

BLOCKCHAIN SOLUTIONS FOR AGENCY PROBLEMS IN
CORPORATE GOVERNANCE

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Forthcoming in: ECONOMIC INFORMATION TO FACILITATE DECISION
MAKING, EDITED BOOK, EDITOR- KASHI R. BALACHANDRAN, WORLD
SCIENTIFIC PUBLISHERS (2019).

Abstract

As a foundational technology, blockchain technology creates the infrastructure for decentralized networked governance that, over time, creates the environment that enables the removal of internal and external monitoring mechanisms previously necessitated by agency problems in corporate governance. Blockchain technology facilitates a substantial increase in efficiency in the agency relationship and lowers agency costs in orders of magnitude.

Key Words: Agency, Principal-Agent, Blockchain, Technology, Agency Cost, Monitoring, Corporate Governance, Blockchain, Distributed Ledger Technology, Emerging Technology

JEL Categories: K20, K23, K32, L43, L5, O31, O32

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I. Introduction

Agency theory is still today the leading theory for governance conflicts between shareholders, corporate managers, and debt holders.¹ A vast literature attempts to explain the nature of the agency conflicts in corporate governance and possible ways to resolve such conflicts.² However, the core agency conflicts emanating from the separation of ownership (shareholder principal) and control (manager agent) cannot be fully addressed by the existing theoretical and legal framework. Attempts to monitor agents is inevitably costly and transaction costs abound.

This book chapter adds to that literature and highlights the evolving solutions offered by blockchain technology. The scope and scale of agency problems in corporate governance can become more adequately manageable over time.

It is important to note that any use of blockchain technology in a corporate governance context necessitates the evolution of blockchain technology. Such evolution is subject to several factors. Similar to the internet itself and perhaps even comparable to electricity, blockchain technology is not a disruptive technology, it is a foundational technology whose transformational impact takes decades rather than years. The use cases of blockchain technology involve most complex

¹ Michael C. Jensen & William H. Meckling, *Theory of the Firm: Managerial Behaviour, Agency Costs and Ownership Structure*, 3 J. Fin. Econ. 305 (1976).

² For an overview of the relevant literature Andrei Shleifer & Robert W. Vishny, *A Survey of Corporate Governance*, 737 J. Fin. 737 (1997).

structures that are all interdependent. In other words, development of one area alone cannot be successful as the existence of multiple additional support structures are needed. By way of comparison, the use of electricity necessitated wiring and light bulbs, connectors, generators etc. One cannot exist without the others being in place. Even if the infrastructure elements are being developed in any of the major areas of use cases for blockchain technology complex discussions around structural changes are needed before the technology can be applied.

The complexity of blockchain technology and its evolving characteristics and use cases also impacts its ability to serve in a corporate governance role. More specifically, in the corporate governance context it requires the authorities, who most likely understand the use case and not the technology, to come to a consensus on how and when to implement such technology for that governance use case.

II. Agency Problems in Corporate Governance

Agency problems originate from the lacking trust between principals and agents. The agency relationship can be defined as a contract between principal and agent whereby the agent acts on principals' behalf because principal delegated a modicum of decision-making authority to the agent.³ Because of the delegated authority, the agents'

³ Jensen and Meckling, *supra* note 1.

decisions affect both the agents' welfare and the principals' welfare. The agency model at its very basic level suggests that information asymmetries between the principal and the agent and agents' opportunistic behavior resulting from self-interest leads to principals' lacking trust in agents. Because of bounded rationality, incomplete foresight, and information asymmetries between principal and agent,⁴ it is impossible for principals to contract for every possible action or inaction of the agent in order to induce the agent to act in the best interests of the principal.⁵

The lacking trust in the agent's performance of her duties creates the underlying problems in corporate governance. Despite best efforts at monitoring and bonding, the interest of manager agents and shareholder principals in corporate governance are never fully aligned and agency losses inevitably arise from conflicts of interest between principals and agents, known as residual loss. Residual loss arises because the cost of enforcing suboptimal contracts between principals and agents always exceed the benefits of performing the contractual obligations.

Agency costs arise because the principal attempts to control, monitor, and supervise the agent. As a result of lacking trust in the integrity of the principal agent relationship, and in an attempt to minimize

⁴ Wulf A. Kaal, *Evolution of Law: Dynamic Regulation in a New Institutional Economics Framework*, in *FESTSCHRIFT ZU EHREN VON CHRISTIAN KIRCHNER* (Wulf A. Kaal & Schmidt M. Schwartze eds., 2014).

⁵ Michael J. Brennan, *Corporate Finance Over the Past 25 Years*, 24 *FIN. MGMT.* 9 (1995).

information asymmetries, principals are forced to put into place costly mechanisms to align their interest with those of the agents. Most prominently, such control mechanisms involve periodic reporting, compensation structures for agents, bonding, among others. In the corporate context, agency costs can be seen as the lost value to shareholders (loss in corporation's share price) that results from diverging interests between shareholders (principal) and corporate managers (agents). As such, agency costs are the sum of monitoring costs, bonding costs, and residual loss.⁶

Monitoring costs are costs to the principal resulting from observing, measuring, and controlling an agent's behavior. Monitoring costs can include the cost of audits, executing executive compensation contracts, and cost of hiring/firing manager agents. While such monitoring costs are generally paid by the principal, agents may be responsible for such costs as well because agents' compensation is subject to adjustments to cover monitoring costs.⁷

Bonding costs are the cost of establishing and adhering to system structures that allow agents to act in shareholder principal's best interests or compensate shareholder principals appropriately if agents do not act in their best interest. While bonding costs are typically paid by the agents, they may in addition to financial costs include the cost of increased disclosures to shareholder principals. If the marginal

⁶ Jensen & Meckling, *supra* note 1.

⁷ Eugene F. Fama & Michael C. Jensen, *Separation of Ownership and Control*, 88 J.L. & ECON. 301 (1983).

reduction in monitoring equals the marginal increase in bonding costs, agents no longer incur bonding costs.

The agency relationship in modern finance and corporate governance is characterized by attempts to optimize incentives between principals and agents, control costs, minimize information asymmetries, control adverse selection and moral hazard, optimize risk preferences between principals and agents, and engage in monitoring.

1. Remedial Attempts

Centralization around well-established principal-agent hierarchies in corporations defines the existing corporate governance structure.⁸ Such governance hierarchy and the associated governance structures revolve around authority, responsibility and control flows with the investors at the epicenter of that hierarchy,⁹ particularly the minority investors.¹⁰

The dominant corporate governance solution for the agency problem today focuses on shareholder value maximization.¹¹ Implementation

⁸ Ion Ivan et al., *Requirements for Corporate Governance Assessment Based on Ontologies*, 15 Econ. Informatics 49, 49 (2015); Mark Fenwick & Erik P.M. Vermeulen, *The Future of Capitalism: "Un-Corporating" Corporate Governance*, (Lex Research Topics in Corp. Law & Econ., Working Paper No. 2016-4, 2016), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2795042.

⁹ ICSA: THE GOVERNANCE INSTITUTE, *What is Corporate Governance?*, <https://www.icsa.org.uk/about-us/policy/what-is-corporate-governance>, (last visited Apr. 16, 2019).

¹⁰ Rafael Law Porta et al., *Investor Protection and Corporate Governance 2* (2000) (unpublished article), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=183908.

¹¹ According to the dominant view, the goal of a firm should be to increase the financial interests of the investors and by doing so the firm can maximize

of the shareholder primacy doctrine results mostly in measures that aim at aligning the interests of all of the other actors/stakeholders within those of the investor-shareholders.¹² Thus, reducing the risk of managerial misbehavior.¹³ If management acts opportunistically at the expense of shareholder value, the associated firm underperformance and possible bankruptcy harms all stakeholders.¹⁴ Conversely, by aligning the interests and incentives of the various actors with those of the investor-shareholders, the resulting increase in firm performance — as measured by the share price — benefits all of the stakeholders in a firm, as well as the public who benefit from the goods and services

opportunities to be successful. Stephen M. Bainbridge, *Director v. Shareholder Primacy in the Convergence Debate*, 16 TRANSNAT'L LAW. 45 (2002), available at <https://scholarlycommons.pacific.edu/globe/vol16/iss1/5>. Please CITE all in this debate with short summaries of their main points – there are many papers that summarize the debate with full citations to the debate participants. Make Marin, *The Crisis of Shareholder Primacy*, RESEARCH AT CAMBRIDGE (Mar. 19, 2012), <http://www.cam.ac.uk/research/discussion/the-crisis-of-shareholder-primacy>; H. Jeff Smith, *The Shareholders vs. Stakeholders Debate*, MITSLOAN MGMT REV. (July 15, 2003), <http://sloanreview.mit.edu/article/the-shareholders-vs-stakeholders-debate/>; Lynn A. Stout, *The Shareholder Value Myth* (Cornell Law Faculty Publications, Paper 771, 2013), <https://scholarship.law.cornell.edu/cgi/viewcontent.cgi?referer=&httpsredir=1&article=2311&context=facpub>. <http://scholarship.law.cornell.edu/cgi/viewcontent.cgi?article=2311&context=facpub>

¹² N. Craig Smith & David Ronnergard, *Shareholder Primacy, Corporate Social Responsibility, and the Role of Business Schools*, 134 J. BUS. ETHICS 463 (2016).

¹³ Alessio M. Paces, *RETHINKING CORPORATE GOVERNANCE: THE LAW AND ECONOMICS OF CONTROL POWERS* (2013).

¹⁴ Maria Maher & Thomas Andersson, *Corporate Governance: Effects on Firm Performance and Economic Growth*, ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT 7 (1999), <https://www.oecd.org/sti/ind/2090569.pdf>; David Larrabee, *Maximization of Shareholder Value: Flawed Thinking That Threatens Our Economic Future*, ENTERPRISING INV. (Sept. 24, 2014), <https://blogs.cfainstitute.org/investor/2014/09/24/maximization-of-shareholder-value-flawed-thinking-that-threatens-our-economic-future/>.

that a successful firm provides.¹⁵ Following this logic, increasing shareholder control over other actors within the firm has become the primary goal of corporate governance rules.¹⁶ The correct corporate governance is seen as naturally resulting in shareholder value.¹⁷

While the shareholder value approach to governance and many other attempts at optimizing corporate governance and addressing the agency problems in corporate governance helped optimize the agency problems, many examples suggest that the core underlying agency problems cannot fully be resolved within the existing theoretical and legal infrastructure.

A standard approach for effective corporate governance involved outside independent directors on corporate boards who hold managerial positions in other companies, thus separating the problems of decision management and decision control.¹⁸ However, CEOs who often dominate the board make the separation of these functions much more difficult, which hurts shareholders. Furthermore, outside directors' separation of decision management and decision control depends on their concern over reputation as an incentive, which is

¹⁵ Stout, *supra* note 11 (Discussing residual claimants arguments and potential benefits to society through the company); *see also* Smith, *supra* note 12.

¹⁶ Justin Fox & Jay W. Lorsch, *What Good Are Shareholders*, HARV. BUS. REV. (Jul.-Aug. 2012), <https://hbr.org/2012/07/what-good-are-shareholders>;

¹⁷ *Id.*; Margaret

M. Blair, *Shareholder Value, Corporate Governance, and Corporate Performance: A Post- Enron Reassessment of the Conventional Wisdom*, in CORPORATE GOVERNANCE AND CAPITAL FLOWS IN A GLOBAL ECONOMY 53-82 (P.K. Cornelius & B. Kogut eds., Oxford University Press 2003).

¹⁸ Fama & Jensen, *supra* note 7.

insufficient in most cases.

Another much touted governance mechanism for firms involved firms' capital structures with emphasis on higher debt levels. Higher levels of insider ownership by increasing debt and reducing equity¹⁹ in the firm's capital structure acts as a bonding mechanism for manager agents.²⁰ Management by issuing debt rather than paying dividends creates contractual obligations to pay out future cash flows in ways unattainable through dividends. Debt financing can also help create external capital market monitoring which incentivizes managers' avoidance of personal utility maximization and increases value maximizing strategies for shareholders.²¹

In an effort to curtail the inevitable instability that is a by-product of the pervasive agency problem in the corporate governance system,²² governments have responded to corporate governance scandals by adopting a number of regulatory changes. Such changes include substantively increased disclosure requirements.²³ Shareholder

¹⁹ Jensen & Meckling, *supra* note 1.

²⁰ Michael C. Jensen, *Agency Costs of Free Cash Flow, Corporate Finance and Takeovers*, 76 Am. Econ. Rev. 323 (1986).

²¹ Frank H. Easterbrook, *Two Agency Cost Explanations of Dividends*, 74 Am. Econ. Rev. 650 (1984).

²² Mark J. Roe, *The Inevitable Instability of American Corporate Governance*, in *RESTORING TRUST IN AMERICAN BUSINESS* (American Academy of Arts and Sciences eds., 2004).

²³ Benjamin E. Hermalin & Michael S. Weisbach, *Transparency and Corporate Governance* (Nat'l Bureau of Econ. Research, Working Paper No. w12875, 2007), <https://ssrn.com/abstract=958628>; Fenwick & Vermeulen, *supra* note 8 ("The political response to corporate scandals has been the introduction of more regulation.

activism reform by itself has been unable to sufficiently improve the corporate governance system.²⁴ Upgrading the U.S. proxy system has been another government priority.²⁵ Changes in executive compensation has been another approach to address the instability of the existing corporate governance system.²⁶ Government-sponsored

In a US context, for instance, “Sarbanes-Oxley” and “Dodd-Frank” function as shorthand for these new swathes of legal rules, but such a trend can be found everywhere. The inevitable result has been the emergence of a regulatory landscape that requires large modern corporations to make a much more significant investment in compliance and the management of legal risk.”).

²⁴ Stephen M. Bainbridge, *Shareholder Activism and Institutional Investors* (UCLA Sch. of Law Pub. Law-Econ. Research, Working Paper No. 05-20, 2005), <https://ssrn.com/abstract=796227>; Jonathan M. Karpoff, *The Impact of Shareholder Activism on Target Companies: A Survey of Empirical Findings* (2001), <https://ssrn.com/abstract=885365> (“[T]he disagreement among researchers is more apparent than real. Most evidence indicates that shareholder activism can prompt small changes in target firms’ governance structures, but has negligible impacts on share values and earnings.”); Roberta Romano, *Less Is More: Making Shareholder Activism A Valued Mechanism Of Corporate Governance* (Yale Law & Econ., Research Paper No. 241; Yale ICF, Working Paper No. 00-10; Yale SOM, Working Paper No. ICF- 00- 10) (2000), <https://ssrn.com/abstract=218650> (“The finance literature presents an apparent paradox: Notwithstanding commentators’ generally positive assessment of the development of such shareholder activism, the empirical studies suggest that it has an insignificant effect on targeted firms’ performance. Very few find evidence of a positive impact, and some even find a significant negative stock price effect from activism.”); John C. Coffee Jr., *Liquidity Versus Control: The Institutional Investor as Corporate Monitor*, 91 COLUM. L. REV. 1277 (1991).

²⁵ The existing U.S. proxy system lacks transparency; has few accountability mechanisms; is complex and costly; tolerates record-keeping inaccuracies partially because it provides no audit trail; and produces voting results that cannot be verified. John C. Wilcox, *Shareholder Nominations of Corporate Directors: Unintended Consequences and the Case for Reform of the u.S. Proxy System*, in *SHAREHOLDER ACCESS TO THE CORPORATE BALLOT* (Lucian Bebchuck, ed. 2005); Henry T. C. Hu & Bernard S. Black, *The New Vote Buying: Empty Voting and Hidden (Morphable) Ownership*, 79 S. CALIF. L. REV. 811, 811 (2006); David Yermack, *Shareholder Voting and Corporate Governance*, 2 Ann. Rev. Fin. Econ. 103 (2010).

²⁶ Lucian A. Bebchuk & Jesse M. Fried, *Executive Compensation as an Agency Problem*, 17 J. Econ. Persp. 71-92 (2003); Lucian A. Bebchuk et al., *The Wages of Failure: Executive Compensation at Bear Stearns and Lehman 2000-2008*, 27 YALE J. ON REG. 257-282 (2010); Roe, *supra* note 22.

organizational experimentation that enables new business models and new organizational structures is desirable and valuable and may be one of the few ways to facilitate the much needed corporate governance reform.²⁷

2. *Path Dependencies*

Despite the unresolved substantive problems associated with the division of ownership (shareholders) and control (agent),²⁸ the corporate form with the diffused share ownership that leads to such conflicts, and the incomplete and suboptimal rules that govern such conflicts, remains the most popular form of a governance mechanism.

The popularity of existing mechanisms to address the agency problems in corporate governance may be related to path dependencies created by the evolution of internal and external monitoring mechanisms in corporate governance and the evolution of governance mechanisms designed to limit the scope of agency problems, instituted to address the agency problems in corporate governance.

Existing universal governance solutions are often ineffective because

²⁷ Bengt R. Holmström & Steven N. Kaplan, *The State of U.S. Corporate Governance: What's Right and What's Wrong?* (ECGI – Fin., Working Paper No. 23/2003, 2003), <https://ssrn.com/abstract=441100>.

²⁸ Roe, *supra* note 22 (“The core fissure in American corporate governance is the separation of ownership from control—distant and diffuse stockholders, with concentrated management—a separation that creates both great efficiencies and recurring breakdowns.”).

agency conflicts and the specific scope of agency conflicts differ across firms. Governance mechanisms and the effectiveness of governance mechanisms in reducing agency conflicts in firms differ from firm to firm. Each type of governance mechanism and combinations of governance mechanisms can help reduce aspects of agency costs associated with the separation of ownership (principal shareholder) and control (manager agent). However, existing governance mechanisms work well in some firms but are ineffective in others. The literature today is still lacking a comprehensive understanding of workable governance mechanisms and solutions across a broad spectrum of firms.

III. Blockchain Solutions for Agency Problems in Corporate Governance

Blockchain offers unprecedented solutions for agency problems in corporate governance. Supervisory tasks that were traditionally performed by principals to control their agents can be delegated to decentralized computer networks that are highly reliable, secure, immutable, and independent of fallible human input and discretionary human goodwill. Blockchain technology provides an alternative governance mechanism that eliminates agency costs - the principal's cost of supervising agents - by creating trust in the contractual relationship between the principal and the agent.

1. Blockchain Guarantees

Blockchain technology provides formal guarantees to participating principals and agents that address agency problems in corporate

governance. Because of the blockchain guarantees, the technology allows a qualitatively different solution for agency problems in corporate governance, especially if compared with the existing finance infrastructure that is riddled with agency problems (see credit rating, executive compensation etc.).

The immutability of the blockchain and its cryptographic security systems provide transactional guarantees and create trust between principals and agents in the integrity of their contractual relationship. Such guarantees ensure no participant can circumvent the rules embedded in blockchain code. Blockchain guarantees include contract execution between principal and agent only if and when all contract parameters were fulfilled by both parties and verified by a majority of miners/nodes in the system. Hence, in the blockchain infrastructure, there is no need for the principal to institute oversight and monitoring with the associated agency costs. Because of the governance guarantees embedded in code, blockchain addresses the inherent agency problems in modern finance and corporate governance comprehensively.

Blockchain technology secures the integrity of principal agent relationships by removing fraudulent transactions. Compared with existing methods of verifying and validating transactions by third party intermediaries (banking, lending, clearing etc.), blockchain's security measures make blockchain validation technologies more transparent, faster, and less prone to error and corruption. While

blockchain's use of digital signatures helps establish the identity and authenticity of the parties involved in the transaction, it is the completely decentralized network connectivity via the Internet that allows the most protection against fraud. Network connectivity allows multiple copies of the blockchain to be available to all participants across the distributed network. The decentralized fully distributed nature of the blockchain makes it practically near impossible to reverse, alter, or erase information in the blockchain. Blockchains' distributed consensus model, e.g. the network "nodes" verify and validate chain transactions before transaction execution, makes it extremely rare for a fraudulent transaction to be recorded in the blockchain. Blockchain's distributed consensus model allows node verification of transactions without comprising the privacy of the parties. Blockchain transactions are therefore arguably safer than a traditional transaction model that requires third-party intermediary validation of transactions. Blockchain technology is also substantively faster than traditional third-party intermediary validation of transactions.

Cryptographic hashes used in blockchain technology further increase blockchain security and removes trust barriers in agency relationships that require monitoring of agents and create agency costs. Cryptographic hashes are complex algorithms that use details of the existing entirety of transactions of the existing blockchain before the next block is added to generate a unique hash value. That hash value ensures the authenticity of each transaction before it is added to the block. The smallest change to the blockchain, even a single

digit/value, results in a different hash value. A different hash value in turn makes any form of manipulation immediately detectable. As such, hash cryptology provides another level of guarantee in a agency relationship executed through blockchain technology.

Smart contracts enabled by blockchain technology allow for the comprehensive, near error free, and zero transaction/agency cost coordination of agency relationships. Smart contracts and smart property are blockchain enabled computer protocols that facilitate, verify, monitor, and enforce the negotiation and performance of a contract between principal and agent. Agency relationships in smart contracts run exactly as coded without any possibility of opportunistic behavior of the agent. All contractual terms are public and fully transparent. Accordingly, a company's finances, for instance, are visible on the blockchain to anyone, not just to the company's accounting department. Smart agency contracts run on a custom built blockchain, that enables principals and agents to store registries of debts or promises, create entire markets, among many other aspects that have not yet been considered.

Agency related governance in the blockchain takes place without intermediaries, counterparty risk, and principal's control mechanisms. Blockchain technology simply does not require the layers of control and verification that prior financial systems necessitated. Control mechanisms such as regular management (agent) meetings with shareholders (e.g. at the AGM etc.), financial disclosures,

management agent scrutiny through analyst reports and financial press, pressure on management from stock market performance, hedge fund investors, and other institutional and private investors, are no longer part of the blockchain enabled agency relationship in corporate governance.

Blockchain technology facilitates a substantial increase in the efficiency of agency relationships in orders of magnitude and lowers agency costs equally substantial in orders of magnitude. The removal of checks and balances in corporate governance, monitoring of agents, audit requirements, disclosure regimes, market pressure, executive agent compensation schemes, among many others, provides a qualitative shift in efficiency in the agency relationship and in corporate governance overall.

Self-validating blockchain transactions can help resolve the agency issues between most of the stakeholders and constituents of modern corporations. In addition to addressing the traditional agency problem in corporate governance between shareholder principals and manager agents, blockchain enabled smart contracting allows for the public and fully transparent, secure, and completely networked exchange between the corporation and customers, owners and investors, other stakeholders, staff, regulators, strategic partners, suppliers and service providers.

2. Removal of Agents

Blockchain technology can facilitate the removal of agents as

intermediaries in corporate governance through code, peer-to-peer connectivity, crowds, and collaboration. While it is still difficult to imagine a world without governance structures facilitated by agency constructs, Decentralized Autonomous Organizations (DAOs) have started to challenge the core belief that governance necessitates agency.

The first DAO, launched in May 2016, in the founders' attempt to set up a corporate-type organization without using a conventional corporate structure, had a governance structure that was entirely built on software, code, and smart contracts that ran on the public decentralized blockchain platform Ethereum. Because it was pure computer code it had no physical address, no jurisdiction that could claim jurisdiction/control over it, and it was not an organization with a traditional hierarchy as we know it from traditional corporate structures. The DAO did not use a traditional corporate structure that necessitated formal authority and empowerment flowing top down from investors/shareholders through a board of directors to management and eventually staff. Indeed, it had no directors, managers or employees. In essence, all the core control mechanisms typically employed by principals in agency relationships were entirely removed in the DAO.

While the first DAO was subject to many limitations and ended in quite some controversy, future DAOs may be less prone to problems. Fundamental flaws in the DAO code enabled hackers to transfer one

third of the total funds to a subsidiary account. This hack in combination with additional technological limitations brought down the first DAO initiative. Yet, future DAOs are already created and DAO enthusiasts never stopped testing it. A new DAO is currently being developed that is not set up as a Venture Capital Fund but rather as a donation DAO where participants donate and don't expect returns. DAO enthusiasts and the DAO community in general are constantly improving the DAO and it seems possible that future DAOs may improve agency problems in corporate governance much more thoroughly than is currently fathomable.

3. Reforming Governance Hierarchies

DAO token holders are free from existing corporate hierarchies and their restricting effects. People who work for a DAO are subject to a different kind of agency relationship and not subject to a supervisor or CEO. Instead, DAO workers work in a dynamic set of working relationships that continuously and dynamically self-organize around projects and outcomes, not corporate hierarchies with implicit hierarchical biases and associated suboptimal outcomes.

The core common denominator for all DAO token members is the unifying desire to optimize the DAO structure and the DAO token value. If a member-identified optimization has the potential to make the DAO more meaningful, useful, or valuable to the token holder members, the DAO token holders will desire to perform such optimization tasks as it is in their very interest to do so to help increase the value of the DAO tokens. Accordingly, token holders are

determined to increase the value of tokens rather than lower the value. To increase the value of its tokens, members can make DAO optimization proposals, e.g. optimize the voting procedure, webpage etc., that explain what actions ought to be taken to optimize and what value such actions will add to the respective DAO token holder community. The token holder community then votes on a given optimization proposal. If a proposal passes, the proposing DAO member will receive an award in the form of new tokens. Any such payment is added to the respective DAO blockchain but now requires for the proposing token holder to perform on the proposed parameters of optimization. In other words, once the optimization proponent has made a deal with the DAO, it's in the blockchain and the proponent is required to deliver on the proposal or her contract is cancelled.

Performance assessment in the DAO structure is based on value optimization not on hierarchical or political processes. DAO workers' performance are assessed in an anonymized proposal voting scheme which is the only basis for assessment and payment. If DAO members perform well, they will get remunerated regardless of politics, background, or education. The only thing that counts for purposes of assessment of DAO works is their performance of optimization parameters. This is an important difference between classical corporate hierarchies and DAO member performance of optimization proposals, e.g. the DAO's non-discriminatory performance measures.

Non-performance penalties in the DAO structure are free from biases. If DAO community members do not deliver on a proposal that was voted in by the DAO token holder community they lose credibility in the DAO token holder community and may be perceived as lacking an ability to add value. In fact, non-performance on proposal comes with significant reputational penalties. Non-performers in the DAO structure will be less likely to have future opportunities to earn tokens because the other token holders are unlikely to approve non-performer proposals. Crucially, non-performance reputational penalties are entirely free from racial or cultural biases and associated implications as the token holders are unlikely to even know each other. Rather, they all work towards a common goal of optimizing the DAO and the token value.

The DAO token holders' focus on adding value benefits all constituents. Because projects that cannot add value take token holders' time away from more productive endeavors, token holders become focused on managing their time and efforts. Unlike in traditional hierarchical organization where face-time and unproductive meetings are the norm, the self-governing DAO token optimizer avoids any such corporate hierarchy inefficiencies and frees herself from top-down inefficiencies and bad outcomes. In essence, the DAO work proposal and value optimization structure allows the avoidance of bad projects, bad colleagues, and unproductive meetings. The only thing that counts is the value proposition. In other words, the focus shifts from political positioning and supervisor pleasing without performance to a focus on adding active value to a given project. If

value can be added, the tasks will be performed, if the assessment of the proposal suggests that the value proposition is in doubt token holders will try to spend their time and skills on more productive and value-adding tasks. Importantly, because the DAO structure functions without supervisors, DAO token holders who decide they cannot add value on a given task can move to more productive endeavors that better utilize their skills without any penalties that would exist in the traditional hierarchical corporate structure.

Politics in the DAO structure have a different nature compared with traditional hierarchical corporate structures. In a traditional corporate hierarchy, position in the hierarchy and associated authority determine effort. In other word, the supervisor in the hierarchical structure can determine where, what, and when workers have to perform, resulting in suboptimal outcomes, attendance of unproductive and useless meetings, among many other negative effects. By contrast, in the decentralized DAO environment, influence is determined by the value a given token holder contributed to a project's success.

4. Agency Reform

The “value to effort focus of work flows” in the DAO structure has the potential to reform agency relationships. The value-focused performance in the DAO structure helps optimize work flows and creates sustainable solutions for DAO token holders. The supervisor in the traditional hierarchical corporate structure can determine where, what, and when workers have to perform, which often results in attendance of unproductive meetings, facetime, support for

suboptimal outcomes to please supervisors, among many other suboptimal outcomes. By contrast, in the decentralized environment of DAOs, influence and outcomes are not created by hierarchy but rather determined by the value a token holder's contributions to a project's success. Moreover, if a token holder adds substantial value to the DAO, other DAO token holders will want to add their skills in the same context which focuses the token holders' efforts on the highest possible value proposition.

The traditional regulatory infrastructure that attempts to overcome the corporate governance problems associated with the separation of ownership (shareholders) and control (management) relies heavily on fiduciary duties. In the DAO structure such duties are less needed. Because of the value to effort focus of work flows in the DAO structure, supervision of management and imposition of legal duties on management is less needed because there are fewer or no supervisors. Rather, token holders optimize the DAO together according to their best value propositions in accordance with their unique skillsets, backgrounds, and training.

IV. Open issues

The discussion above has outlined the potential of blockchain technology as an emerging technology for governance design. Many of the ideal-typical and theoretical evaluations therein are subject to real-world limitations.

First and foremost, blockchain technology is a foundational

technology whose transformational impact takes decades rather than years to take hold and reform legacy systems. Most complex systems and structures that will be reformed by the technology are interdependent. Reform and development of one area alone cannot be successful as the existence of multiple additional support structures are needed. Even if the infrastructure elements are being developed in any of the major areas of use cases for blockchain technology, complex discussions around structural changes in legacy systems are needed before the technology can be applied.

In the corporate governance context, the application of blockchain technology may evolve within existing centralized structures or in a decentralized environment. The former requires the authorities to come to a consensus on how and when to implement such technology for the governance use case. For the latter, core issues that have afflicted centralized governance solutions, such as information asymmetries between principal and agent, censorship, opportunism of agents, breaches of fiduciary duties, liability rules for principals and agents, and fraud or third-party interference, can only be truly removed to fully reform the agency relationship if and when a truly decentralized public blockchain emerges that is scalable and fully secure.

As agency relationships become more complex, a backstop for human behavior in agency relationships becomes necessary. The notion that agency relationships in smart contracts run exactly as coded without any possibility of opportunistic behavior of the agent is less likely to

uphold in complex agency relationships. Similarly, without a decentralized human backstop to code, the immutability of the blockchain and its cryptographic security systems may not be able to create truly transactional guarantees and trust between principals and agents in the integrity of their contractual relationship.

Blockchain-based corporate governance solutions in DAOs require evolutionary blockchain governance protocols. Socially optimal hard-forking rules cannot suffice. Blockchain-based guarantees embedded in blockchain code can help ensure that no participant in business transactions and agency relationships can circumvent the set of governance rules. Blockchain guarantees include contract execution between principal and agent only if and when all contract parameters were fulfilled by both parties and verified in a consensus algorithm. Hence, in the blockchain infrastructure, a lower level of oversight and monitoring of agents changes the cost structure of the principal agent relationship. Yet, the basis of such coded guarantees will evolve and require protocol upgrades for that changing environment. Without evolutionary governance upgrades the cost reduction for the agency relationship cannot be maintained.

V. Conclusion

Agency problems in corporate governance can be reformed by way of blockchain technology. As a foundational technology, blockchain-based governance solutions for agency problems in corporate governance depend on the creation of infrastructure components that have not yet been conceptualized in the decentralized technology

evolution. Once supported by the necessary infrastructure components, decentralized networked governance can, over time, create the environment that enables the removal of internal and external monitoring mechanisms previously necessitated by agency problems in corporate governance.

Yet, the boundaries of technological implementation may necessitate a long-term commitment by all constituents in the governance reform process. Centralized and decentralized blockchain based governance solutions require different implementation efforts.