The Implications of Modern-Business Entity Law for the Regulation of Autonomous Systems*, 19 STAN. TECH. L. REV. 93 (2015).

132. Sergio Gramitto, *The Technology and Archeology of Corporate Law*, SSRN (2019), <http://ssrn.com/abstract=3232816>.

133. The instrumental perspective focuses on the ends that are served by conferring legal personhood, as explained in the text regarding policies since the industrial revolution that support enterprise as best-served by incorporation. There are other perspectives such as those that delve into the meaning of personhood and defend the freedom of will where there is sentience. See F. Patrick Hubbard, *Do Androids Dream? Personhood and Intelligent Artifacts*, SSRN (2010), <http://ssrn.com/abstract=1725983>; see also Evan J Zimmermann, *Machine Minds: Frontiers in Legal Personhood*, SSRN (2017), <http://ssrn.com/abstract=2563965> (arguing that legal personhood can save a programme from being terminated).

134. The concession theory of the corporation posits that corporations attain legal personality but comply with transparency conditions set by the state in order to further economic development and progress.

135. Van den Hoven van Genderen, *supra* note 55.

136. Choi, *supra* note 124.

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corporations that develop or deploy AI—could be a sound policy choice to limit the cost of innovation. This could pave the way for other forms of cost-sharing of the risks and harms to society, such as having compulsory insurance or a minimum paid-up capital policy for AI with legal personalities.¹³⁷

Nevertheless, corporations or shareholders may have no incentive to support AI gaining legal personhood, even with the benefit of being shielded from liability. This is because legal personhood carries certain implications, such as rights. If AI has rights over property or profits,¹³⁸ this would create uncertainty for corporations and their shareholders to how wealth should be distributed and appropriated. The question regarding rights for AI are further enumerated below.

c. Rights for AI?

Schirmer raises skepticism regarding the wisdom of conferring rights, such as those conferred to natural persons, to AI, and prefers to base the legal capacity of AI on the functions it serves.¹³⁹ What “rights” are appropriate and conferrable on AI as legal persons, and who would determine these policy choices? To pose these questions is to open up a Pandora’s box.

Corporate groups can use the legal personhood of AIs to conduct controversial learning, such as in weapons or, just as subsidiaries traditionally used to partition assets in risky businesses and jurisdictions.¹⁴⁰ Indeed, LoPucki goes so far as to say that algorithmic entities would most certainly be deployed to conduct illegal or severely high risk activities.¹⁴¹ In this regard, should AI subsidiaries be treated differently under English law from other subsidiaries, *i.e.*, the latter of which enjoy separate legal personhood and are not implicated in enterprise liability?¹⁴² Or, should a different policy choice be made?

It is also an open question whether AI should have rights under employment or labor law, countervailing the arguments raised in the grievances of displaced human agency from jobs. Should AI have citizenship rights such as political rights? This would introduce questions relating to the conceptual nature of

137. Wagner, *supra* note 126.

138. Gramitto, *supra* note 132 (discussing Roman law on slavery as an analogy for the corporate law paradigms involving AI at Board level).

139. Schirmer, *supra* note 55.

140. See Henry Hansmann & Reinier Kraakman, *Organizational Law as Asset Partitioning*, 44 EUROPEAN ECONOMIC REVIEW 807 (2000); Larry Catá Backer, *The Autonomous Global Enterprise: On the Role of Organizational Law Beyond Asset Partitioning and Legal Personality*, 41 TULSA L.J. 101 (2006).

141. Lynn M. LoPucki, *Algorithmic Entities*, 95 WASH. U.L.R. 887, 904 (2018).

142. There is no doctrine of enterprise liability in the UK. See *Adams v. Cape Industries PLC* [1990] Ch 433; see also *Prest v. Petrodel Resources Ltd* [2013] UKSC 34. Case law has made a small inroad with regard to a parent company’s direct duty of care where circumstances of control exist, but this area is still in development. See *Chandler v. Cape PLC* [2012] EWCA Civ 525; see also *Ogale Community v. Royal Dutch Shell* [2018] EWCA Civ 191; see also *Vedanta v. Lungowe & Ors* [2019] UKSC 20.

citizenship and the practical risks of corporate manipulation of democratic systems.¹⁴³

Ultimately, is an agency such as the Companies Registration House¹⁴⁴ able to determine if AI should be given legal personhood, and what rights should be granted? Should such rights be granted in a limited but standardized set, or should each right be considered and vetted before being granted on a case-by-case basis? It would also be challenging to consider the full matrices of pros and cons of rights under either approach, as unintended consequences are bound to occur. Considering rights raises a plethora of issues, including incentives, social trust, shifts in power, accountability, regulation, and governance. The complexification of the space for law, institutions and governance with the radical/disruptive advent of AI shows a similar trajectory with respect to radical/disruptive DLT, which we turn to next.

4. *Radical/Disruptive DLT*

As discussed above, DLT has the potential to create radical change when deployed in the context of identifying and empowering shareholders. Actors placed in lesser or disempowered positions within existing institutions can be unshackled and allocated a position of newly exercisable power in DLT's distributed and peer-to-peer structure. DLT can facilitate changes that directly challenge existing institutions based on presumed allocations of authority or power. We discuss three key issues below: (a) the flattening of power structures that DLT can facilitate, (b) the need to consider new governance norms, and (c) the new configurations of legal rights brought about by tokenization in the DLT economy.

a. Shifts in structure of economic agency and implications for the corporate economy

The peer-to-peer nature of DLT is not novel, as the platform economy has already ushered in a peer-to-peer model for business that challenges the established corporate economy. The platform economy is based on the idea of marketizing access to assets, instead of promoting traditional consumption to attain ownership of whole assets.¹⁴⁵ This is possible because large assets like a home or car are often underutilized.¹⁴⁶ Marketizing access to such assets, such as in the home-sharing or ride-sharing business models of Airbnb, Couchsurfing,

143. Van den Hoven van Genderen, *supra* note 55; Woodrow Barfield, *Towards a Law of Artificial Intelligence*, in RSCH. HANDBOOK ON L. A.I. (Woodrow Barfield & Ugo Pagallo eds., 2018).

144. This is the registration agency for companies incorporated in the UK. It processes incorporation applications and does not undertake 'merit' vetting of companies. See GOV.UK, <https://www.gov.uk/government/organisations/companies-house> (last visited Oct. 12, 2020).

145. ARUN SUNDARAJAN, *THE SHARING ECONOMY* 5 (MIT Press 2016); RACHEL BOTSMAN & ROO ROGERS, *WHAT'S MINE IS YOURS: HOW COLLABORATIVE CONSUMPTION IS CHANGING THE WAY WE LIVE* (Collins ed., 2011).

146. SUNDARAJAN, *supra* note 145.

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Uber, Lyft, and BlaBlaCar can meet a variety of urban consumption needs.¹⁴⁷ There is no longer a necessary hierarchical divide between business and retail, as platforms allow retail-level participants to assume economic agency like businesses, but perhaps on a more casual basis. Such movements can be empowering, as people can supplement their main income¹⁴⁸ with income from vacation rentals on Airbnb or occasional jobs on TaskRabbit.¹⁴⁹ The DLT-based economy extends opportunities for new economic agency further by offering new forms of commoditization and peer trading, such as peer-to-peer energy trading.¹⁵⁰

As economic agency on DLT systems is generated by smart contracts, economic agency is highly pre-defined and precise. However, contracts may be incomplete, especially if off-chain activity is required. For the purchase and sale of CryptoKitties, smart contracts may affect purchase and sale, transfer of value and ownership, and recording of transactions. Such a system is entirely on-chain as it relates to crypto-goods or services. However, where DLT is used to effect transactions that still require off-chain delivery, such as goods or services located elsewhere in cyberspace or physically, there is room for error, default, or dispute to arise. Given the irreversibility of DLT's transaction record, how would off-chain deviations be dealt with, and what implications would this have for the ledger?¹⁵¹ Would the laws that apply to the sale of goods or contracts still be applicable in light of the peer-to-peer nature of the transaction and the operation of smart contracting on an *ex ante* basis?¹⁵²

The peer-to-peer nature of the DLT economy and its system of *ex ante* smart contracting raise new questions regarding the nature of new economic agency and whether rights need to be redefined. Policy choices have been slowly developing for the platform economy to bring them in line with social

147. Michèle Finck & Sofia Ranchordás, *Sharing and the City*, 49 VAND. J. TRANSNAT'L L. 1299 (2016).

148. Diana Farrell et al., *The Evolution of the Online Platform Economy: Evidence from Five Years of Banking Data*, 109 AEA PAPERS & PROC. 362–66 (2019); Deborah Meilhan, *Customer Value Co-Creation Behavior in the Online Platform Economy*, 7 J. SELF-GOVERNANCE & MGMT. ECON. 19 (2019).

149. Willem Pieter De Groen et al., *The Impact of the Platform Economy on Job Creation*, 6 INTERECONOMICS 345 (2017) (showing that just over 10% of workers in the EU are carrying out full-time economic activity on platforms).

150. WEPower, <https://wepower.network/> (last visited Oct. 12, 2020). Peer-to-peer energy trading is growing in a number of Continental countries. Thomas Morstyn et al., *Using Peer-To-Peer Energy-Trading Platforms to Incentivize Prosumers to Form Federated Power Plants*, 3 NATURE ENERGY 94 (2018); Jodie Giles, *Peer to Peer Trading and Microgrids – the next Big Thing?*, REGEN (Feb. 21, 2018), <https://www.regen.co.uk/peer-to-peer-trading-and-microgrids-the-next-big-thing/>.

151. Usha R. Rodrigues, *Law and the Blockchain*, 104 IOWA L. REV. 680 (2019); Blaise Carron & Valentin Botteron, *How smart can a contract be?*, in BLOCKCHAINS, SMART CONTRACTS, DECENTRALISED AUTONOMOUS ORGANISATIONS & L. 101 (Daniel Kraus et al. eds, 2019).

152. Sarah Green, *Smart Contracts: Interpretation and Rectification* LLOYD'S MAR. & COM. L. Q., May 2018, at 234 (2018).

expectations of their novel economic agency.¹⁵³ We turn to new needs for governance in the DLT economy.

b. New governance needs, structures and norms in DLT systems

It has been written at length that the disintermediated, peer-to-peer nature of the DLT system means that centralized systems of governance are rejected.¹⁵⁴ Indeed, not having centralized institutions may be the design and hallmark of the ethos inherent to DLT systems, which reject the tyrannies and power structures of conventional institutionalized governance.¹⁵⁵ At scale, the DLT economy gives rise to questions of whether conventions such as corporate governance are necessary, or whether the new needs of corporations should be met by new governance norms.

Commentators are of the view that there is a need for governance in DLT systems,¹⁵⁶ despite the progress made by DLT in solving the Byzantine Generals' Coordination Puzzle. In a decentralized system such as the bitcoin blockchain, the key problem is double spending which can be undetected¹⁵⁷ as there would be no centralized institution to verify transactions and maintain a common ledger. This problem is solved by the programming of a consensus protocol for the bitcoin blockchain to which all participants of the system, or nodes, must adhere. In other words, code provides the solution for the lack of centrally-orchestrated coordination amongst nodes, the Byzantine Generals' Coordination Puzzle.¹⁵⁸

However, the consensus protocol may not be sufficient for the smooth running of DLT systems. For example, if an emergency occurs, such as the discovery of a bug in the protocols programmed for the DLT systems, are there emergency response institutions that could respond to the problem in a decentralized, uncoordinated state of things? The lack of clear institutions of authority on DLT allows for defaulting to majority control. However rogue behavior can result from majority control, where any majority that attains 51

153. Due to lobbying in favour of innovation. Sofia Ranchordás, *Digital Agoras: Democratic Legitimacy, Online Participation and the Case of Uber-petitions*, 5 THEORY & PRAC. LEGIS. 31 (2017); Mara Ferreri & Romola Sanyal, *Platform economies and urban planning: Airbnb and regulated deregulation in London*, 55 URBAN STUDIES 3353 (2018); Ebru Tekin Bilbil, *New Governance and Digital Platform Companies: The Case of Uber*, 6 INT'L J. PUB. ADMIN. IN DIGIT. AGE 49 (2017).

154. John Flood & Lachlan Robb, *Trust, Anarcho-Capitalism, Blockchain and Initial Coin Offerings*, SSRN (Nov. 20, 2017) <http://ssrn.com/abstract=3074263>.

155. Flood & Robb, *supra* note 154.

156. David S. Evans, *Economic Aspects of Bitcoin and Other Decentralized Public-Ledger Currency Platforms*, (Coase-Sandor Inst. for L. & Econ. Working Paper No. 685, 2014); Angela Walch, *The Bitcoin Blockchain as Financial Market Infrastructure: A Consideration of Operational Risk*, 18 LEGIS. & PUB. POL'Y 837 (2015); Marcella Atzuri, *Blockchain Technology and Decentralized Governance: Is the State Still Necessary?*, SSRN (2015), <http://ssrn.com/abstract=2731132>.

157. Satoshi Nakamoto, *Bitcoin: A Peer to Peer Electronic Cash System*, BITCOIN (2008), <https://bitcoin.org/bitcoin.pdf>; Jean Bacon et al., *Blockchain Demystified: A Technical and Legal Introduction to Distributed and Centralized Ledgers*, 25 RICH. J.L. & TECH. 1 (2018).

158. Kelvin Low & Ernie Teo, *Bitcoins and Other Cryptocurrencies as Property?*, 9 L. INNOVATION & TECH. 235, 238 (2017).

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percent control of the nodes can effect miscreant behavior, such as hacking and theft.¹⁵⁹ In each case, the founder-developers of the DLT system would intervene and create a fork in the blockchain, so that rogue behavior is not legitimized in the forked chain.¹⁶⁰ However, this creates governance by forking, *i.e.*, moving clusters of users into a different “community” existing alongside the previous community, without any further governance over rogue behavior. Such governance is minimal and primitive; it avoids norm development, prevention, and sanctioning, and the DLT ecosystem’s development of social character and culture can be stunted. Nevertheless, the development of sociology in DLT ecosystems must be kept to a minimum, so as not to create rules of inclusion/exclusion, which are against the ethos of an open DLT system.

Where the conduct of economic activity or agency is concerned, to what extent can economic activity or agency flourish without the support of institutions, such as legal institutions, for commercial certainty and to incentivize investment? The need to resolve *ex post* problems is the *raison d’être* for the rise of institutions for dispute resolution, law, and justice.¹⁶¹ To date, the most successful peer-to-peer marketplaces or platform economies, such as eBay, Amazon, Alibaba and Airbnb, and new financial sector actors, such as peer-to-peer lending platforms Zopa, Funding Circle and crowd investing platform Seedrs, are centrally coordinated by platform technology unicorns. This also means that new peer-to-peer infrastructures are introduced and maintained by the new giants in the corporate economy, with the purpose of creating and maximizing wealth in the same ethos as the corporate giants of old.¹⁶² On a more normative level, decentralized initiatives would struggle at scale, as

159. Haig, *supra* note 48.

160. *How many bitcoin forks are there?*, FORKDROP, <https://forkdrop.io/how-many-bitcoin-forks-are-there> (last visited Oct. 12, 2020); *Ethereum Executes Blockchain Hard Fork to Return DAO Funds*, COINDESK (2016), <https://www.coindesk.com/ethereum-executes-blockchain-hard-fork-return-dao-investor-funds>; see Anthony Cuthbertson, *Cryptocurrency Hackers Steal \$1.5m of Ethereum Classic in Rare Attack*, INDEPENDENT (Jan. 8, 2019), <https://www.independent.co.uk/life-style/gadgets-and-tech/news/ethereum-classic-attack-cryptocurrency-bitcoin-coinbase-etc-a8716986.html> (discussing an attack on the already forked ethereum classic in Jan 2019).

161. Dani Rodrik, *Getting Institutions Right*, IFO INSTITUT (2004), <https://www.ifo.de/DocDL/dicereport204-forum2.pdf>; Dani Rodrik et al., *Institutions Rule: The Primacy of Institutions over Geography and Integration in Economic Development*, 9 J. ECON. GROWTH 131 (2004) (discussing the importance of legal institutions such as private property rights and regulatory frameworks).

162. THE LAW OF ORGANISATIONS AND GOVERNANCE: DECENTRALISED BUSINESS MODELS AND DIGITAL TRANSFORMATION (Roger M. Barker & Iris H-Y Chiu eds., forthcoming 2021).

organization¹⁶³ is a phenomenon sustained by structures,¹⁶⁴ power,¹⁶⁵ institutions,¹⁶⁶ and values.¹⁶⁷

Therefore, the scalability of the DLT economy depends on policy choices in relation to governance structures and institutions. Commentators question whether policies and laws should be reformed, so that special responsibilities or liabilities are attached to DLT developers and miners who maintain the ledger.¹⁶⁸ Blemus further considers whether DLT enterprises, which enroll token financiers to support them, should become stakeholder-based ecosystems.¹⁶⁹ Should policy choices be considered in relation to the unique corporate governance needs of DLT enterprises, such as the roles of developers, the roles and rights of token financiers, relational mechanisms such as decision-making, accountability and dispute resolution, and crucially, distributional frameworks in relation to the wealth created on the DLT system?¹⁷⁰ The resolution of these issues can pave the way for scalable DLT to be used in organizing transactions that are not sufficiently undertaken by the corporate economy today, such as socially-oriented endeavors or social enterprises.¹⁷¹

5. Fundamental/Structural Changes Led by AI, DLT or Both

Commentators have offered a futuristic vision of a new economy: one operated by AI that renders human agency redundant. Bayern posits a vision

163. Haridimos Tsoukas, *Organisation as Chaosmos*, in PHILOSOPHICAL ORGANISATION THEORY (Oxford Univ. Press 2018) (describing organisation as generating order from disorganised or chaotic states).

164. The Weberian organisational order and the Parsonian functionalist approach to organisation. See Tuomo Peltonen et al., *Introduction: In Search of Alternative Origins of Organizing*, in ORIGINS OF ORGANISING, at x (Tuomo Peltonen et al. eds., 2018); Tuomo Peltonen, *Revisiting the Sociological Origins of Organization Theory: The Forgotten Legacy of Pitirim Sorokin*, in ORIGINS OF ORGANISING 28 (Tuomo Peltonen et al. eds., 2018).

165. Stewart Clegg, *Managing Organization Futures in a Changing World of Power/Knowledge*, in THE OXFORD HANDBOOK OF ORGANIZATION THEORY (Christian Knudsen & Haridimos Tsoukas eds., 2005).

166. DOUGLASS C. NORTH, INSTITUTIONS, INSTITUTIONAL CHANGE AND ECONOMIC PERFORMANCE (James Alt & Douglass North eds., 1990).

167. Amitai Etzioni, *A Comparative Analysis of Complex Organisations*, 91 POL. SCI. Q. 341 (1962).

168. Angela Walch, *Deconstructing “Decentralization”: Exploring the Core Claim of Crypto Systems*, in CRYPTO ASSETS: LEGAL & MONETARY PERSP. (forthcoming 2019); Matthias Tarasiewicz & Andrew Newman, *Cryptocurrencies as Distributed Community Experiments*, in HANDBOOK DIGIT. CURRENCIES 200 (2015); see Karen Yeung, *Regulation by Blockchain: The Emerging Battle for Supremacy between the Code of Law and Code as Law*, 82 MODERN L. REV. 207 (2019); Philipp Hacker, *Corporate Governance for Complex Cryptocurrencies? A Framework for Stability and Decision Making in Blockchain-Based Organizations*, in REGULATING BLOCKCHAIN: TECHNO-SOCIAL & LEGAL CHALLENGES 16 (P. Hacker et al. eds., 2019).

169. Stéphane Blemus & Dominique Guegan, *Initial Crypto-asset Offerings (ICOs), Tokenization and Corporate Governance*,” (Univ. of Paris Sorbonne I Working Papers, 2019).

170. Roman Beck et al., *Governance in the Blockchain Economy: A Framework and Research Agenda*, 19 J. ASS’N FOR INFO. SYS. 1020 (2018).

171. See Wulf Kaal, *Blockchain Technology and Race in Corporate America*, SSRN (2019), http://ssrn.com/abstract_id=3071378; see also Iris H-Y Chiu & Edward F. Greene, *The Marriage of Technology, Markets and Sustainable (and) Social Finance — Insights from ICO Markets for a New Regulatory Framework*, 20 EUR. BUS. ORG. L. REV. 139 (2019).

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where a corporate legal person is incorporated first by human agency and then entrusted to AI to be managed and operated. Humans may even withdraw if not incentivized to undertake corporate governance roles in monitoring and voting.¹⁷² Such AI would be programmed to serve the founder’s purposes and could execute contracts with third parties or carry out actions and deals based on coded instructions dependent on the fulfilment of pre-determined conditions. Similarly, Petrin envisages AI with “fused” capacities, both operational and managerial.¹⁷³ The automation of the highest executive-level functions can be supported by executive-level decision-making that is fully-informed, objective, and consistent,¹⁷⁴ overcoming the agency problem with shareholders.¹⁷⁵ With such AI, shareholders no longer need to suffer from information asymmetry, for they no longer have to monitor boards from a distance or rely on highly ineffective means of governance and control, such as third-party auditing and structuring of executive remuneration.

This AI-dependent vision could lead to a capitalist system on autopilot. Unfortunately, however, wealth creation and distribution issues are more nuanced. At its logical extreme, the autopilot enterprise system described above could lead to a potentially highly inequitable capitalist system that inhibits social mobility and ultimately would not be self-sustaining. In such a system, corporate and enterprise activities would be dominated by two types of investors—those who own enough capital to buy sophisticated AI to manage corporate assets, and the technologically savvy who can produce their own similarly sophisticated AI. This dominance would further incentivize these two types of investors to competitively exploit other resources, human or otherwise, resulting in social inequalities and sustainability problems.

In this AI-controlled economic universe, humans are unlikely to enjoy a restful and recreational existence envisaged by Silicon Valley proponents of the “Universal Basic Income” (UBI).¹⁷⁶ In anticipation of the fundamental/structural changes that may be brought about by “techno-capitalism”, several Silicon Valley gurus have called for new social policy in the form of the UBI. The UBI is a fixed sum, close to the living wage, to which every human being would be entitled (whether employed or not), so as to mitigate the disruptions to work opportunities or life caused by the advent of AI. The UBI would replace social welfare programs, would become a fundamental human right, and would provide

172. Shawn Bayern et al., *Company Law and Autonomous Systems: A Blueprint for Lawyers, Entrepreneurs, and Regulators*, 9 HASTINGS SCI. & TECH. L.J. 135, at 151 (2017).

173. Petrin, *supra* note 56.

174. See Enriques & Zetsche, *supra* note 1 (Acknowledging this point but taking a more critical perspective).

175. Murray et al., *supra* note 86; Wulf Kaal, *Blockchain Solutions for Agency Problems in Corporate Governance*, in ECON. INFO. TO FACILITATE DECISION MAKING (Kashi R. Balachandran ed., 2019).

176. Jathan Sadowski, *Why Silicon Valley is Embracing Universal Basic Income*, THE GUARDIAN (June 22, 2016), <https://www.theguardian.com/technology/2016/jun/22/silicon-valley-universal-basic-income-y-combinator>.

room for humans to consider how to reinvent themselves in entrepreneurship, innovation, or traditional employment in the new techno-economy. UBI can also be cynically seen as an opioid strategy to appease otherwise angry humans in economically and socially displaced situations.¹⁷⁷ Is the monthly UBI of about USD 1,500 as envisaged by techno-capitalists in Silicon Valley sufficient to buy a way out of human capacity for critique, reflection and revolution?

The futuristic vision of AI displacement or replacement of human economic agency may be efficient in a number of ways. However, if economic agency is understood more broadly in a sociological and psychological context,¹⁷⁸ then human agency remains relevant where AI is not fully sentient, and where humans have input about the structural changes brought about by techno-capitalism. This calls into question the social and political stability of such a vision, particularly if it ignores the potency of sociological and political capacity on the part of human agency. Instead of merely looking at legal and institutional change to support a techno-capitalist economy, there could be contests by legal and institutional movements to contain and govern such an economy. Such movement is already emerging in the form of pressure for the ethical governance of AI, not by self-regulation from the tech industry, but regulation by international and collective bodies such as the OECD.¹⁷⁹ This point is elaborated in Sections II and III.

Because DLT enables a flattened network structure for economic agency, enterprise and work opportunities could arise within such structures, without being tyrannized by AI-driven hierarchies. As such, the techno-capitalist future could look more like that posited by Zovko.¹⁸⁰ Zovko opines that, with the advent of technological breakthroughs such as 3D printing and the Internet of Things, it is possible for economic life to become more individualistic instead of being subject to industrialised and corporatized work patterns in industrial economies. Individuals can become ad hoc entrepreneurs of 3D printed products and designs on demand, while also earning by giving others a Lyft or renting out the spare bedroom on Airbnb. Economic agency becomes “prosumerist”, multifaceted, and tailor-made; work, play and social interaction similarly becomes on-demand, networked, virtual as well as real, and fused. As a result, the industrialized work-

177. Sadowski, *supra* note 176.

178. Literature from economic sociologists and those that deal with microfoundations of economic action beyond incentives provide further perspectives. See, e.g., Mark Granovetter, *Economic Action and Social Structure: The Problem of Embeddedness*, 91 AM. J. SOCIO. 481 (1985) (covering the social embeddedness of economic activities); Jens Beckert, *Re-imagining Capitalist Dynamics: Fictional Expectations and the Openness of Economic Futures*, in RE-IMAGINING ECON. SOCIO. (Patrik Aspers & Nigel Dodd eds., 2015); Victor Nee & Sonja Opper, *Economic Institutions from Networks*, in RE-IMAGINING ECON. SOCIO. (Patrik Aspers & Nigel Dodd eds., 2015); Nina Bendelj, *Thinking about Social Relations in Economy as Relational Work*, in RE-IMAGINING ECON. SOCIO. (Patrik Aspers & Nigel Dodd eds., 2015).

179. *OECD Principles on Artificial Intelligence*, OECD, <https://www.oecd.org/going-digital/ai/principles/> (last visited Oct. 12, 2020).

180. Zovko, *supra* note 5.

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life, contracted employment and the corporate model of mass production and wealth creation may all be fundamentally shaken up.¹⁸¹

Much of economic life could be managed by tokenization on ledger-based economies, and humans could become fused biologically with aspects of AI in order to manage their agency in all their activity, economic or otherwise. We are of the view that the forces that propel capital towards economic domination and displacement of human agency in work as described above will be equally matched by the forces that propel towards disintermediation and new forms of economic mobilization and technological empowerment for human agency. In other words, the economic roles of machines and human economic agency would likely both be transformed, and it is not necessarily a binary battle between machines and humans for economic agency.

Along with the economic landscape, we also need to explore the legal implications under the AI-driven regime. As we tokenize the spare seat at our dinner table, should we be faced with hygiene and food regulations? Should our paying dinner guest be able to sue for a stomach upset? How will peer-to-peer economies change allocations of private law duties, rights and liabilities?¹⁸² Should we all subscribe to insurance tokens that clearly delineate risks and costs *ex ante* so that we can dip in and out of different economic agencies with ease? Will we see a rise in regulation for *ex ante* risk distribution in a movement from “tort to regulation”?¹⁸³ Ultimately, will new bottom-up developments of governance unique to such networked economies provide the working norms for such economies and displace general legal paradigms?

Changes to laws and institutions are not merely reactive but also proactive, as policy choices can be made to cope with new activities as well as to facilitate and govern them.¹⁸⁴ The pressure for new freedoms and clarification of uncertainties, and the need to ensure that institutions can withstand the test of time (the rhetoric regarding technological neutrality¹⁸⁵ favored by the European Commission, for example) represent different waves of pressure compelling institutional responses. Barfield sees the scale of legal and institutional change as likely to become significant — affecting many “established” domains such as employment law, consumer law, product liability, intellectual property, and competition laws.¹⁸⁶

181. Oliver Cann, *Robots in the Boardroom and Other Technology Tipping Points*, WORLD ECONOMIC FORUM (Sep. 9, 2015) <https://www.weforum.org/press/2015/09/robots-in-the-boardroom-and-other-technology-tipping-points/>.

182. Bayern, *supra* note 131; Ryan Calo, *Robotics and the Lessons of Cyberlaw*, 103 CALIF. L. REV. 513,554-55 (2015) (querying whether *ex ante* distributions of risk will be more pronounced).

183. Jackson, *supra* note 125; see ROGER BROWNSWORD, *LAW, TECHNOLOGY AND SOCIETY* (2019).

184. Barak Orbach, *What is Regulation?*, 30 YALE J. REG. ONLINE 1 (2012).

185. Rory Copeland, *FCA Final Guidance on Cryptoassets: jettisoning tech-neutrality?*, OXFORD LAW (2019), <https://www.law.ox.ac.uk/business-law-blog/blog/2019/09/fca-final-guidance-cryptoassets-jettisoning-tech-neutrality>.

186. Woodrow Barfield, *Towards a law of artificial intelligence*, in RSCH. HANDBOOK ON L. A.I. (Woodrow Barfield & Ugo Pagallo eds., 2018).

Moreover, Fenwick and his colleagues champion the development of platform governance, where systems of order can be co-generated by all stakeholders of a platform.¹⁸⁷ Although they write in the context of the platform economy, these insights are applicable to the DLT business platform, which is also distributed and networked. The rise of platform governance can bring about institutional replacements for existing legal and governance norms. Private laws of organizations and transactions, as well as public regulatory institutions for economic life, are both challenged by staying relevant of and adjusting to a more democratized system, where decisions are made by stakeholders collectively.¹⁸⁸ We may also see new combinations of co-regulatory partnerships between private and public sector actors, as Finck proposes,¹⁸⁹ to shape the generation of norms and policies for the flattened and networked economy.

Policy choices, however, still must be made in relation to old normative questions. We use the term “policy choice” in a broad manner that encompasses lawmakers’ and regulators’ choices, as well as collective social choices that are effectively “soft law.”¹⁹⁰ Normative questions that relate to the allocation of power and rights in relation to transformations in social and economic life,¹⁹¹ as well as regulators’ roles in safeguarding the social commons,¹⁹² remain relevant whether we look at society as being physically bounded in geography or as existing in virtual communities. All the scenarios discussed in radical/disruptive or fundamental/structural CorpTech suggest that institutional responses would be necessary to cope with, govern, permit, facilitate, or restrict new configurations in economic agency and governance structures, and give rise to new entities, legal conceptualizations, and institutions of economic life.

We turn now to Section II, which argues that policy choices for old normative questions will be made within an institutional paradigm. Section II explores the institutional theoretical framework, and Section III applies this framework to

187. Much literature advocates that platform systems should generate stakeholder-based governance, not centralised domination by corporate owners of platforms. See, e.g., Mark Fenwick et al., *The “Unmediated” and “Tech-driven” Corporate Governance of Today’s Winning Companies*, 16 N.Y.U. J.L. & BUS. 75 (2020); Mark Fenwick et al., *The End of “Corporate” Governance (Hello “Platform” Governance)* (Eur. Corp. Governance Inst., Working Paper, No. 430/2018, 2018).

188. BROWNSWORD, *supra* note 183 at 181 (arguing that “the destiny of legal rules is to be found somewhere in the range of redundancy, replacement, redirection, revision and refinement”).

189. MICHÈLE FINCK, *BLOCKCHAIN REGULATION AND GOVERNANCE IN EUROPE* 171 (2018).

190. Such as social initiatives that are not binding but may be influential, including ethical principles for AI. See Luciano Floridi et al., *AI4People—An Ethical Framework for a Good AI Society: Opportunities, Risks, Principles, and Recommendations*, 28 MINDS & MACHINES 689 (2018).

191. Such as issues relating to legal agency. See *infra* Section I (discussing “Radical/Disruptive AI” for example).

192. Brownsword discusses how legal and regulatory institutions could respond to technological change. BROWNSWORD, *supra* note 183 at 191-202. These institutions would be caught between interpreting technology changes within the needs of coherence and social stability, while responding to new needs in allocating responsibility and rights to achieve goals such as public safety and protection from harm. *Id.* Old normative questions are themselves contested (e.g., see the discussion in Chapter 5 on the nature of the rule of law and its disconnection from particular substantive norms) and solutions addressing them are far from clear or consensual. *Id.*

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predict the extent of institutional changes that will occur in response to CorpTech.

II. AN INSTITUTIONAL THEORY OF CORPORATE LAW REFORM

In this Section, we construct a multi-theoretical framework for mapping policy choices in view of technological change. This multi-theoretical framework extrapolates in greater detail the perspective of “deep normative structures” articulated by Eidenmüller, who argues that technological revolutions are mediated by a society’s “deep normative structures” at any given time.¹⁹³ In this framework, policy choices are not dictated by technological functionalities or efficiency-driven economic perspectives alone.

First, we consider how institutional change may be brought about by technological change. Our review of theoretical literature in this area distills the key drivers that support institutional change in response to technological changes. Next, we review theoretical literature on corporate law and governance reform and distill the key factors for corporate law evolution. Both sets of reviews can be integrated to analytically derive an institutional-based, multi-theoretical framework for predicting change in corporate law and governance in response to technological change.

A. Theoretical Drivers for Institutional Change in Response to Technological Change

Institutions can be thought of as formal and informal rules, norms, patterns, forms, systems, ceremonies, or even rituals through which human interactions or relations are stabilized through expectations and conduct.¹⁹⁴

Commentators are generally of the view that technological change, which relates to functionality and the “material world,” is not deterministic of institutional change.¹⁹⁵ Institutions are social creations, and change is socially embedded¹⁹⁶ and mediated.¹⁹⁷ In this broad universe of social sense-making of technological change, institutional change is generally preceded by “ideological” change. North explains “ideology” as a “short-cut” device for making sense of the world, underpinning institutions that society accepts.¹⁹⁸ Hence, institutional change requires a collective and cognitive change of world view. This change of world view goes through a process of stabilization in social opinion and response,

193. Horst Eidenmüller, *Machine Performance and Human Failure: How Shall We Regulate Autonomous Machines?*, SSRN (2019), <http://ssrn.com/abstract=3414602>.

194. NORTH, *supra* note 166 at 3.

195. Eidenmüller, *supra* note 193; Peter Lindseth, *Technology, Democracy, and Institutional Change*, in, DIGIT. DEMOCRACY GLOBALISED WORLD 345 (Colette Cuijpers et al. eds., 2017).

196. Mark Granovetter, *Economic Action and Social Structure: The Problem of Embeddedness*, 91 AM. J. SOCIO. 481 (1985).

197. Jannis Kallinikos et al., *Governing Social Practice: Technology and Institutional Change*, 42 THEORY & SOC’Y 395 (2013); SHIPING TANG, A GENERAL THEORY OF INSTITUTIONAL CHANGE (2017).

198. NORTH, *supra* note 166 at 23.

and ultimately to legitimization, possibly through changes to law and policy.¹⁹⁹ From ideological change to the process of social absorption and acceptance, institutional change is socially determined as it relates first to social cognition and then to enactment in rules, norms, patterns, systems, rituals, ceremonies, habits, or other artifacts of social life.²⁰⁰ In sum, social capital and its mobilization are key to institutional change. The social determinants include (a) the impact of power structures and incentives; (b) bottom-up structures; (c) organizational mediation; (d) government or policy leadership and (e) temporal conditions. We survey these below.

1. *Impact of Power Structures and Incentives*

North argues that institutional change is generally slow and “sticky,” as existing institutions reflect power allocations in politics and society. Powerful interest groups have incentives to defend their hold on power as reinforced by extant institutions.²⁰¹ Bebchuk and Roe also argue that power allocations tend to be entrenched because existing institutions affect the incentives and resources of corporate actors to choose and implement corporate rules.²⁰² For example, controlling shareholders will have the incentive to maintain the existing rules that favor them and oppose proposed rules that disadvantage them.²⁰³ Another example is corporate insiders, who have the incentive and ability to deploy corporate assets to lobby politicians in order to extract private benefits of control.²⁰⁴ Further, one could argue that the Chinese government, as the controller of the state-owned enterprises (SOEs), has used AI to further its anti-democratic ends.²⁰⁵ It is thus questionable whether CorpTech will seriously

199. TANG, *supra* note 197.

200. Lindseth, *supra* note 195; Raoni Rajao & Niall Hayes, *Conceptions of Control and IT Artefacts: An Institutional Account of the Amazon Rainforest Monitoring System*, J. INFO. TECH., Dec. 2009, at 24; Jochen Runde et al., *On the Adoption of Technological Product Innovations: Rules, Routines and the Transition to Digital Imaging*, 33 CAMBRIDGE J. ECON. 1 (2009).

201. NORTH, *supra* note 166.

202. Lucian A. Bebchuk & Mark J. Roe, *A Theory of Path Dependence in Corporate Ownership and Governance*, 52 STAN. L. REV. 127, 157-60 (1999).

203. Bebchuk & Roe, *supra* note 202.

204. Lucian A. Bebchuk & Zvika Neeman, *Investor Protection and Interest Group Politics*, 23 R. FIN. STUD. 1089, 1091 (2010) (identifying corporate insiders as such as incentivised group for lobbying in relation to investor protection regulations).

205. For example, the state as the controlling shareholder of state-owned enterprises in autocratic states such as China has used AI to threaten human rights. The government has worked with private companies and SOEs to produce and use AI-powered facial recognition system to curtail the rights and liberties of Uighurs. The SOEs have partnered with private companies to develop an AI social credit system that collects data on individuals' financial and social history and transactions with a view to controlling and exposing their behavior. Kyle Matthews & Alexandrine Royer, *Artificial intelligence has been weaponized in China. That should be a wake-up call for the world*, CBC NEWS (May 21, 2019), <https://www.cbc.ca/news/opinion/ai-china-1.5140612>; Ryan Daws, *US Adds Chinese AI Firms to Ban List Citing Abuses Against Muslims in Xinjiang*, ARTIFICIAL INTELLIGENCE NEWS (Oct. 8, 2019), <https://artificialintelligence-news.com/2019/10/08/us-chinese-ai-firms-ban-list-abuses-muslims-xinjiang/>. For a list of the Chinese SOEs and private companies that have been blacklisted by the US government, see DEPARTMENT OF COMMERCE, <https://s3.amazonaws.com/public-inspection.federalregister.gov/2019-22210.pdf> (last visited Oct. 12, 2020).

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subvert the powers and incentives of the interest groups, particularly governments who own and control SOEs in authoritarian or autocratic states.

On the other hand, one may argue that entrenched interests may not always prevent new power clusters from arising, as market-based forces can generate new elites, such as the new technological elite of today. Cultures that are open to economic enabling and technology transformations, such as the US, are also open to new power shifts and reconfigurations.²⁰⁶ Nevertheless, new technological elites—such as Facebook and Amazon in the US, or Alibaba, Baidu, and Tencent in China—are companies controlled by controlling shareholders and their interests and powers are entrenched with existing institutions.

2. *Bottom-up Structures*

Top-down power structures tell only part of the story. Commentators mostly agree that institutional change is socially mediated and enacted.²⁰⁷ The “social capital” needed for institutional change driven by technological change is often not incentive-based alone but galvanized in collective contexts of human discourse and interaction. Further, how society makes sense of and applies the new technology is most important in determining whether technological change will receive social endorsement and be diffused. Thus, social capital can be found in “bottom-up” paradigms, where social relationships and networks galvanize and accelerate such social capital.²⁰⁸ Indeed, technological revolutions in social networks, including the advent of social media, have increased the channels for social diffusion.

3. *Organizational Mediation*

Much of social capital can be found in business and the workplace. Fountain’s work provides insight into how organizational structures and culture are built upon organizational relationships, norms, and values, and asserts that technological change is often mediated within these relationships.²⁰⁹ Thus, organizational mediation is a key contributor to technological change. Institutional change is often the result of organizational adoption of technological change where relationships and values are reinforced (more than disrupted) by such change. Kalinikos argues that even where technological change results in “disembedding” effects for organizational structures and norms, new

206. Lynne Kiesling & David Chassin, *Decentralized Coordination Through Digital Technology, Dynamic Pricing, and Customer-Driven Control: The Gridwise Testbed Demonstration Project*, 21 ELEC. J. 51 (2008) (discussing an experiment based in the US that brings in retail participants to join in the supply side of energy markets, showing the transformative potential for energy markets and price formation); Katharina Pistor et al., *Innovation in Corporate Law*, 31 J. COMP. ECON. 676 (2003).

207. Kallinikos et al., *supra* note 197; JANE E. FOUNTAIN, BUILDING A VIRTUAL STATE: INFORMATION TECHNOLOGY AND INSTITUTIONAL CHANGE (2001); TANG, *supra* note 197.

208. Norman Clark et al., *New Science, Capacity Development and Institutional Change: The Case of the Andhra Pradesh-Netherlands Biotechnology Programme*, 1 IJTMSD 196 (2002).

209. FOUNTAIN, *supra* note 207.

configurations of organizational structures must still cohere with the social fabric.²¹⁰

4. *Government or Policy Leadership*

One may question whether government leadership in innovation is key to institutional change. Empirical research from China indicates that top-down policy driving innovation *per se* does not guarantee institutional change where incentives are not yet compatible.²¹¹ Indeed, it has been argued that government or policy leadership in innovation is more likely to result in institutional change only if such innovation is successfully commercialized.²¹² Hence, policy alone cannot foster the conditions for social capital that support institutional change. Social endorsement of the technological change by markets and society is crucial to institutional change.

5. *Temporal Conditions*

Finally, temporal conditions affect the social response to technological change. As argued by Iyigun and Rubin, the state of society at a given time affects its response to new technology. Whether society is generally experiencing stability or upheaval/trauma, such as natural or social disasters instead of technologically-led events, impacts its response.²¹³ Research finds that stable societies or “peace-time” conditions are conducive to a social willingness to experiment with, accept, and invest in technological change. However, if a society experiences upheaval, such as a significant natural disaster or social divisions and disturbances, the willingness to absorb and invest in change is scarce, as risk aversion typifies the mood of such societies. Such risk aversion drives society to prefer traditional values and paradigms that seem more familiar and comfortable, giving rise to resistance against technological and institutional change.

We turn now to exploring what drives corporate law and governance changes generally, before deriving a combined theoretic framework.

210. “Disembedding” refers to rendering extant organisational structures or practices at risk of irrelevance or redundancy due to technological change. JANNIS KALLINIKOS, *THE CONSEQUENCES OF INFORMATION: INSTITUTIONAL IMPLICATIONS OF TECHNOLOGICAL CHANGE* 6 (2017).

211. Mingzhi Li & Kai Reimers, *Government Driven Model of Institutional Change Through Adoption of New Technology: A Case Study of the Failed Pharmaceutical Bidding and Procurement Platforms in China*, 6 *CHINESE MGMT. STUD.* 53 (2012).

212. Ronnie J. Philips, *Digital Technology and Institutional Change from the Gilded Age to Modern Times: The Impact of the Telegraph and the Internet*, 34 *J. ECON. ISSUES* 266 (2000); Rahul Mukhereji, *Interests, Wireless Technology, and Institutional Change: From Government Monopoly to Regulated Competition in Indian Telecommunications*, 68 *J. ASIAN STUD.* 491 (2009).

213. Murat Iyigun & Jared Rubin, *The Ideological Roots of Institutional Change*, SSRN (2017), <http://ssrn.com/abstract=2960492>.

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B. Theoretical Drivers for Change in Corporate Law and Governance

Corporate law and governance in many jurisdictions stand at an intersection of competing ideologies, such as shareholder primacy, director primacy (or managerial capitalism), and stakeholder-based or “communitarian” ideologies.²¹⁴ The waxing and waning of ideological trends support corporate law and governance reform. There are, however, underlying drivers for such ideological tides, and we observe a narrow circle of “social capital mobilization” that drive such ideological tides in different times. This narrow circle has centered upon key political economy actors, such as shareholders and directors in liberal market economies labor in coordinated market economies like Germany and Japan; and the state in state-oriented economies like China, Singapore, and South Korea.

C. Shareholder Primacy and Minority Shareholder Protection

The shareholder primacy ideology is frequently said to characterize the corporate law of liberal market economies like the U.S. and U.K., but it is rooted in two different traditions.²¹⁵ In the U.K., the legal preference for shareholder centrality is a legacy issue, as businesses transformed into corporations from the late 19th century, bringing partnership concepts into corporate law.²¹⁶ Partnerships are formed by individuals who are both capital and management providers, and the fusion of ownership and control in many family-owned companies in the U.K. was the context for a corporate law that provides for significant shareholders’ rights in corporate decision-making.²¹⁷ This system of power allocation and accountability that favors shareholders has persisted in the U.K. even though businesses in the U.K. have embraced separation of ownership from control since the post-war period.²¹⁸ In the same manner, the primacy of shareholders is a strong tenet in common law Asian countries, although the

214. See generally, THE CORPORATION (Grietje Baars & Andre Spicer eds., 2017); Lyman Johnson, *Corporate Law and the History of Corporate Social Responsibility*, in RSCH. HANDBOOK ON HISTORY CO. & CORP. L. 370 (2017).

215. Peter A. Hall & David Soskice, *An Introduction to Varieties of Capitalism*, in VARIETIES CAPITALISM: INSTITUTIONAL FOUNDATIONS COMPAR. ADVANTAGE 1 (Peter A. Hall & David Soskice eds., 2001).

216. Paddy Ireland, *Limited liability, Shareholder Rights and the Problem of Corporate Irresponsibility*, 34 CAMBRIDGE J. ECON. 837 (2010).

217. For example, shareholders determine and can amend the corporate constitution. See Companies Act § 21. Much of company law in terms of internal governance is enabling in nature, such as the possibility of opting out of the enabling default ‘constitution’ set out in the Model Articles Regulations, and the *Foss v Harbottle* doctrine that looks to shareholders to ratify internal breaches or errors before resorting to derivative actions. See *id.* § 239. The general meeting has powers to scrutinise substantial transactions, executive pay and to remove any director by an ordinary resolution. See *id.* §§ 168, 190ff, 439A.

218. Dispersed ownership only started taking off from the post-War period, hence company law served the needs of closely-held companies. See generally BRIAN CHEFFINS, CORPORATE OWNERSHIP AND CONTROL: BRITISH BUSINESS TRANSFORMED 252 (2008).

corporate ownership structures there are very different, as they are usually characterized by concentrated family or state ownership of companies.²¹⁹

Shareholder-centric corporate law is further supported by economic ideology, whose qualities of objectivity and neutrality stand in contrast to tradition. However, ideological reinforcement for tradition has taken place, as new shareholder actors have aligned interests and champion the same mantle. The ideology of shareholder primacy accelerated in the 1970s with the rise of economic theories for corporate organization seemingly providing an objective, and not power-centered, basis for shareholder primacy. This arose largely in the U.S. but has become an ideological foundation for theories of corporate governance, driving much international convergence.²²⁰ Economic efficiency theories of organization frame corporations as voluntary organizations that house a “nexus of contracts” to organize resources for production,²²¹ and shareholders as “residual claimants” that provide the bedrock of stable capital for corporate exploitation.²²² Power allocation, a key theoretical issue in corporate governance,²²³ creates the agency problem—the possible diversion of interest between managers who manage shareholders’ capital and shareholders who are residual claimants.²²⁴

The rise of institutional shareholders worldwide is the power context that supports shareholder primacy as the dominant ideology in corporate law. Private savings and investment rose as state welfare retreated after the Second World War, in turn giving rise to the growth in the investment intermediation and asset management sectors. Together, these new financial actors have become key owners of global equities. The rise of institutional investors would not fundamentally shake up shareholder-centric ideology,²²⁵ as their incentives remain aligned with that fundamental bedrock. However, institutional investors, who are usually minority shareholders, champion a slightly different type of

219. See generally ERNEST LIM, A CASE FOR SHAREHOLDERS’ FIDUCIARY DUTIES IN COMMON LAW ASIA (2019).

220. International convergence is driven by institutional investors in global capital markets, Paul L. Davies & Klaus J. Hopt, *Corporate Boards in Europe – Accountability and Convergence* 61 AM. J. COMP. L. 301 (2013); Mathias M. Siems, *Convergence in Corporate Governance: A Leximetric Approach*, 35 J. CORP. L. 729 (2010); Carsten Gerner-Beuerle, *Determinants of Corporate Governance Codes*, 13 INSTITUTIONAL ECON. 271 (2014). Policies introduced by international financial institutions such as the IMF and the World Bank in their lending programmes often makes corporate governance reform essential, in the mould of Anglo-American corporate governance norms.

221. Ronald H. Coase, *The Nature of the Firm*, 4 ECONOMICA 386 (1937).

222. Armen A. Alchian & Harold Demsetz, *Production, Information Costs, and Economic Organisation*, 62 AM. ECON. REV. 777 (1972).

223. Defined by the OECD: “Corporate governance involves a set of relationships between a company’s management, its board, its shareholders and other stakeholders. Corporate governance also provides the structure through which the objectives of the company are set, and the means of attaining those objectives and monitoring performance are determined.” *G20/OECD Principles of Corporate Governance*, OECD (2015), at <https://www.oecd.org/daf/ca/Corporate-Governance-Principles-ENG.pdf>.

224. Michael C. Jensen & William H. Meckling, *Theory of the Firm: Managerial Behaviour, Agency Costs and Ownership Structure*, 3 J. FIN. ECON. 305 (1976).

225. Richard C. Nolan, *The Continuing Evolution of Shareholder Governance*, 65 CAMBRIDGE L.J. 92 (2006).

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shareholder centricity, which focuses on minority shareholder protection, and find ideological resonance in the law and finance school of thought.

Since the late 1990s, the beginning of globalization has heralded an introduction to liberation in capital markets,²²⁶ stimulating comparative research into the growth and success of capital markets around the world.²²⁷ In identifying salient factors that promote capital flows into any particular jurisdiction, encouraging investment in that jurisdiction's listed companies, and attracting companies to list in that jurisdiction, commentators have found that "law matters".²²⁸ A jurisdiction's corporate law, and laws relating to its securities markets, are game-changing factors for the attractiveness of its capital markets, the strength of which benefits the corporate economy and economic development generally.²²⁹ This "law and finance" research strand has produced influential policy proposals internationally, encouraging jurisdictions to provide for minority shareholder protection through law. Such moves are welcomed by the institutional shareholders that command trillions of pooled fund moneys for global investment.²³⁰ Such ideology is also favored by European policy makers,²³¹ who focus on building a single and strong European capital market.²³² Such ideology is navigated within political economy contexts; in the case of Germany, for example, commentators remark how German corporate law institutions have changed, even if the Anglo-American introductions are implemented with national flavor.²³³ Further, the pro-minority shareholder ideology has profoundly influenced institutional change in jurisdictions with shareholder-centric corporate laws that nevertheless served controlling shareholders. The mobilization of the shareholder primacy²³⁴ and "law and

226. John Williamson & Molly Mahar, *A Survey of Financial Liberalization*, in *ESSAYS INT'L FIN.* 51, 62 (1998) (providing an example on the liberalisation of international capital markets).

227. See, e.g., Rafael La Porta et al., *Law and Finance*, 106 *J. POL. ECON.* 1113 (1998); Rafael La Porta et al., *What Works in Securities Laws*, 71 *J. FIN.* 1 (2006).

228. La Porta et al., *supra* note 229; John C. Coffee, *Law and the Market: The Impact of Enforcement*, 156 *U. PA. L. REV.* 229 (2007); Amir N. Licht, *Cross-Listing and Corporate Governance: Bonding or Avoiding?*, 4 *CHI. J. INT'L L.* 141 (2003).

229. Carsten Gerner-Beurle, *Law and Finance in Emerging Economies: Germany and Britain 1800–1913*, 80 *MODERN L. REV.* 263 (2017).

230. ROGER M. BARKER & IRIS H-Y CHIU, *INVESTMENT MANAGEMENT AND CORPORATE GOVERNANCE* 10 (2017).

231. Gregory Jackson & Arndt Sorge, *The Trajectory of Institutional Change in Germany, 1979–2009*, 19 *J. Eur. Pub. Pol.* 1146 (2012).

232. EU Shareholders Rights Directives 2007 and 2017 are aimed at making it easier and empowering institutional shareholders to engage and vote.

233. Adam Winkler, *Corporate Law or the Law of Business?*, 67 *L. & CONTEMP. PROBS.* 109 (2004); Dalia Tsuk, *Corporations Without Labor: The Politics of Progressive Corporate Law*, 151 *U. PA. L. REV.* 1861 (2003); Iris H-Y Chiu, *An Institutional Theory of Corporate Regulation*, 71 *CURRENT LEGAL PROBS.* 279 (2018).

234. Henry H. Hansmann & Reiner H. Kraakman, *The End of History for Corporate Law*, 89 *GEO. L. J.* 439 (2000).

finance” ideologies has found favor with policy makers who view such policy choice as favorable to regulatory competition.²³⁵

D. Shareholders vs Management and the Political Economy

Since the post-war period, however, a concurrent movement in power configuration and ideological contest—the rise of professional managers—has been afoot in the U.S. and U.K. With increasing separation of ownership from control in corporations, a new and powerful class of managerial elite has come about, who may not be shareholders at the same time.

The managerial class could spearhead a different ideology that centralizes the managers themselves, not the shareholders, in corporate governance, such that shareholders would become just another group of constituents to manage. In jurisdictions where ownership and control are separated, the main contest is the primacy contest between shareholder and director primacy.

U.S. and U.K. corporate laws bear many hallmarks of the ideological contest between shareholder and director primacy. In the U.S., corporate managers’ control of decision making, instead of shareholders’, is the *de facto* reality (with the exception of Michigan State courts, which endorse shareholder primacy as the primary purpose of corporations).²³⁶ Corporate managers grew in power, giving rise to an era of managerial capitalism.²³⁷ This is reflected in Delaware corporate law, which includes directorial primacy doctrines in relation to the decisions of corporate control.²³⁸ Hence, there is a strong ideological strand in the U.S. favoring director primacy,²³⁹ and the perspective that directors are professional stewards of corporate resources who can balance the interests of all stakeholders in their ultimate pursuit of the well-being of the corporation as its

235. Peter Gourevitch, *Politics and Corporate Governance: What Explains Policy Outcomes?*, in *CORPORATIONS & CITIZENSHIP* (Greg Urban ed., 2014); Gregory Schaffer, *Law and Business*, in *OXFORD HANDBOOK BUS. & GOV.* (David Coen et al. eds., 2010); Hatsuru Morita, *Corporate Law Reform and the Political Environment: An Empirical Analysis Employing Public-Comment Procedure Data in Japan*, 4 *ASIAN J.L. & SOC’Y* 309 (2017) (providing a Japanese take).

236. Powers in the hands of corporate managers was a subject of concern in ADOLF A. BERLE & GARDINER C. MEANS, *THE MODERN CORPORATION AND PRIVATE PROPERTY* (Transaction Publishers 1991) (1932), and the Berle-Dodd debate in E Merrick Dodd, *For Whom are Corporate Managers Trustees?*, 45 *HARV. L. REV.* 1145 (1932). See *Dodge v. Ford Motor Company*, 204 Mich. 459 (Mich. 1919) (providing an example from the Michigan courts); see also Jonathan R. Macey, *A Close Read of an Excellent Commentary on Dodge v Ford*, 3 *V.A. BUS. & L. REV.* 177 (2008).

237. Alfred D. Chandler Jr., *The Emergence of Managerial Capitalism*, 58 *BUS. HIST. REV.* 473 (1984).

238. Bebchuk points out that, compared to their UK counterparts, shareholders in Delaware-incorporated companies do not have the right to propose Charter amendments and are excluded from game-ending and corporate restructuring decisions. Lucian A. Bebchuk, *The Case for Increasing Shareholder Power*, 118 *HARV. L. REV.* 833 (2005). Further, Delaware upholds the right of management to defend vigorously against takeovers by means of poison pills so that the market for corporate control is muted in its disciplinary effect. Lucian A. Bebchuk & Allen Ferrell, *On Takeover Law and Regulatory Competition*, 57 *BUS. LAWYER* 1047 (2002).

239. CHRISTOPHER M. BRUNER, *CORPORATE GOVERNANCE IN THE COMMON LAW WORLD* (2013).

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own legal entity.²⁴⁰ In the U.K., the entity theory is long established i.e. that the corporation is its own legal person.²⁴¹ Shareholders however have a central place as holders of ‘residual power’ that can direct management,²⁴² as well as being able to exercise key powers in director appointment or removal.²⁴³ Powerful boards separate from shareholders only became the norm for large British companies in the post-war period.²⁴⁴

The power balance between the capital and managerial classes in jurisdictions where ownership and control are largely separated provides the context for mobilizing ideological trends and their influence upon institutional change. In the U.K., corporate law reforms to empower shareholders are often introduced after corporate scandals that involve wrongdoing by management.²⁴⁵ However, this is often balanced by concurrent reforms that target management and seek to make management more robust, such as the introduction of the independent director institution in the U.K.²⁴⁶ and the internal control regulations under the U.S. Sarbanes-Oxley Act 2002 after the fall of Enron.²⁴⁷ In other jurisdictions with a different political economy, the larger picture is similar, in that corporate law is borne out of the power balance achieved in the political economy.

E. Shareholders vs Stakeholders

It is argued that the ideology of stakeholder or communitarian types of corporate capitalism are reflected in coordinated market economies like

240. Supporters of director primacy include Margaret Blair and Lynn Stout. Margaret Blair & Lynn Stout, *A Team Production Theory of Corporate Law*, 85 VA. L. REV. 248 (1999); see Lynn Stout, *The Shareholder Value Myth: How Putting Shareholders First Harms Investors, Corporations, and the Public* (Berrett-Koehler, 2012); see also Stephen M. Bainbridge, *Director Primacy and Shareholder Disempowerment*, 199 HARV. L. REV. 1735 (2006).

241. Directors’ duties are owed to the corporation as its own entity as distinguished from the body of shareholders or individual shareholders, *Peskin v Anderson* [2000] EWCA Civ. 326; see also Andrew Keay, *An entity maximisation and sustainability model*, in CORP. OBJECTIVE 173 (2010); Andrew Keay, *Ascertaining the Corporate Objective: An Entity Maximisation and Sustainability Model*, SSRN (2008), http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1889236.

242. Regulations for Model Articles of Private and Public Companies, art. 4 (UK).

243. Companies Act 2006 § 168.

244. CHEFFINS, *supra* note 218 (discussing how mergers and acquisitions activity rose to disrupt close family ownership of companies, and then the growth of the stock market and the willingness on the part of corporations to make public offers, matched by the growth in appetite in the investing community, particularly institutions, resulted in greater dispersion of ownership in British publicly listed companies).

245. For example, the call for shareholder scrutiny of corporate governance practices is based on the first Cadbury Code of Corporate Governance after the corporate failures of Polly Peck and BCCI in the UK, SIR ADRIAN CARBURY, REPORT OF THE COMMITTEE ON THE PRINCIPAL FINANCIAL ASPECTS OF CORPORATE GOVERNANCE (1992) [hereinafter “CADBURY REPORT”], and the introduction of the Stewardship Code for shareholders in the UK in 2010 after the global financial crisis 2007-09.

246. First introduced in the Cadbury Code. CADBURY REPORT, *supra* note 245. This institution has only been strengthened over the years, as evidenced in the increase in independent Board composition to 50%, UK Corporate Governance Code 2018, Provision 11, as well as the role of the independent director in premium listed companies on the London Stock Exchange with controlling shareholders. See UK Financial Conduct Authority Listing Rules 9.8.4A.

247. *E.g. id.* § 30102.

Germany²⁴⁸ and Japan,²⁴⁹ although post-war occupation by the U.S. also introduced significant changes to their corporate law and governance arrangements. The corporate laws and governance arrangements in these economies reflect communitarian economic bargains, such as those between labor and capital, and culminate in institutions of corporate governance such as co-determination, the representation of workers on corporate boards in Germany,²⁵⁰ and the entrenched nature of the Japanese managerial class who are sourced from long-term employees.²⁵¹

F. The State as the Shareholder

The stakeholder or communitarian ideologies are also found in state-oriented economies such as China, India, and Singapore, albeit in a different form from the coordinated market economies like Germany and Japan.²⁵² A central feature of the corporate governance system in these economies is that the state, through state-owned enterprises (“SOEs”) is the controlling shareholder of a significant percentage of companies.²⁵³ The state therefore often exerts direct or indirect control over the management of a company. These SOEs have public-oriented and socio-economic objectives such as the production and supply of key public services and goods, the generation of employment and the equitable distribution of resources.²⁵⁴ Consequently, the managers of SOEs in this context are given more latitude than the companies in liberal market economies to pursue objectives that do not simply maximize shareholders’ profits, as long as their actions are consistent with the state’s developmental, and hence, communitarian goals.²⁵⁵ However, the objectives of these SOEs in state-oriented economies are distinguishable from the companies in the coordinated market economies. In state-oriented economies, labor rights are generally attenuated, as labor unions in, for example, China and Singapore are *de facto* organs of the state.²⁵⁶ In this way, the state can exert short-term pressure on management as well as on labor by curbing the rights of employees. In coordinated and liberal market economies,

248. Sigurt Vitols, *Varieties of Corporate Governance: Comparing Germany and the UK*, in *VARIETIES CAPITALISM: INSTITUTIONAL FOUNDATIONS COMPAR. ADVANTAGE* 337 (Peter A. Hall & David Soskice eds., 2001).

249. Curtis J. Milhaupt, *A Lost Decade for Japanese Corporate Governance Reform?: What’s Changed, What Hasn’t, and Why*, (Columbia Law Sch., Working Paper No. 234, 2003).

250. Stephen C. Smith, *On the Economic Rationale for Codetermination Law*, 16 J. ECON. BEHAV. & ORGANIZ. 261 (1991).

251. Milhaupt, *supra* note 249.

252. Nahee Kang & Jeremy Moon, *Institutional Complementarity Between Corporate Governance and Corporate Social Responsibility: a Comparative Institutional Analysis of Three Capitalisms*, 10 SOCIO-ECON. REV. 85 (2012).

253. THE OXFORD HANDBOOK OF ASIAN BUSINESS SYSTEMS (Michael A. Witt & Gordon Redding eds., 2014); OXFORD HANDBOOK ON STATE CAPITALISM AND THE FIRM (Mike Wright et al. eds., forthcoming).

254. ERNEST LIM, *SUSTAINABILITY AND CORPORATE MECHANISMS IN ASIA* (2020).

255. CORPORATE GOVERNANCE AND LABOUR MANAGEMENT: AN INTERNATIONAL COMPARISON (Howard Gospel & Andrew Pendleton eds., 2005).

256. LIM, *supra* note 254.

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in contrast, the interests of labor are accorded due protection in the form of co-determination (in Germany)²⁵⁷ and the appointment of employees as managers (in Japan).²⁵⁸

Political economy contexts for corporate law and governance reform are fundamentally important to ideological mobilization and institutional culmination.²⁵⁹ However, these contexts are unstable and are shifting. Since the millennium, significant corporate scandals have rocked social confidence in the corporate economy and have caused social discourse to penetrate the narrow power circle of policy influence in corporate law. This has resulted in corporate law and regulatory reform of a new nature.

G. Other Social Penetration into Corporate Law

Corporate law and governance reform is largely mobilized by incentive-based ideology reinforcing the interests of powerful groups in the political economy. However, since the 1990s, social discourse has become increasingly relevant, though yet insignificant in shaping institutional reform.²⁶⁰ Social discourse about corporations remains insignificant until moments of corporate scandal or disrepute provide points of inflection.²⁶¹ In the 1990s, the failures of Polly Peck and BCCI in the U.K. led to reform by way of a set of corporate governance best practices being introduced,²⁶² which have since been adopted by the London Stock Exchange as part of its premium listing requirements.²⁶³ This industry-generated solution represented a gradual step towards the healing of social confidence without severe disruption to business. Similarly, in the early 2000s, the American energy giant Enron's collapse resulted in severe criticism of corporate governance norms and consequent reform.²⁶⁴ These reforms

257. Mitbestimmungsgesetz 1976 (4 May 1976), Codetermination Act 1976, BGBl. I S. 1153, § 9.

258. Dan Puchniak, *Multiple Faces of Shareholder Power in Asia: Complexity Revealed*, in RESEARCH HANDBOOK ON SHAREHOLDER POWER 524 (Jennifer G. Hill & Randall S. Thomas eds., 2015).

259. MARK J. ROE, *THE POLITICAL DETERMINANTS OF CORPORATE GOVERNANCE* (2002); Marianna Belloc & Ugo Pagano, *Co-Evolution Paths of Politics, Technology and Corporate Governance* (Eur. Corp. Governance Inst., Working Paper No. 36/2005, 2005); Roberta Romano, *Metapolitics and Corporate Law Reform*, 36 STAN. L. REV. 923 (1984).

260. Lai Si Tsui-Auch & Toru Yoshikawa, *Institutional Change Versus Resilience: A Study of Incorporation of Independent Directors in Singapore Banks*, 14 ASIAN BUS. & MGMT. 91 (2015); *Milhaupt, supra* note 251 (discussing Japan).

261. Jennifer G. Hill, *Regulatory Responses to Global Corporate Scandals*, 23 WIS. INT'L L.J. 367 (2005).

262. CADBURY CODE, *supra* note 245 (giving rise to the first UK Corporate Governance Code).

263. See Iris H-Y Chiu, *Learning from the UK in the Proposed Shareholders' Rights Directive 2014? European Corporate Governance Regulation from a UK Perspective*, 114 ZVGIRWISS 1 (2015) (discussing the evolution of UK corporate governance norms).

264. In the US, the passage of the Sarbanes-Oxley Act 2002 followed from the collapse of Enron. see John C. Coffee, Jr., *What Caused Enron? A Capsule Social and Economic History of the 1990s*, 89 CORNELL L. REV. 269, 308-09 (2004); Geoffrey P. Miller, *Catastrophic Financial Failures: Enron and More*, 89 CORNELL L. REV. 423 (2004). The UK did not embark on significant reform in response to Enron but a review into the effectiveness of Board oversight was carried out, especially in relation to the

ultimately are incremental in nature and rely on the self-healing capacities of the corporation to better manage and control risks.²⁶⁵ Further, since the corporate scandals described herein were attributed to fraudulent management,²⁶⁶ shareholder-centric ideology was not fundamentally disturbed.

Following the global financial crisis of 2007–09, both management and shareholders in several failed financial institutions in the U.S., U.K. and Europe were criticized for having indulged in and condoned excessive risk taking.²⁶⁷ Consequently, stakeholder or communitarian discourse finally started to influence corporate law reform. First, regulatory intervention into corporate governance at banks and financial institutions,²⁶⁸ and the institution of regulatory accountability,²⁶⁹ introduced a public interest discourse into corporate governance.²⁷⁰ Second, institutional shareholders, whose power grew as they increasingly informally monitored corporations,²⁷¹ became subject to increased regulatory scrutiny.²⁷² Finally, the upheaval and loss of social confidence in the wake of the crisis culminated in legislation related to certain aspects of corporate social responsibility,²⁷³ which was previously confined to “soft law.”²⁷⁴

Board’s roles in internal control and ensuring the veracity of financial reporting, *See* Financial Reporting Council, *Internal Control: Guidance for Directors on the Combined Code* (1999).

265. Sarbanes-Oxley Act of 2002, 116 STAT. 745; *see* Coffee, *supra* note 264; *see also* Miller, *supra* note 264.

266. Michael D. Goldman & Eileen M. Filliben, *Corporate Governance: Current Trends and Likely Developments for the Twenty-First Century*, 25 DEL. J. CORP. L. 683 (2000).

267. DAVID WALKER, A REVIEW OF CORPORATE GOVERNANCE IN BANKS AND FINANCIAL INSTITUTIONS (2009).

268. Regulatory interventions have been made to prescribe corporate governance and internal control organisation at financial institutions in order to overhaul their risk and control cultures. BASEL COMMITTEE, GUIDELINES: CORPORATE GOVERNANCE PRINCIPLES FOR BANKS (2015); EUROPEAN BANKING AUTHORITY, GUIDELINES ON INTERNAL GOVERNANCE UNDER DIRECTIVE 2013/36/EU (2017); IRIS H-Y CHIU, REGULATING (FROM) THE INSIDE: THE LEGAL FRAMEWORK FOR INTERNAL CONTROL AT BANKS AND FINANCIAL INSTITUTIONS.

269. HOUSE OF COMMONS AND HOUSE OF LORDS, PARLIAMENTARY COMMISSION ON BANKING STANDARDS, CHANGING BANKING FOR GOOD (2013). This precedes the UK’s introduction of the senior managers’ regime, which is a regime for personal responsibility in banking misconduct. UK FINANCIAL CONDUCT AUTHORITY HANDBOOK COCON.

270. Peter O Mülbart, *Corporate Governance of Banks after the Financial Crisis - Theory, Evidence, Reforms*, (Eur. Corp. Governance Inst., Working Paper 130/2009, 2010).

271. Via Stewardship Codes, the pioneering one introduced in the UK in 2010.

272. The EU Shareholders’ Rights Directive 2017 at Arts 3g-I; Iris H-Y Chiu, *European Shareholder Rights Directive Proposals: A Critical Analysis in Mapping with the UK Stewardship Code?*, 17 ERA FORUM 31 (2016); *see* *UK’s Stewardship Code 2020*, FINANCIAL REPORTING COUNCIL, <https://www.frc.org.uk/investors/uk-stewardship-code> (last visited Oct. 12, 2020) (setting best practices for asset owners and managers in their investment management).

273. Examples of such legislation include disclosure regulation, supply-chain focused obligations, anti-corruption and anti-tax avoidance regulations that intervene into corporate processes. *See* Chiu, *supra* note 233.

274. *See* discussions *infra* Section I; Harri Kalimo & Tim Staal, *Softness in International Instruments - the Case of Transnational Corporations*, 41 SYRACUSE J. INT’L L. & COM. 257 (2014); Fabrizio Cafaggi, *New Foundations of Transnational Private Regulation*, 38 J.L. & SOC’Y 20 (2011); Colin Scott et al., *The Conceptual and Constitutional Challenge of Transnational Private Regulation*, 38 J.L. & SOC. 1 (2011).

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Corporations face increasing social pressure to make improvements, such as to manage sustainability risks and address social issues.²⁷⁵

The technology revolutions in AI and DLT can facilitate more diffused and flatter information structures that can empower more stakeholders and citizens. Hence, existing power structures, such as the managerial and shareholder classes, are demonstrating adherence towards internalizing these challenges, in order to continue shaping institutional change and defending extant power structures. For example, Business Roundtable, which represents the powerful managerial class in the U.S., has reshaped director primacy rhetoric in-line with the stewardship of sustainability and social responsibility goals.²⁷⁶ Many other policymakers, such as the EU and U.K., continue to adopt the shareholder primacy ideology by endowing shareholders' theoretical monitoring role with greater levels of public interest, such as by enhancing institutional shareholders' accountability. The EU Shareholders' Rights Directive 2017 compels institutions to consider "environmental, social and governance" risks in their portfolios and their monitoring of asset managers.²⁷⁷ Furthermore, sustainability risks are increasingly managed by the introduction of institutions' disclosure requirements.²⁷⁸

The above account of institutional change in corporate law is reflected in many jurisdictions. We turn now to derive a combined theoretical framework for how technological change may affect corporate law and governance reform.

H. A Combined Multi-Theoretic Framework for Institutional Change in Corporate Law/Governance in Response to Technology Change

We introduce a visual representation of the combined theoretical framework to describe how technology revolutions in AI and DLT would shape institutions in corporate law and governance. Theories of technology and institutional change suggest that institutional change culminates as a result of social mobilization and legitimation of a "new ideology" associated with new technology.²⁷⁹ We suggest that the major power groups influencing corporate

275. Business and human rights was an earlier starting point, see UN Guiding Principles for Business and Human Rights (2011); LARRY CATÁ BACKER, THE GUIDING PRINCIPLES OF BUSINESS AND HUMAN RIGHTS AT A CROSSROADS: THE STATE, THE ENTERPRISE, AND THE SPECTRE OF A TREATY TO BIND THEM ALL (2014); Karin Buhmann, *Public Regulators and CSR: The 'Social Licence to Operate'*, 136 J. BUS. ETHICS 669 (2016). There is increasing focus on corporate internalisation of sustainability goals such as the new EU proposal for climate risk reporting. See *Financial Groups at the Front of Fight against Climate Change*, FINANCIAL TIMES (Sep. 9 2019), <https://www.ft.com/content/ed036756-854f-3668-a9a9-6d00881cf13d>.

276. *Business must act on a new corporate purpose*, FINANCIAL TIMES (Aug. 19, 2019), <https://www.ft.com/content/3732eb04-c28a-11e9-a8e9-296ca66511c9>.

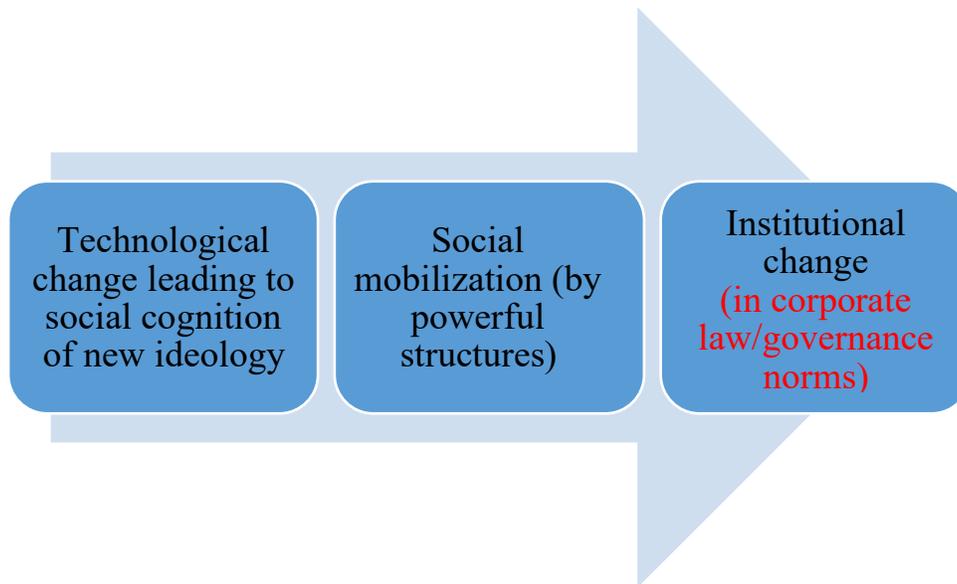
277. EU Shareholders' Rights Directive 2017, art. 3g & 3h.

278. EU HIGH LEVEL EXPERT GROUP ON SUSTAINABLE FINANCE (HLEG), FINANCING A SUSTAINABLE EUROPEAN ECONOMY (2018); Regulation 2019/2088 of the European Parliament and of the Council of 27 November 2019, at art. 3-7 (discussing sustainability-related disclosures in the financial services sector).

279. See *infra* Section I.

law and governance norms would mobilize old ideology with technological spins in order to achieve incremental institutional changes that align with their incentives and interests. It would be unlikely that institutional change would be achieved to facilitate radical/disruptive or fundamental/structural changes discussed earlier in this article *to the extent that it would denude extant power structures of their power.*

Figure 1: Diagram representing the theoretical framework for technological change and its relationship to institutional change in corporate law and governance norms



We now turn to Section III which applies the multi-theoretical framework above and discusses three concrete predictions about the future of corporate law and governance norms.

III. TECHNOLOGY VS IDEOLOGY – PREDICTING THE VERDICT IN CORPORATE LAW AND GOVERNANCE NORMS

We predict that technological revolutions will reinforce extant powerful structures rather than making them obsolete. Threats perceived by powerful structures in relation to AI would be mitigated by increased calls for ethical regulation. The threats perceived by powerful structures in relation to DLT would be mitigated by absorption and reframing of DLT for corporate use.

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A. *The Hold of the Powerful Political Economy Groups on Ideology and Institutional Change*

In Section I, we depicted the possible radical/disruptive or fundamental/structural changes that could shake up corporate organization and governance, such as AI-only corporate personalities without shareholders and directors, or DLT-enabled platform governance that supplants corporate governance. These changes pose ideological challenges to corporate law and governance. Director primacy may become redundant, while communitarian forms of governance would conflict ideologically with capital-controlled AI-fronted businesses. We suggest that ideological challenges will be mediated by existing powerful structures in the corporate economy. To this end, we expect that AI and DLT will primarily be framed in incentive-based or efficiency-driven terms; this would reinforce existing power structures, even if there is some change in the way “things are done.” Meanwhile, radical/disruptive or fundamental/structural changes that threaten those power structures would unlikely be mobilized.

Both managerial and shareholding classes are likely to welcome AI and DLT in terms of improving efficiency and delivering the corporate purpose and profits. We are unlikely to see much opposition to DLT, which will create efficiencies in organizing trade finance or supply chains. We would also expect to see AI being deployed to reform information-based tasks, from risk management²⁸⁰ to corporate reporting.²⁸¹ AI would also likely be used in evaluative tasks and perhaps even in board evaluation.²⁸² However, the board and C-suite officers would likely insist on the ultimate delivery of a human (usually value) judgment, even if assisted to a great extent by AI, where liability or legal risks may be implicated. This is because while directors and managers may be exposed to legal risk or liability, these risks are substantially mitigated by legal mechanisms (including, but not limited to, the business judgment rule and D&O insurance).²⁸³ In other words, management would likely increase rhetoric supporting and upholding existing legal duties and institutions, while appearing to be progressive in relation to technological responsiveness.

As Möslein points out, there would be intractable problems in judging robots *ex post* in care and skill regimes, and in programming robots *ex ante* to adhere to such regimes.²⁸⁴ Directors’ duty of care and skill is an open-ended and heavily human-centered regime for judgment, based on the standard of care expected of

280. Gary L. Evans, *Disruptive Technology and the Board: The Tip of the Iceberg*, 3 *ECON. & BUS. REV.* 205 (2017). Sharon Sutherland, *When Boards Look at AI- What Do They See?*, ERNST AND YOUNG, https://www.ey.com/en_gl/board-matters (last visited Oct. 12, 2020).

281. *AI and Corporate Reporting*, FINANCIAL REPORTING COUNCIL (2019), <https://www.frc.org.uk/getattachment/e213b335-927b-4750-90db-64139ace44f2/AI-and-Corporate-Reporting-Jan.pdf>.

282. Sutherland, *supra* note 280; PAXTON, *supra* note 14.

283. Directors’ and Officers’ liability insurance.

284. Möslein, *supra* note 111.

a reasonable director with equivalent skills and qualifications.²⁸⁵ Human-centeredness is also key to the loyalty regime.²⁸⁶ While directors may be incentivized to support their replacement because the obsolescence of human management, as suggested by Petrin,²⁸⁷ results in the shifting of liability to software providers, we hold that directors are unlikely to be deterred by liability regimes. This is because the incentives presented by power, pay, and perks of membership in the managerial class are more attractive.²⁸⁸ There are also other vested interests in supporting the essential humanness of the managerial class, such as lucrative business schools that educate and train the managerial elite.

There is another reason why AI is unlikely to eradicate the human-centeredness of the directors' liability regime. Because AI is designed by humans for humans, AI is likely to mirror and entrench the views of humans.²⁸⁹ Management could influence the coding process to generate certain predictive analytics in a way that will advance its own interests.²⁹⁰ After all, the AI's coder or supplier would likely be sensitive to the wishes of those purchasing the software. This conflict of interest is similar to that which exists when a company engages proxy advisors for services.²⁹¹ In this manner, there is an element of human responsibility in the design of AI, even if an AI director is appointed to the board. Second, insofar as the AI software periodically requires updated data to be fed into it, management can selectively feed certain data sets and omit others. Thus, even if AI directors become a reality, they could not completely eliminate directorial or managerial liability on the part of responsible human beings who have influenced the process of design, as long as human agents are responsible for the selection, purchase, maintenance, and operation of the AI machine.

We also advance the idea that the irreplaceability of the essentially human directorial organ of a given company will be supported by shareholders, even where there is separation of ownership from control. AI directorial organs may make more informed and consistent decisions than a fallible human,²⁹² but there also exists countervailing expert evidence that supports human supremacy in deciding qualitative or strategic matters. This is due to the complexity of the

285. Companies Act 2006 § 174; *Re Brian D Pierson (Contractors) Ltd* [1999] BCC 26.

286. Such as whether a director who resigns may be able to use existing knowledge and expertise to help set up a future competing business. *See Foster Bryant Surveying Ltd v. Bryant* [2007] EWCA Civ 200.

287. Petrin, *supra* note 56.

288. The growth of executive remuneration in the corporate sector has been marked especially in Western jurisdictions. *See* David Sarokin, *CEO Compensation in the US v. the World*, CHRON (Oct. 9, 2020), <https://work.chron.com/ceo-compensation-vs-world-15509.html>.

289. Enriques & Zetsche, *supra* note 1; Dignam, *supra* note 76.

290. Enriques & Zetsche, *supra* note 1.

291. Tao Li, *Outsourcing Corporate Governance: Conflicts of Interest Within the Proxy Advisory Industry*, 64 MGMT. SCI. 2473 (2018); Matthew Fagan, *Third-Party Institutional Proxy Advisors: Conflicts of Interest and Roads to Reform*, 51 U. MICH. J.L. REFORM 621 (2018).

292. Enriques & Zetsche, *supra* note 1.

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human instinct and the visionary nature of forward-looking human judgment.²⁹³ There is unlikely to be conclusive ‘science’ that says AI-based directorial organs are superior to their human counterparts.²⁹⁴ Indeed, although narrow AI can engage successfully in predictive analytics, namely statistical analysis and the identification of patterns of decision-making,²⁹⁵ there is no evidence that AI is equipped to handle complex, strategic decision-making that entails the weighing of competing facts and evidence; nor has it been demonstrated that AI can understand the complex trade-offs that are required in board decisions.

The replaceability of the board, if at all viable and appropriate, is a choice for shareholders. We argue that shareholders prefer the existing regime, where they can call on directors to account and engage in compensatory litigation in securities or derivative suits where directors have been negligent. The obsolescence of the directorial organ would mean structural changes to the shareholder litigation landscape.²⁹⁶ Given the uncertainties involved in calling software providers to account,²⁹⁷ shareholders would face significant disruption to the familiar landscape of risk and compensatory allocation.

At the same time, the managerial class would likely be unable to avoid pressures from shareholders, competitors, and the market to demonstrate optimal deployment of new technologies.²⁹⁸ Hence, we expect that AI may be used to assist with strategies, such as the role of VITAL discussed at the beginning of this article, or to assist company secretaries.²⁹⁹ In turn, the managerial class will likely demonstrate human supremacy over AI by changing risk, governance, and board structures to manage and govern AI’s use and deployment in a corporation. Boards would likely push for and shareholders would likely welcome³⁰⁰ the establishment of innovation committees or technological oversight committees on boards,³⁰¹ as well as governance structures at the highest levels for overseeing technological revolutions. These measures would likely be seen as being

293. Jarrahi, *supra* note 79.

294. See Enriques & Zetsche, *supra* note 1 (discussing the inconclusive arguments); see also Petrin, *supra* note 56.

295. Harry Surden, *Machine Learning and Law*, 89 WASH. L. REV. 8 (2014).

296. See Dan W. Puchniak & Masafumi Nakahigashi, *Japan’s Love for Derivative Actions: Irrational Behavior and Non-Economic Motives as Rational Explanations for Shareholder Litigation*, 45 VAND. J. TRANSNAT’L L. 1 (2012) (discussing an incentive-based discourse for shareholder litigation in the US and Japan).

297. See discussion *infra* Section I.

298. Irving Low, *Is Technology Disrupting Governance?*, BUSINESS TIMES (Sep. 20, 2018), <https://www.businesstimes.com.sg/companies-markets/is-technology-disrupting-governance>.

299. Because the company secretary’s advisory role is an essential aspect of the director’s discharge of their duty of care and skill, it is unlikely that such a role will become fully automated. See PAXTON, *supra* note 14.

300. Ronald F. Premuroso & Som Bhattacharya, *Is There a Relationship between Firm Performance, Corporate Governance, and a Firm’s Decision to Form a Technology Committee?*, 15 CORP. GOVERNANCE: AN INT’L REV. 1260 (2007).

301. Moksh Matta et al., *Understanding the Board’s Involvement in Information Technology Governance*, SSRN (2016), <http://ssrn.com/abstract=2778811>; Lawrence J. Trautman & Kara Altenbaumer-Price, *The Board’s Responsibility for Information Technology Governance*, 28 JOHN MARSHALL J. COMPUT. & INFO. TECH. L. 313 (2011).

modernist and responsive, but the most radical or fundamental changes to power would likely be stealthily sidelined. The managerial class is also likely to add its weight to championing for greater scrutiny, regulation, and ethnicization of AI.

What about the radical, almost fundamental/structural change that DLT offers—real-time accountability, information-sharing with shareholders, and facilitation of their decision-making,³⁰² perhaps rendering the board or management obsolete? This is unlikely to take hold, from both a technical and an ownership structure perspective.

From a technical lens, any deployment of DLT in corporate governance is likely to be permissioned and not permission-less. While permission-less DLT³⁰³ allows anyone to join the peer-to-peer network,³⁰⁴ permissioned DLT restricts access to participants identified by a set of rules.³⁰⁵ As the board has a duty to maintain proper internal controls and a risk management system, DLT for corporate governance cannot be permission-less. Hence, the rules and governance structure of DLT would necessarily be decided by human decision-makers within the company. At best, DLT may transform the platform of interactions but would not itself render the usual corporate governance actors obsolete.

From an ownership structure perspective, concentrated ownership structures—where the managerial and shareholder class are often fused or interrelated—would have no need to mobilize new ideology for shareholder decision-making powered by DLT. Given that controlling shareholders are the norm for the majority of the world's companies,³⁰⁶ DLT will likely play a limited role in enhancing accountability by controlling shareholders and in facilitating the exercise of shareholder governance rights by non-controlling shareholders. Controlling shareholders typically hold positions on the board and in management (as in family-owned companies) or control appointments to the board (as in SOEs). Even if DLT increases the speed of voting and the accuracy of vote tabulation, and hence incentivizes minority shareholders to exercise their voting rights and exert influence, the controlling shareholders would not be outvoted and would continue to retain power. Thus, this institutional change would be relevant only to dispersed ownership structures. As discussed in Section I, several jurisdictions have adopted incremental market and legal changes to facilitate DLT-powered shareholder meetings. However, these

302. See discussion *infra* Section I.

303. Anna Donovan, (*Shadow*) *Banking on the Blockchain: Permissioned Ledgers, Interoperability and Common Standards*, in RESEARCH HANDBOOK ON SHADOW BANKING (Iris H-Y Chiu & Iain G. MacNeil eds., 2018).

304. Xiwei Xu et al., *A Taxonomy of Blockchain-Based Systems for Architecture Design*, in 2017 IEEE INTERNATIONAL CONFERENCE ON SOFTWARE ARCHITECTURE (ICSA), GOTHENBURG 243 (2017).

305. Yermack, *supra* note 87.

306. OECD Corporate Governance Factbook 2019, OECD, <http://www.oecd.org/corporate/corporate-governance-factbook.htm> (last visited Oct. 12, 2020).

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developments are far from changing entrenched institutions, such as annual general meetings and powers of shareholder intermediaries.³⁰⁷

Would DLT revolutionize corporate decision-making by enabling shareholders to participate in real-time, alongside directors? The managerial class would have no incentive to seek more frequent general meetings or real-time decision making. This is partly because such a change would erode the power and importance of the managerial class. The managerial class would likely deploy the rhetoric of inefficient “governance by referenda” to resist any move to real-time decision-making by shareholders. On the other hand, if the general meeting participates in every key corporate decision, this would erode the basis for shareholder derivative litigation against directors for negligent decision-making.

However, shareholders are unlikely to seek structural changes to the annual general meeting that would have them participate in and be responsible for every key corporate decision. On the one hand, shareholder involvement overcomes the agency problem, and by marginalizing the directorial organ, corporations would save on expenses in relation to executive remuneration, leaving more room for dividends. However, institutional shareholders are still likely to prefer a back seat. They welcome having a monitoring role and legal regimes that enhance their powers to monitor and challenge, but they are likely uninterested in taking over the full suite of management themselves. This is because institutions generate their investment returns by both market gains (trading) and productive gains (investing in equities and obtaining dividends from real profitability). As market trading has become increasingly important to investment management³⁰⁸ and shareholder engagement is costly in terms of time and effort, it is already difficult to persuade institutions to undertake shareholder engagement.³⁰⁹ Importantly, in the U.S., index funds, which account for 25 percent of shares in all S&P companies (and is projected to increase to 40 percent in the next twenty years), engage in few stewardship activities and defer excessively to corporate managers.³¹⁰ DLT is unlikely to bring about a significant change in the incentives and strategies of index funds, whose business model is to minimize cost.

Further, institutions would likely incur more advisory expenses, such as the appointment of proxy advisory firms, to engage in expanded corporate governance roles, making cost a deterring factor. Such a change may appeal to

307. The custodians and investment funds holding securities interests on behalf of ultimate investing beneficiaries.

308. BARKER & CHIU, *supra* note 230.

309. One of the rationales underlying the UK Stewardship Code 2010. See DEPARTMENT FOR BUSINESS, INNOVATION AND SKILLS, THE KAY REVIEW OF UK EQUITY MARKETS AND LONG-TERM DECISION MAKING (2012).

310. Lucian A. Bebchuk & Scott Hirst, *Index Funds and the Future of Corporate Governance: Theory, Evidence, and Policy*, 119 COLUM. L. REV. 2029 (2019).

activist hedge funds,³¹¹ whose investment strategy is to get involved in management in order to shape the company's value creation. An increase in the intensity of shareholder powers and involvement in corporate decision-making would lead to activist hedge funds capturing a larger portion of the market for corporate influence. This implication may not be welcomed by all shareholders.³¹² It may also be argued that DLT will not incentivize activism by hedge funds because DLT provides a high level of transparency that is adverse to activist hedge fund strategies.³¹³ A central strategy of activist hedge funds is to surreptitiously buy shares in the company until it reaches a certain level that triggers legally required disclosure; DLT may inhibit this strategy.³¹⁴

Finally, if the dynamics of shareholder power are altered, such as by enhanced decision-making facilitated by real-time information reporting, then the corresponding question of changes to shareholders' duties in corporate law would arise.³¹⁵ Shareholders now enjoy the freedom to exercise their vote as they please,³¹⁶ and many institutions would not relish the conflict between their duties in investment management to their beneficiaries, and their duties to the companies that they are invested in. In sum, there would unlikely be sufficient consensus in the institutional shareholders' universe to mobilize such an institutional change.

Similarly, it is unlikely that ideological change towards disintermediating the investment chain³¹⁷ powered by DLT would be mobilized. The investment intermediaries (the powerful shareholder class) are unlikely to support such ideological change, as investment funds have no legal obligation to empower beneficiaries to vote directly.³¹⁸ Further, if particular governance rights are allocated to beneficiaries, does this mean that their investment risk becomes tied to particular securities investments? Would this deprive investors of the benefit of diversified risk allocation in a collective fund vehicle, and thereby be counterproductive to their investment objectives? Although investment

311. Brian Cheffins & John Armour, *The Past, Present and Future of Shareholder Activism by Hedge Funds*, (University of Cambridge Faculty of Law Research Paper No. 38/2011, 2012).

312. Some shareholders follow hedge fund activists in order to benefit from their efforts and the consequent boost to companies' share price. See Marco Becht et al., *The Returns to Hedge Fund Activism: An International Study* (Eur. Corp. Governance Inst., Law Working Paper No. 402/2014, 2014); see also Lucian A. Bebchuk et al., *The Long-Term Effects of Hedge Fund Activism*, 115 COLUM. L. REV. 2085 (2015). However, hedge fund activism has also been reported to create destructive effects. See John C. Coffee & Darius Palia, *The Impact of Hedge Fund Activism: Evidence and Implications*, (Eur. Corp. Governance Inst., Law Working Paper No. 266/2014); Marcel Kahan & Edward B Rock, *Hedge Funds in Corporate Governance and Corporate Control*, 155 U. PA. L. REV. 1021 (2007); Frank Partnoy, *U.S. Hedge Fund Activism*, (Univ. San Diego Legal Stud. Rsch. Paper No. 15-187, 2015).

313. Yermack, *supra* note 87.

314. Lucian A. Bebchuk & Robert Jackson Jr., *The Law and Economics of Blockholder Disclosure*, 2 HARV. BUS. L. REV. 39 (2012).

315. See Iman Anabtawi & Lynn Stout, *Fiduciary Duties for Activist Shareholders*, 60 STAN. L. REV. 1255 (2008).

316. Northern Counties Securities Ltd v. Jackson & Steeple Ltd [1974] 2 All ER 625.

317. Van der Elst & LaFarre. *supra* note 2.

318. See discussion *infra* Section I.

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intermediaries have come under criticism for not being effective shareholders in stewarding their beneficiaries' assets,³¹⁹ such criticism cannot be legally conclusive with regard to their discharge of fiduciary duties to their beneficiaries.³²⁰ It may also be argued that the beneficiary group has mixed interests in being directly empowered. Some beneficiaries enjoy the lack of transparency with regards to their identity,³²¹ while many individual savers in funds would likely experience inertia or the collective action problem in participating directly in corporate governance.

The powerful managerial and shareholder groups will frame technological change within an incentive-based paradigm in order to mobilize ideologies that are unlikely to result in radical or fundamental/structural change to corporate law and governance that erodes their powers. There may, however, be incremental change, such as the new law in Delaware that permits DLT to be used for communications with shareholders.³²² It is yet unclear whether bottom-up forces may challenge the shareholder and managerial groups in their grip on and framing of technological change, so as to favor futuristic visions of managerial replacement, shareholder governance or indeed, stakeholder participation. For instance, stakeholder groups may argue that managerial replacement is optimal, as AI would be objective, consistent and perhaps less susceptible to the sociopathic tendencies that have been written about many corporate leaders in power.³²³ This is a different perspective than just the agency problem, and the weeding out of sociopathic corporate leaders can be perceived to be socially beneficial. Stakeholder groups may also press for more involvement in corporate governance, as the enabling features of the DLT can accommodate distributed participation, rendering obsolete the traditional arguments about the inefficacies of having too many groups represented at the corporate governance table.³²⁴

However, bottom-up forces have had an uphill climb in influencing corporate law and regulation,³²⁵ and in the area of corporate social responsibility in which they have been the most influential, "soft law" is far more prominent than legislation.³²⁶ The breakthrough of bottom-up forces in shaping ideological and institutional change in corporate law and governance has been sporadic and modest overall.

319. Simon CY Wong, *Is Institutional Investor Stewardship Still Elusive?*, BUTTERWORTHS J. BANKING & FIN. L., Sept. 2015, at 508 (2015); Arad Reisberg, *The UK Stewardship Code: On a road to Nowhere*, 15 .CORP. L. STUD. 217 (2015).

320. See THE LAW COMMISSION, FIDUCIARY DUTIES OF INVESTMENT INTERMEDIARIES (2014) (containing a useful summary of the primarily financially-driven nature of the fiduciary duty). As funds use a variety of strategies including their corporate governance roles in seeking financial performance, such roles are not exclusively determinative of the discharge of fiduciary duties.

321. Geis, *supra* note 97; Nord, *supra* note 95.

322. Laster & Rosner, *supra* note 93.

323. See generally JEROME WANT, CORPORATE CULTURES (2006).

324. John Argenti, *Stakeholders: The Case Against* 30 LONG RANGE PLANNING 442 (1997).

325. Chiu, *supra* note 233.

326. *Id.*

Although AI and DLT will be institutionally mediated within corporate law and governance, the corporate sector would have to reckon with broader movements in the social context. We observe that the ethical and regulatory governance of AI is inspiring greater general social mobilization, and not just governance by the managerial class. Such frameworks will firmly confine AI to an anthropocentric paradigm of governance. This general movement will resonate with the actors in the landscape for corporate law and governance reform.

B. Ethical and Regulatory Governance of AI

The general tide of social change in the face of technological change would likely converge on the cautious and incremental, especially in the West. This is because AI and DLT are likely to unleash social dialogues that countervail each other. Even if DLT offers new ways of thinking about economic agency in freer terms, such as not being tied down to a day job in a corporatized institution, the insecurities and income volatility, as well as potential exploitation in the gig economy, have been well-canvassed.³²⁷ Fundamental questions are likely to be socially navigated not only on the basis of incentives, but also in relation to more normative and collective reflection on the meaning of life and community.³²⁸ These exchanges are likely to be protracted.

Further, temporal conditions in the West have changed from relative economic stability, from the 1980s to early 2000s, to increasing likelihood of turbulence, especially in relation to political conditions. The rise of far-right nationalism, as well as anti-establishment/anarcho-capitalism, are both observed,³²⁹ and under such temporal conditions, that general conservatism regarding technology-led institutional change may prevail.³³⁰ Even if there is still a strong pro-innovation stance supported by authorities and markets in the U.S. and U.K.,³³¹ there is a diminished likelihood of a “bubbly” embrace of

327. Brishen Rogers, *Employment Rights in the Platform Economy: Getting Back to Basics*, 10 HARV. L. & POL. REV. 480 (2016); Alberto Di Minin et al., *Assessing the Platform Economy*, 32 ISSUES IN SCI. & TECH. 13 (2016).

328. Remington Tonar, *Humanity's Search for Meaning in the Age of AI and Automation*, MEDIUM (Sep. 4, 2018), at <https://medium.com/@AItheist/humanitys-search-for-meaning-in-the-age-of-ai-and-automation-18c850544502>. Living with robots would raise questions regarding the rightfulness of anthropocentric notions of agency and morality, which need to be rethought for individuals and society in a context of such side-by-side living. DAVID J. GUNKEL, *THE MACHINE QUESTION: CRITICAL PERSPECTIVES ON AI, ROBOTS AND ETHICS* (2012).

329. Such as the Brexit referendum in the same year in the UK, turbulent political conditions in some European countries such as Italy and Greece and far-right governments in Austria and Hungary have raised concerns.

330. Iyigun & Rubin, *supra* note 213.

331. Such as the Innovate UK initiative. GOV.UK, <https://www.gov.uk/government/organisations/innovate-uk> (last visited Oct. 12, 2020); see Department of Business, *Government Response to House of Lords Artificial Intelligence Select Committee's Report on AI in the UK: Ready, Willing and Able?*, UK PARLIAMENT (June 2018), <https://www.parliament.uk/documents/lords-committees/Artificial-Intelligence/AI-Government-Response2.pdf> (setting out that exploring the capabilities and efficiencies of AI and a data economy are

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technological change and subsequent institutional implications. Further, because economic recessions during the COVID-19 pandemic³³² threaten social stability,³³³ governments are likely to tread with care when considering dramatic policy pushes towards technological and institutional change.

There is a different institutional context in China in terms of social remodeling using AI and DLT, such as social “scoring” of citizens³³⁴ and the deployment of facial recognition technologies.³³⁵ The top-down enforcement of technological management as a new administrative state or even rule of law³³⁶ creates institutional change, even though the ensuing social mediation may yield unpredictable results.³³⁷ In the West, such technological management by authorities remains at an experimental stage;³³⁸ this can be attributed to the institutional framework at work, where different aspects of social mediation are already taking place, introducing forces that countervail and balance each other.

This underlying social context would likely reinforce the incrementalism experienced in corporate law and in governance norms. We already see a rise in voluntary ethical governance of AI by the technological sector, such as the standards introduced by the IEEE, the professional organization for the technology sector,³³⁹ and the “Partnership on AI to Benefit People and Society”, an alliance formed by Google, Amazon, IBM, Facebook and Microsoft, to

priorities but these require trust and ethical governance). The EU also embraces the innovative potential of AI but with caution to ‘leaving no-one behind’ in socio-economic changes and in setting up ethical and legal frameworks. See COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE EUROPEAN COUNCIL, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS, ARTIFICIAL INTELLIGENCE FOR EUROPE (2018) [hereinafter “AI FOR EUROPE”].

332. Richard Paartington, *Covid-19: UK economy plunges into deepest recession since records began*, THE GUARDIAN (Aug. 12, 2020), <https://www.theguardian.com/business/2020/aug/12/uk-economy-covid-19-plunges-into-deepest-slump-in-history>; Jeffrey Frankel, *The US is officially in recession thanks to the coronavirus crisis*, THE GUARDIAN (June 16, 2020), <https://www.theguardian.com/business/2020/jun/16/us-recession-coronavirus-crisis>.

333. Roberto Censolo & Massimo Morelli, *COVID-19 and the Potential Consequences for Social Stability*, 26 PEACE ECON., PEACE SCI. & PUB. POL. 1 (2020).

334. *China Ranks Citizens with a Social Credit System: Here’s What You Can Do Wrong and How You Can be Punished*, THE INDEPENDENT (Apr. 10, 2018), <https://www.independent.co.uk/life-style/gadgets-and-tech/china-social-credit-system-punishments-rewards-explained-a8297486.html>.

335. The Economist, *China: Facial Recognition and State Control*, YOUTUBE (Oct. 24, 2018), <https://www.youtube.com/watch?v=Ih2gMNRUuEY>.

336. BROWNSWORD, *supra* note 183.

337. Mingzhi Li & Kai Reimers, *Government Driven Model of Institutional Change Through Adoption of New Technology: A Case Study of the Failed Pharmaceutical Bidding and Procurement Platforms in China*, 6 CHINESE MGMT. STUD. 53, 57 (2012).

338. Madhumita Murgia, *How London became a test case for using facial recognition in democracies*, FINANCIAL TIMES (Aug. 1, 2019), <https://www.ft.com/content/f4779de6-b1e0-11e9-9fdcab53d6959> (showing how the trialling of such a system generated debate and controversy); see Dan Sabbagh, *London Mayor Writes to Kings Cross Owner over Facial Recognition*, THE GUARDIAN (Aug. 14, 2019), <https://www.theguardian.com/technology/2019/aug/13/london-mayor-writes-to-kings-cross-owner-over-facial-recognition-concerns> (discussing how the London mayor expressed concern at such use of technology in private developments of public places such as Kings Cross station).

339. *IEEE Global Initiative for Ethical Considerations in Artificial Intelligence (AI) and Autonomous Systems (AS)*, IEEE, https://standards.ieee.org/news/2017/ieee_p7004.html (last visited Oct. 12, 2020) (providing a list of standards).

explore research and engage in stakeholder partnership to develop standards for the AI industry.³⁴⁰ We predict that there may be convergence from many social quarters on subjecting AI and DLT to social scrutiny and governance.

However, leaving ethical governance to the technological sector is widely criticized as insufficient, as technologists often view ethical issues as *ex post* problems to be fixed with a technological solution,³⁴¹ instead of as a normative learning paradigm that can shape software engineers' mindsets.³⁴² The bridge between technologists' approach and social engagement is still under construction. Technologists see the embedment of ethics as the need to code specific choice sets and preferences,³⁴³ and research highlights a lack of engagement between the technological sector and ethicists.³⁴⁴ Technologists are possibly far from understanding the debates and dilemmas that ethicists face,³⁴⁵ such as answering the question of "what is obscene?"³⁴⁶ or "who should make ethical choices?"³⁴⁷

The OECD has introduced broad principles for AI development, namely:

- Respect for human autonomy;
- Prevention of harm;
- Fairness; and
- Explicability.³⁴⁸

340. *Partnership on AI formed by Google, Facebook, Amazon, IBM and Microsoft*, THE GUARDIAN (Sep. 28, 2016), <https://www.theguardian.com/technology/2016/sep/28/google-facebook-amazon-ibm-microsoft-partnership-on-ai-tech-firms>.

341. Thilo Hagendorf, *The Ethics of AI Ethics*, 30 MINDS & MACHINES 99 (2020); Alan K. Mackworth, *Architectures and Ethics for Robots Constraint Satisfaction as a Unitary Design Framework*, in MACHINE ETHICS (Michael Anderson & Susan L. Anderson eds., 2011).

342. Hagendorf, *supra* note 341; Michael Veale et al., *When Data Protection by Design and Data Subject Rights Clash*, 8 INT'L DATA PRIVACY LAW 105 (2018).

343. Ethical capacity is built into a robot largely by coding choice sets, and machine engagement with ethics can never be the same as human engagement at a sentient level. *See, e.g.*, James H Moor, *The Nature, Importance, and Difficulty of Machine Ethics*, in MACHINE ETHICS 13 (Michael Anderson & Susan L. Anderson eds., 2011); Selmer Bringsjord et al., *Piagetian Roboethics via Category Theory Moving beyond Mere Formal Operations to Engineer Robots Whose Decisions Are Guaranteed to be Ethically Correct*, in MACHINE ETHICS 361 (Michael Anderson & Susan L. Anderson eds., 2011); Luís M. Pereira & Ari Saptawijaya, *Modelling Morality with Prospective Logic*, in MACHINE ETHICS 398 (Michael Anderson & Susan L. Anderson eds., 2011); Susan L. Anderson & Michael Anderson, *Prima Facie Duty Approach to Machine Ethics: Machine Learning of Features of Ethical Dilemmas, Prima Facie Duties, and Decision Principles through a Dialogue with Ethicists*, in MACHINE ETHICS 476 (Michael Anderson & Susan L. Anderson eds., 2011).

344. Hagendorf, *supra* note 342.

345. Various ethical strands of thought are also in conflict with each other such as deontological and utilitarian perspectives. *See* J. Storrs Hall, *Ethics for Machines*, in MACHINE ETHICS 28 (Michael Anderson & Susan L. Anderson eds., 2011); James Gips, *The Ethical Robot*, in MACHINE ETHICS 244 (Michael Anderson & Susan L. Anderson eds., 2011); Thomas M. Powers, *Prospects for a Kantian Machine*, in MACHINE ETHICS 464 (Michael Anderson & Susan L. Anderson eds., 2011).

346. Amitai Etzioni & Oren Etzioni, *AI-assisted Ethics*, 18 ETHICS & INFO. TECH. 149 (2016).

347. Should AI ethics be left to the individual to determine what is best for himself/herself. *See* Etzioni & Etzioni, *supra* note 346 (proposing such a system).

348. OECD, *supra* note 179.

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These principles are just a starting point, as their high-level nature needs to be translated into application for technology designers.³⁴⁹ Also, the scope of ethical AI principles can be further expanded by accounting for other values, such as universal human rights and sustainability.³⁵⁰ It remains uncertain, though, how these principles can provide robust governance in the absence of mandatory accountability³⁵¹ or auditing of technological developments. Researchers are increasingly calling for opening up the black box of machine learning³⁵² to determine the how algorithmic decision-making has taken place.

Social mobilization in navigating technological changes may gradually converge upon a mixture of industry, stakeholder, and regulatory initiatives for governing AI,³⁵³ perhaps on an international level.³⁵⁴ Co-regulatory measures are likely to be fostered, since relying on any one group of constituents such as industry, stakeholders or regulators is unlikely to generate a fully informational and strategic matrix for initiatives. The industry is conflicted in its commercial interests, while regulators would be both users and deployers of technology — for example, the use of AI in regtech³⁵⁵ to detect non-compliance, and even predictive analytics.³⁵⁶ The dialogue around technology and institutional response must incorporate balanced representation of the competing interests in society.³⁵⁷

The development of AI is likely to be socially mediated through governance frameworks and initiatives from a variety of quarters, whether public, private, or both. This larger context supports and reinforces our prediction in relation to technology's incremental impact on corporate law and governance development.

349. Brent Mittelstadt, *AI Ethics: Too Principled to Fail?*, NATURE MACHINE INTELLIGENCE, November 2019, at 1.

350. Hagendorf, *supra* note 342.

351. The scrutiny of algorithmic operations in finance driving trading decisions, for example, has been lagging and is sub-optimal because of the systemic impact of such operations. See FRANK PASQUALE, THE BLACK BOX SOCIETY (2015).

352. Brent D. Mittelstadt et al., *The Ethics of Algorithms: Mapping the Debate*, BIG DATA & SOC'Y, July 2016, at 1, 6 (discussing on the need for scrutability of the functionality of algorithms).

353. E.g., Floridi et al., *supra* note 190 (describing the standards); FINCK, *supra* note 189 at 171-80 (discussing co-regulation).

354. The European Commission is looking into instituting ethical standards and legal reform in product liability law for AI developers. See AI FOR EUROPE, *supra* note 331 at ¶ 3.3; see also OLIVIA J ERDÉLYI & JUDY GOLDSMITH, REGULATING ARTIFICIAL INTELLIGENCE: PROPOSAL FOR A GLOBAL SOLUTION (2018) (proposing an international organisation to regulate AI).

355. This is experimented in financial regulation where regulators increasingly use AI to filter compliance reporting for concerning signals. See Dirk A, Zetzsche et al., *Regulating a Revolution: From Regulatory Sandboxes to Smart Regulation*, 23 FORDHAM J. CORP. & FIN. L. 31 (2017); see also Nizan G. Packin, *Regtech, Compliance and Technology Judgment*, 93 CHICAGO-KENT L. REV. 193 (2018) (voicing concerns regarding technological judgments).

356. ERIC SIEGEL, PREDICTIVE ANALYTICS: THE POWER TO PREDICT WHO WILL CLICK, BUY, LIE OR DIE (2013) (outlining the mechanics of predictive analytics and providing a discussion of pros and cons).

357. Brownsword, *supra* note 183.

C. Mainstream and Fringe DLT

Although DLT can be used to construct a distributed economic space that rejects centralized institutions and, potentially any institution of authority, the social mediation of its potential may not culminate in fundamental/structural institutional change. We predict that certain efficiency qualities of DLT may be harnessed by mainstream corporations, which in turn create new business processes and market experiences that are competitive and innovative. We are skeptical that the decentralized economic visions powered by DLT will become mainstream.

DLT is being experimentally used in business transformations in mainstream corporate sectors where efficiency gains are most likely,³⁵⁸ such as global supply chains,³⁵⁹ movements of international finance,³⁶⁰ the internet-of-things economy,³⁶¹ and augmentation of virtual storage and access.³⁶² However, the revolutionizing nature of the distributed ledger as a coordinating database should not be exaggerated, as existing infrastructure is not entirely woeful or inefficient. Empirical research finds that conventional cloud storage and computing supported by Amazon, for example, is less expensive than DLT by a factor of two.³⁶³ Further, existing coordination mechanisms in the corporate sector or the internal IT system of a large corporation may not be interoperable or upgradeable using DLT.³⁶⁴ Even as “fintech” payment companies, such as Ripple, challenge existing payment providers in the market with their DLT offering, existing payment providers have not embarked on a full scale DLT conversion. Instead, we see a significant consolidation amongst existing payment providers, integrating their coordination and communications mechanisms to improve complementary efficiencies and grow in scale, such as Visa’s acquisition of

358. *Blockchain Beyond the Hype: What is the Strategic Business Value?*, MCKINSEY & CO. (June 2018), <https://cybersolace.co.uk/CySol/wp-content/uploads/2018/06/McKinsey-paper-about-Blockchain-Myths.pdf>.

359. Thomas Bocek et al., *Blockchains Everywhere - A Use-case of Blockchains in the Pharma Supply-Chain*, IFIP, <http://dl.ifip.org/db/conf/im/im2017exp/119.pdf> (last visited Oct. 12, 2020); Sulkowski, *supra* note 4.

360. Such as in international payments, led by Ripple’s XRP DLT, and also other types of international finance such as trade finance, *see* Akgiray, *supra* note 84, and clearing and settlement of financial instruments transactions, *see* Avgouleas & Kiaiyas, *supra* note 85.

361. Gianluca Salvotti et al., *A Structured Framework to Assess the Business Application Landscape of Blockchain Technologies*, in 51ST HAW. INT’L CONF. ON SYS. SCI. (2018).

362. *Id.*; Mendling et al., *supra* note 4.

363. PAUL RIMBA ET AL., *COMPARING BLOCKCHAIN AND CLOUD SERVICES FOR BUSINESS PROCESS EXECUTION* (2017).

364. *See* McKinsey & Co., *supra* note 358.

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Earthports and Payworks,³⁶⁵ Mastercard’s acquisition of Vyse³⁶⁶ and Transfast³⁶⁷ and Ant Financial’s acquisition of WorldFirst.³⁶⁸

We may see incremental adoption in terms of internal sharing of information and documentation, but extant technology such as Dropbox would equally facilitate this. We may also see DLT being used for general meetings, such as in Santander as mentioned earlier, but one would have to see what difference it makes for participation and voting, as compared to virtual meetings already facilitated through Skype. We are also skeptical that DLT would facilitate radical or disruptive changes, such as real-time accounting. The sharing of raw numbers with investors need not produce informed information for them or the securities marketplace.³⁶⁹ Further, existing EU/U.K. insider dealing laws, which require companies to inform markets without delay when firms become aware of price-sensitive information,³⁷⁰ are not markedly different from implementing “real-time accounting”. However, this regulation applies only to information that becomes price-sensitive, and information can develop from being preliminary to price-sensitive over a course of formation.³⁷¹ Real-time accounting is more demanding than the EU/U.K. regulation, and there is arguably no existing legal support for it.

One could argue that the rise of peer-to-peer infrastructures—such as DLT-enabled peer-to-peer energy trading, or global wireless internet (in the example of Iungo discussed in Section I),³⁷² may raise serious disruptive challenges to conventional business and ultimately, their governance. We predict that there will be social interest in engaging with alternative economic spaces, but the fringe nature of such an economic space is likely to persist.

Truly decentralized DLT platforms can herald a different way of economic organization, as flat peer-to-peer structures can promote equality and

365. BUSINESSWIRE (May 8, 2019), <https://www.businesswire.com/news/home/20190507006199/en/Visa-Acquires-Control-Earthport>; <https://www.pymnts.com/news/partnerships-acquisitions/2019/visa-acquires-germany-based-payworks/>.

366. PYMNTS, <https://www.pymnts.com/mastercard/2019/acquisition-vyze-pos-financing/> (last visited Oct. 12, 2020).

367. Steve Murphy, *Mastercard to Acquire Transfast, Expand Cross Border Business*, PAYMENTS JOURNAL (Mar. 13, 2019), <https://www.paymentsjournal.com/mastercard-acquire-transfast-cross-border-business/>.

368. Alex Webb, *How Jack Ma can Turn British Coal into an Asian Gem*, BLOOMBERG (Feb. 14, 2019), <https://www.bloomberg.com/opinion/articles/2019-02-14/jack-ma-s-ant-financial-buys-worldfirst-may-boost-alibaba-growth>.

369. Too much or unprocessed information does not necessarily ‘inform’ rational decision-making. See Richard E. Mendales, *Collateralized Explosive Devices: Why Securities Regulation Failed to Prevent The CDO Meltdown, And How To Fix It*, 5 U. ILL. L. REV. 1359 (2009).

370. EU Market Abuse Regulation, Regulation (EU) No 596/2014, art. 17 (2014) (discussing market abuse (market abuse regulation) and repealing Directive 2003/6/EC of the European Parliament and of the Council and Commission Directives 2003/124/EC, 2003/125/EC and 2004/72/EC which are directly applicable to the UK and is preserved for application after the UK’s withdrawal from the EU on 31st Dec 2020).

371. See *Geltl v. Daimler AG* [2012] EUECJ C-19/11 (2012).

372. See discussion *infra* Section I for an example of a global wireless internet network that uses peer-to-peer infrastructures.

inclusiveness in governance.³⁷³ Such alternative structures can generate a form of stakeholder capitalism³⁷⁴ and challenge extant models of shareholder-centered capitalism. We are, however, skeptical of the contagious effect of these novel structures and governance, because their impact can be limited by the lack of scale of DLT-based businesses. Truly decentralized DLT-based business models face challenges in scalability as long as DLT developers stubbornly hold to a decentralized ethos of minimal governance and interference. The lack of “organization” of such infrastructure would likely confine it to precise use instead of growth in scale.³⁷⁵ However the alternative appeal of niche innovations such as peer-to-peer music or artwork sharing³⁷⁶ platforms could be significant, even if they may not rival mainstream platforms in market share.³⁷⁷

Further, regulators’ stance on the growing “initial coin” or “token” offering market would also affect the rise of DLT-based development businesses. As heated activity in this marketplace has raised serious concerns of regulatory arbitrage, the position taken by the U.S. Securities and Exchange Commission and Commodity Futures Trading Commission has had a marked impact on the market for token finance. Developers may choose to exclude U.S. investors,³⁷⁸ seek exemptions under existing securities rules, or conform to these rules.³⁷⁹ In this manner, token offerings would be shaped more like securities offerings and DLT business models would consequently be molded to conform to the corporatized model.

In sum, the social mobilization of DLT is likely to be driven by efficiency motivations on the part of conventional corporations. In so doing, cost may be driven down and consumers may remain happy with the extant productive economy. We see the cult appeal of fringe DLT-based crypto-economy businesses, but mainstream corporations are unlikely to pursue decentralization. Further, DLT-based businesses may be inherently limited in scalability due to their lack of governance.

373. See *e.g.*, FAIRMONDO, <https://www.fairmondo.de/global> (last visited Oct. 12, 2020) (a German-based marketplace for ethical trading, based on membership governance and one vote per member in a flattened decision-making hierarchy).

374. R. Edward Freeman, *A Stakeholder Theory of the Modern Corporation*, in *THE CORPORATION AND ITS STAKEHOLDERS* 125 (Max BE Clarkson ed., 1998).

375. See discussion *infra* Section I.

376. For example, Resonate.is, a Berlin-based ethical music streaming company that aims to strike a fair distributive balance for the supply and demand sides of downloadable music. RESONATE, <https://resonate.is> (last visited Oct. 12, 2020). Another platform co-operative that aims to promote the distribution of high-quality usable images while ensuring distributive fairness between the supply and demand sides is Stocksy United based in Canada. STOCKSY, <https://www.stocksy.com/service/about/> (last visited Oct. 12, 2020).

377. See Charlie Hu, *Inside Resonate’s Quest To Build A Smarter, Fairer Streaming Service From The Ground Up*, FORBES (June 8, 2016), <https://www.forbes.com/sites/cheriehu/2016/06/08/resonate-smarter-fairer-streaming-service/>.

378. Lukas Hofer, *Why Token Issuers Exclude U.S. Investors*, ICO (Apr. 26, 2020), <https://www.ico.li/us-investors/>.

379. Kevin Helms, *SEC Begins Green-Lighting Token Offerings*, BITCOIN (July 17, 2019), <https://news.bitcoin.com/sec-token-offerings/>.

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CONCLUSION

The rise of AI and DLT fascinates businesses and lawyers, as it raises concerns that major institutional change may be inevitable. Today's corporate law and governance norms have become cherished traditions over decades but may face change from AI and DLT. This foreboding is premised upon the possibility of human agency being replaced and economic organization being "flattened" at various levels, from top management to lower levels of skilled human capital.

We argue that any such institutional change will be navigated within a multi-factor theoretic framework that combines insights from institutional change, technological development, and historical corporate law reform. This allows us to predict that technological change will be socially mediated and mobilized through an institutional framework towards three levels of possible changes: from incremental/facilitative changes, which we are already observing, to radical/disruptive and fundamental/structural changes, which would require considerable change and are more controversial. A highly automated and anti-hierarchical vision of the future may be some way away; our institutional framework still places human and social mediation of technology at the heart of institutional change. Institutional change is ultimately not technology-deterministic but is institutionally framed and anchored. The application of our framework points to nuanced predictions for change in corporate law and governance norms. Future directions for research could include empirical research into the intensity of technological absorption by corporations, in terms of whether corporations embrace incremental/facilitative forms of technological innovation much more readily compared to radical/disruptive or fundamental/structural forms of innovations, and what factors drive corporations' adoption of technological changes at these three levels.