Curtis Meloy Goldsby

Demystifying Digital Governance

Exploring the Mechanisms and Trade-offs of Blockchains for Organizations

Demystifying Digital Governance:
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Exploring the Mechanisms and Structures of
Blockchains for Organizations

Digital governance gedemystificeerd:
een verkenning van de mechanismen en afwegingen van
blockchains voor organisaties

Thesis

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PREFACE

As I sit here, writing these acknowledgements at Columbia University in the heart of New York City, a surge of emotion washes over me. In a full circle moment that both delights and overwhelms me, I have returned to the city where I was born. I now live in Europe, but my first home was in Astoria, Queens, I am currently employed by a tech company based on Madison Avenue, and earlier this week I proposed to the love of my life next to the majesty of the Brooklyn Bridge (she said yes). Now, as I approach the completion of my PhD at Erasmus University Rotterdam in the Netherlands, I am honored to acknowledge the people who have accompanied me on my international academic adventure.

I come from a hard-working family of successful musicians and artists, where academic degrees are not as coveted as they might be in other professions. I stumbled into academia in 2012—during my undergraduate studies in Cologne, Germany—when I discovered a hidden passion for academic research and writing. In 2015, during an internship at BMW in Munich, I crossed paths with a mentor named Marc, who had received his PhD in the early 2000s. Marc came from a similar upbringing to mine, minus the musician part. He looked me straight in the eye one day during my internship and said, “You know what? You have it in you to do a PhD, too!” His words, comforting and wise, ignited something in me. From that moment on, I knew the path I had to follow. More importantly, I had the confidence to begin. Every step of the way, I have appreciated the magnitude of this opportunity. And I have never been alone. I stand on the sturdy shoulders of

multiple human beings who have taken the time to weave a strong web of support for my ambitions and efforts.

First, I want to express my heartfelt gratitude to my family. They believed in me at every twist in the road, instilling in me the values of hard work, perseverance, and the certainty that I could achieve anything. To my parents, Robin and John, my sister, Julia, and my grandparents, Ann and Robert (aka Nana and Pap): You are my true heroes, and this achievement is as much yours as it is mine. And I express my special thanks to Jul for designing the cover of this dissertation (to infinity and beyond!).

To my dear fiancée, the treasure of my life, Regina: You have been my rock throughout this arduous PhD process, I owe you a debt of gratitude that words cannot fully express. You have been closest to my journey in every way. Your steadfast encouragement, understanding, and unconditional love have carried me through the darkest moments. Your devotion has provided the fuel that continues to propel me forward. I am forever blessed to have you by my side. Thank you, Sweet Pea.

To my supervisors, Jan and Helge, who took a chance on me, I am forever grateful. You challenged me, pushed me beyond my limits, and guided me with wisdom and patience. Your mentorship has been instrumental in shaping my scholarship. Thank you for lighting the way and trusting in my abilities.

To Marvin, my academic mentor, your unwavering confidence in my capacity to produce quality academic research has been a constant source of inspiration. You have challenged me to think critically, to push boundaries, and to strive for excellence with your incredible work ethic. As we learned early on, we complement each other incredibly well. Your mentorship has left an indelible mark on my academic journey, and for that, I am forever thankful. Because of you, I have relished working in academia. I look forward to many years of extended research with you. In the same breath, I would also like to thank you, Vasileios, for your support in my research on the IBM side. It has been a blast working closely together with you and Marvin on these bleeding edge topics!

To my mentor at IBM, Christian, I extend my deepest appreciation for your counseling on the “practitioner” side of my development. You have ensured that my PhD efforts have not hindered my career at IBM. Your dedication to my growth has been invaluable. I am truly fortunate to have had your mentorship and to have learned from a first-class consultant. You have always made sure that I "drive to arrive."

I would also like to express my profound gratitude to Rebecca and Melanie, whose early and steadfast support during our joint tenure at IBM propelled my academic endeavors and played a pivotal role in making this entire journey possible. Your belief in my ability to navigate both the academic and professional realms simultaneously has been a powerful motivator.

And to my best friends, who hail from all corners of the world—thank you, gentlemen. Eemil, Hans-Peter, Mario, Niklas, and Denver—I thank you for giving me the fortitude to endure this journey. Eemil, we set the groundwork for this PhD during our time at LSE—thank you for showing me the value of mental *and* physical strength. Hans-Peter, you were a springboard for my ideas as I was sharpening my proposal and I thank you for your enthusiasm. Mario, you are a wiz at econometrics, and I still owe you a few lattes for numerous explanations of complicated concepts. Niklas, my fellow traveler on this winding PhD trail, we have so much in common—our undergraduate school, our consulting careers, and our part-time PhD pursuits. Denver, we shared so many pains and gains on our PhD excursion. By keeping each other in the loop, a wonderful new friendship has emerged.

Finally, to other friends, family, colleagues, and supporters who I have not mentioned here in name—those who have helped my development as an academic and encouraged my belief in myself—thank you for shining your bright light of optimism in my direction. You know who you are.

In the words of E.E. Cummings:

"Once we believe in ourselves, we can risk
curiosity, wonder, spontaneous delight, or
any experience that reveals the
human spirit."

I express my heartfelt gratitude to each of you.

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CHAPTER 1.
GENERAL INTRODUCTION

1.1 Theoretical Background

The nature of the firm has long been studied by economists and management scholars to explain *why* organizations exist (Coase, 1937; March & Simon, 1958). Scholars propose that organizations exist due to their innate capacity "to decide" and "to order," which effectively describe the combination of hierarchical control and coordination within a contractual entity to align interests in competitive settings (Aggarwal, Siggelkow, & Singh, 2011; Gulati & Singh, 1998). This trait of organizations can be observed not only inside the firm itself, i.e., "intraorganizational" contexts, but also extends to its interactions with the market surrounding it, i.e., "interorganizational" contexts (Arslan, Vasudeva, & Hirsch, 2023; Couture, Jarzabkowski, & Lê, 2023). Across these settings, theorists suggest that organizations are characterized by *governance forms*, which can be purely "hierarchical" (i.e., traditional command-and control structures), or can assume "hybrid" forms (e.g., joint ventures, non-equity alliances), to realize efficiencies through the way they organize and control exchanges (e.g., transactions). Scholars have complemented this line of inquiry extensively by studying how organizations apply *governance mechanisms* to align deviating interests in competitive settings that exist in these exchange environments. For example, researchers have studied the central role of *control* (Goold & Quinn, 1990; Sundaramurthy & Lewis, 2003), *coordination* (Bechky & Chung, 2018; Gulati, Wohlgezogen, & Zhelyazkov, 2012b), *incentives* (Makadok & Coff, 2009; Rutherford, Buchholtz, &

Brown, 2007), and *trust* mechanisms (Cao & Lumineau, 2015; Schilke & Lumineau, 2023; Westphal, 1999) to achieve governance alignment in inter- and intraorganizational settings. Ultimately, the study of governance is important to understand why organizations exist, how they streamline exchanges within and among each other, and how they navigate tensions in an ever-changing competitive environment.

Prior research on organizations has spawned two dominant theoretical streams associated with governance, namely, transaction cost economics (TCE) and agency theory, which examine governance structures and central mechanisms associated with them. First, *TCE* elucidates how certain transaction costs that would be high when performed in markets (e.g., if individuals attempted certain transactions bilaterally) can be substantially lower when executed in hybrid or hierarchical forms of governance.[1] TCE assumes specific "properties" to be rooted in the nature of the transactions (i.e., uncertainty, frequency, specificity), which can be monitored by "hierarchy" through a unified command and control structure, or by "hybrid" forms that combine market and hierarchy-based mechanisms, such as industry consortia (e.g., Hacker, Miscione, Felder, & Schwabe, 2023a; Zavolokina, Ziolkowski, Bauer, & Schwabe, 2020) or strategic alliances (e.g., Asgari, Singh, & Mitchell, 2017; Bakker, 2016). As such, TCE emphasizes that governance forms emerge based on the transaction characteristics. As a result, the study of TCE often comprises governance mechanisms related to pricing and competition (markets), fiat and incentives (hierarchies), and equity stakes and collaborative agreements, as found in strategic alliances (hybrids).

As the second important stream, *agency theory* studies ways in which organizations deal with critical information and misalignment problems that occur along the hierarchical strata. Agency theory describes the organization as a "nexus of contracts" that is complemented by coordination efforts from principals (e.g., owners, shareholders) and execution by agents (e.g., top management teams, employees) (Alchian & Demsetz, 1972; Fama, 1980). Given its foci on contracts and principal-agent exchanges, agency theory deals with the central problem of finding optimal contracts that align and

[1] "Transactions" relate to the transfer of goods or services across a technologically separable interface (Williamson, 1985, p. 1).

incentivize agents with different interests, in light of information asymmetries that are difficult to monitor (Eisenhardt, 1989a; Jensen & Meckling, 1976). Fundamentally, both theories have been central to explain how to align deviating interests in settings of high opportunism, using governance forms and mechanisms within and outside the organizational perimeters.

However, amidst the pressures on organizations to meet the demands of digital transformation in recent decades (Hanelt, Bohnsack, Marz, & Antunes Marante, 2020), the question arises how digital technologies affect the governance of intra- and interorganizational relationships and the strategic trade-offs involved in their design. Digital technologies are defined as different combinations of information, communication, and other connectivity technologies (Bharadwaj, El Sawy, Pavlou, & Venkatraman, 2013), with a specific focus on technologies to resemble human decision making such as artificial intelligence and / or algorithmic management (Möhlmann, Zalmanson, Henfridsson, & Gregory, 2021). Such algorithmic digital technologies facilitate a shift toward machine and algorithmic modes of governance, which differ radically from more traditional, human-centric governance (Strich, Mayer, & Fiedler, 2021; Tarafdar, Page, & Marabelli, 2023).

The potential shifts engendered by digital governance mechanisms can already be observed in many areas. For example, while markets have traditionally been governed by the law of price, which balances supply and demand, digital ownership certificates, such as non-fungible tokens, offer a new way to limit the supply of digital items and assign value to them (Wilson, Karg, & Ghaderi, 2022). Relatedly, digitally enabled information transparency plays an important role in aggregating information and predicting markets with higher accuracy (Yang, Li, & van Heck, 2015). Moreover, rather than using rule-of-law contracts, self-enforcing smart contracts present in blockchain technology can automatically link rules to their execution, reducing the need for third-party intervention in enforcing contractual claims (Murray, Kuban, Josefy, & Anderson, 2021). More recently, the extreme uptake in generative artificial intelligence (AI) technologies has already shown implications for the way humans in organizations communicate and create (Hacker, Engel, & Mauer, 2023b), which has severe governance implications for regulation, policies, and content moderation (e.g., Davenport & Bean, 2023). In a radical form, the notion of fiat, whereby authority resides at the top of a hierarchical organization (Williamson, 1991), can be replaced by consensus in distributed and hierarchy-free systems such as Decentralized Autonomous Organizations (DAOs) (Augustin, Eckhardt, & de Jong, 2023; Lumineau, Wang, & Schilke, 2021). As such, it is paramount to critically examine the applicability of extant governance theories in light of these novel contexts of digital governance.

1.2 Research Topic

In response, building on ideas from TCE and agency theory, the following chapters that constitute this dissertation demark the critical role of *digital governance* in facilitating digitally enabled exchange relationships (Hanisch, Theodosiadis, & Teixeira, 2022b; Vaia, Arkhipova, & DeLone, 2022). To this end, Chapter 2, titled “Digital Governance: A Conceptual Framework and Research Agenda,” proposes a general typology of digital governance, which examines analog, augmented, and automated governance modes, each associated with specific control, coordination, incentive, and trust mechanisms. This essay suggests that digital technologies affect the governance of intra- and interorganizational relationships on a mechanism level, which lays fundamental conceptual groundwork for the following essays of the dissertation.

Building on this conceptual framework, the dissertation then explores blockchain as a specific example of digital governance in Chapters 3-7. Blockchains have emerged as opportunities to implement digital governance by allowing chronological, encrypted, and chained blocks to store verifiable and synchronized transactions directly across a peer-to-peer network via a decentralized shared ledger (Catalini & Gans, 2020; Hanisch et al., 2022b; Yuan & Wang, 2016). As distributed software architectures, blockchains enable direct interactions without the need for a centralized platform or governing authority (Chod, Trichakis, Tsoukalas, Aspegren, & Weber, 2020; Vergne, 2020). In practice, blockchains often surface as “permissioned” or “permissionless” systems, which describes whether the blockchain has a central authority or not (Beck, Müller-Bloch, & King, 2018). Most blockchains—regardless of permissions—share two similar features, which are distributed ledgers and smart contracts (Schmeiss, Hoelzle, & Tech, 2019). Blockchains use distributed ledgers to provide a reliable record of ownership and transaction flows so that local changes to a ledger update all other ledgers in accordance with the consensus protocols. Blockchains also use “smart contracts”—i.e., algorithms and protocols—to define the rules for transactions and automatically enforce them, which can result in reduced agency costs (Murray et al., 2021). Blockchains thereby create algorithmic trust and enable a system that allows multiple organizations that do not trust one another to interact without opportunistic repercussions under preset conditions (Goldsby & Hanisch, 2022; Lemieux, Rowell, Seidel, & Woo, 2020; Werbach, 2016). Therefore, blockchains allow the digital governance of inter- and intraorganizational networks through peer-to-peer, algorithmically-trusted transactions that reduce agency costs (Trabucchi, Moretto, Buganza, & MacCormack, 2020), which make for an important phenomenon to study to advance our theoretical and empirical understanding of digital governance (Alvesson & Sandberg, 2023).

Applying the example of blockchain as a specific digital governance technology for organizations, the following chapters examine the mechanisms and trade-offs of blockchain from different theoretical and empirical angles. From an *intraorganizational* perspective, Chapter 3 ("Agency in the Algorithmic Age: The Mechanisms and Structures of Blockchain-Based Organizing") explores the critical trade-offs entailed in *disintermediation and reintermediation* mechanisms that occur inside organizational hierarchies subject to blockchain-based organizing.

From an *interorganizational* angle, Chapters 4-6 examine critical trade-offs that founders of blockchains face in implementing a digital governance solution, including the trade-off between *automated and analog* mechanisms (Chapter 4: "Hierarchies in Hierarchy-Free Systems: Understanding the Antecedents of Consortia Formation in Enterprise Blockchains"), *leadership and adoption* (Chapter 5: "The Lead Organization Paradox: How Blockchain Founders Navigate Trust and Control Tensions in Interorganizational Networks"), and *imprints and governance dynamics* (Chapter 6: "The Hidden Hand of Imprinting: Unraveling Governance Challenges in Interorganizational Blockchain Networks").

The final chapter ("The Boon and Bane of Blockchain: Getting the Governance Right") discusses both intra- and interorganizational insights that are of particular practical relevance for managers considering the implementation of blockchains as a digital governance mode.

1.3 Dissertation Overview

Overarchingly, this dissertation sets out to understand how digital technologies affect the governance of intra- and interorganizational relationships and the strategic trade-offs involved in their design. Figure 1.1 illustrates the research questions under investigation and the trade-offs of interest for each chapter. Figure 1.1 also serves as a valuable guide delineating the structure of the dissertation. Lastly, Table 1.2 offers a comprehensive overview summarizing the theory, objectives, contributions, methods, and publication status of each chapter.

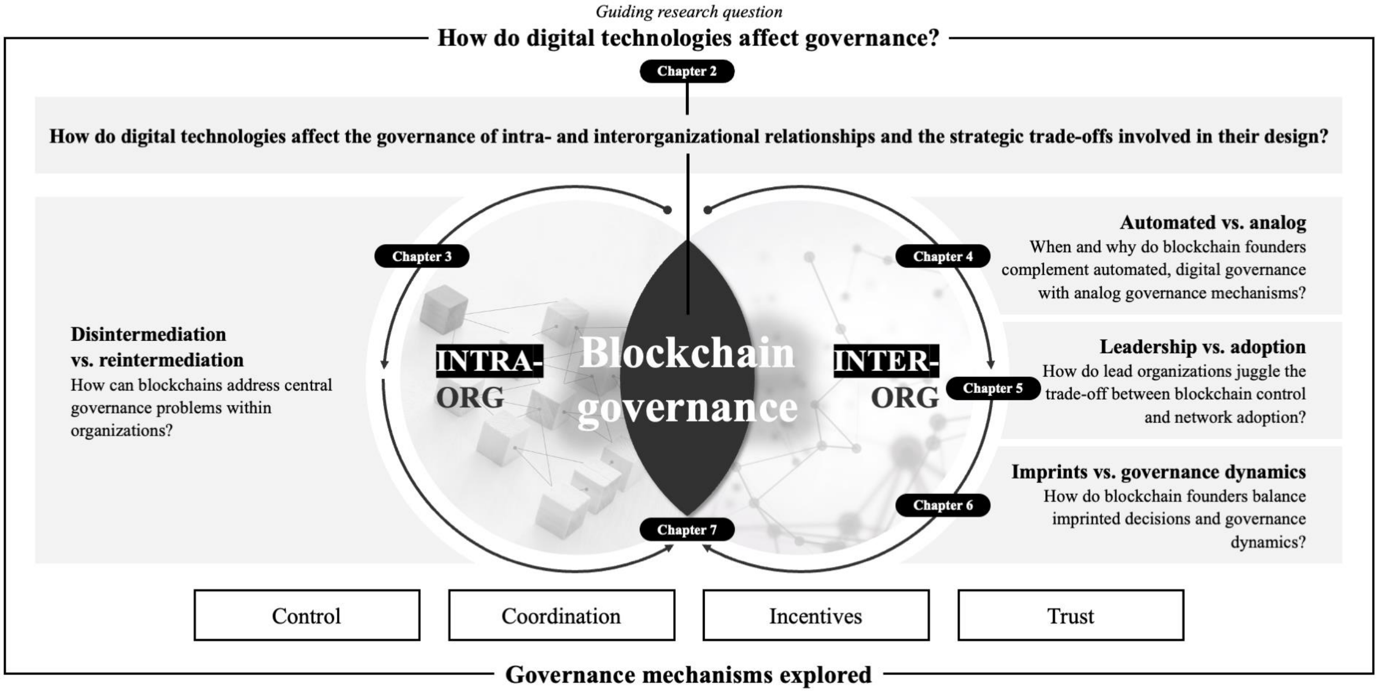
1.3.1 Digital Governance: A Conceptual Framework and Research Agenda

Chapter 2 highlights the critical role of *digital governance* in facilitating digitally enabled exchange relationships. To this end, I propose a typology of analog, augmented, and automated governance modes, each associated with specific control, coordination, incentive, and trust mechanisms. Additionally, I provide a heuristic for determining the optimal governance choice via the interplay of transactivity (i.e., the contributors, connections, and consistency in an exchange network) and corresponding governance costs. The paper advances the governance literature by defining digital governance as a distinct form and outlining key governance mechanisms and choices in the digital era and identifies avenues for future research in this field.

1.3.2 Agency in the Algorithmic Age: The Mechanisms and Structures of Blockchain-Based Organizing

Chapter 3 responds to the question "How can blockchains address central governance problems within organizations?" This conceptual essay covers intraorganizational blockchains from an agency perspective to understand how the distributed, sequenced, and consensus-based nature of blockchains mitigates information asymmetries and affects organizational structures. First, I explain why blockchains are better suited than conventional relational, contractual, and system- based mechanisms to address three pertinent information challenges (concentration, continuity, and conflict). Subsequently, I address the consequences of introducing such blockchains, arguing that they create both direct and sequenced information channels among principals and agents, which elicit an organizational reconfiguration via vertical disintermediation and lateral reintermediation. Finally, I theorize on the implications of blockchain-based organizing for agency theory regarding the chain of command, the unity of direction, and the span of control. Overall, I show how blockchains for intraorganizational governance mitigate principal-agent problems and impact organizational design in profound ways.

Figure 1.1: Research Questions and Dissertation Overview



1.3.3 Hierarchies in Hierarchy-Free Systems: Understanding the Antecedents of Consortia Formation in Enterprise Blockchains

Chapter 4 studies “When and why do blockchain founders complement automated, digital governance with analog governance mechanisms?” Blockchain technology enables interorganizational collaboration by automating governance rules, facilitating large-scale cooperation. However, founder organizations of blockchain networks face challenges when solely relying on blockchain for fully decentralized governance due to their reluctance to cede complete control to algorithms. As a result, some founders choose to retain strategic control within their hierarchies, while others establish consortia as a hybrid solution, offering a balance between centralized and decentralized control. Although consortia provide coordination benefits and reduce opportunistic risks from individual founders, they also come with significant costs and potential hindrances to swift decision-making due to the need for consensus. I propose that the tradeoff in adopting consortia becomes more favorable as the number and diversity of founders increase, along with heightened rivalry and interdependency among them. To test these hypotheses, I analyze 128 enterprise blockchains and discover that the presence of consortia is positively associated with a greater number and diversity of founders, as well as increased rivalry and interdependency. By examining these factors, the study contributes to advancing theories on network governance and enhances the growing literature on blockchain governance.

1.3.4 The Lead Organization Paradox: How Blockchain Founders Navigate Trust and Control Tensions in Interorganizational Networks

Chapter 5 examines “How do lead organizations juggle the trade-off between blockchain control and network adoption?” Blockchain technology offers a promising solution for facilitating the governance of interorganizational supply chain networks. While in theory blockchain is a decentralized technology, in practice, its deployment often requires significant investment from central industry players to generate the necessary financial momentum and attract participation. However, such lead organizations face a paradoxical situation where their ability to attract participants due to their prominent position is offset by the fear of domination, especially from competitors, thereby inhibiting further adoption. As this paradoxical situation has received scarce attention in the literature on blockchains and interorganizational network governance, I address this gap by examining the exemplary case of ClearChain, a blockchain-based network for the global shipping industry, using rich qualitative data including 66 interviews and detailed internal records. Specifically, I focus on the role of the lead organizations as governance orchestrators and examine their efforts to design effective governance solutions that strike a balance between centralized and decentralized trust and control mechanisms. In revealing how ClearChain struggled to find an optimal balance between retaining and devolving control and creating and preventing trust, ultimately leading to its discontinuation, I contribute to network governance and paradox theories by demonstrating that the governance mechanisms set out in the literature do not hold for competitive interorganizational networks.

1.3.5 Beneath the Surface: How Imprints Shape the Governance of Enterprise Blockchain Networks

Chapter 6 explores "How do blockchain founders balance imprinted decisions and governance dynamics?" Interorganizational networks pose a particular challenge to the implementation of effective governance mechanisms due to the interconnectedness and diversity of interests involved. I examine such complex governance issues in three interorganizational blockchain networks that differed drastically in terms of success despite similar goals and founding conditions, with one network shutting down, one stagnating, and another continuing to operate. Drawing on extensive qualitative evidence from 57 interviews and comprehensive internal and external records, I found that the initial imprints from the shared technology provider played a significant role in the initial governance choices, maladaptation problems, and ultimately the success of these blockchain networks. By introducing imprinting theory into governance research, we can explain latent and persistent mechanisms that influence governance decisions at a profound level, often without the actors involved being aware of it.

1.3.6 The Boon and Bane of Blockchain: Getting the Governance Right

Finally, Chapter 7 uncovers insights for practitioners implementing blockchains for digital governance. Countless enterprise blockchains fail to live up to high expectations, often because the supporting governance structures are insufficiently established or have become stagnant. Based on interviews with 153 blockchain executives and an analysis of publicly documented use cases, this article offers a guide for blockchain scholars and practitioners. Its framework highlights the coordination and control challenges that exist in blockchain governance contexts and presents four generic governance modes to address them: chief, clan, custodian, and consortium. Managers can use these governance modes as a basis for four strategic moves (connecting, isolating, loosening, and tightening) to navigate blockchain governance challenges.

1.4 Declaration of Contributions

I (“the author”) disclose the contributions made to each essay within this dissertation, and I am grateful for the collaborative efforts of my supervisory team (promoter: Jan van den Ende; daily supervisors: Helge Klapper and Marvin Hanisch) and co-authors, where applicable. Chapter 1, the introductory chapter of this dissertation, was completed entirely by the author, with feedback from his supervisory team. Across papers, the author acknowledges contributions from other co-authors in terms of conceptualization and theorizing (1), literature review (2), data collection (3), data analysis (4), writing of the manuscript (5), the first draft (6), and feedback and review (7). Table 1.1 details the co-authors’ contributions to the individual chapters.

Table 1.1: Declaration of Contributions

Contributions by chapter	Concept / theorizing (1)	Literature review (2)	Data collection (3)	Data analysis (4)	Writing manuscript (5)	First draft (6)	Feedback / review (7)
Chapter 2							
- Author	√	√	n/a	n/a	√	√	√
- Co-author(s)	√	√	n/a	n/a	√	√	√
Chapter 3							
- Author	√	√	√	√	√	√	√
- Co-author(s)	√	-	√	-	√	-	√
Chapter 4							
- Author	√	√	√	√	√	√	√
- Co-author(s)	√	-	-	√	√	-	√
Chapter 5							
- Author	√	√	√	√	√	√	√
- Co-author(s)	√	√	√	-	√	-	√
Chapter 6							
- Author	√	√	√	√	√	√	-
- Co-author(s)	√	-	-	-	√	-	√
Chapter 7							
- Author	√	√	√	√	√	√	-
- Co-author(s)	√	-	-	-	√	-	√

Notes: √=contribution by author; n/a=not applicable due to the conceptual focus of the study

In order of authorship, **Chapter 2** was co-authored by Marvin Hanisch (*University of Groningen*), the author, Nicolai Fabian (*University of Groningen*), and Jana Oehmichen (*Johannes Gutenberg-Universität Mainz*). **Chapter 3** was co-authored by the author and Marvin Hanisch, and

Chapter 4 was co-authored by Marvin Hanisch, the author, and Vasileios Theodosiadis (*IBM Corporation*). **Chapter 5** was co-authored by Marvin Hanisch, the author, Mélissa Fortin (*Université du Québec à Montréal*), and Mike Rogerson (*University of Surrey*). The author conducted 33 of the 66 interviews as part of this multidisciplinary research team. **Chapter 6** was co-authored by the author, Marvin Hanisch and Helge Klapper (*Purdue University*). **Chapter 7** was co-authored by the author and Marvin Hanisch.

At the time of writing, as highlighted in Table 1.2, Chapters 4-6 are undergoing peer review at top management journals, with the author holding either the first or second author position in these submissions. Chapters 2, 3 and 7 have been accepted for publication in the *Journal of Business Research* and the *California Management Review*, in which the author serves as the second author in the former, and as first author in the latter two publications. Chapters 3-6 have been presented at conferences such as the *Academy of Management* Annual Meeting (in 2021, 2022, and 2023), the *European Academy of Management* (in 2022), and the *Strategic Management Society* (in 2021, 2022, and 2023).

Table 1.2: Summary of Research (by Chapter)

Ch	Title	Theory	Objective	Contribution	Method	Status
2	**Digital Governance:** A Conceptual Framework and Research Agenda *doi:10.1016/j.jbusres.2023.113777*	Transaction cost economics	• Understand how digital technologies are expanding the data and knowledge exchange possibilities • Uncover new challenges for designing effective governance mechanisms	• **Typology** of *digital governance*, incl. *analog*, *augmented*, and *automated* forms of trust, coordination, control, and incentives • **Research agenda** for *governance by* and *governance of* algorithms	**Conceptual**	**Published** *Journal of Business Research* EJL Ranking: **S**
3	**Agency in the Algorithmic Age:** The Mechanisms and Structures of Blockchain-Based Organizing *doi:10.1016/j.jbusres.2023.114195*	Agency theory	• Study how blockchains solve central governance problems within organizations • Understand how blockchains transform organizational structures and operations	• **Conceptual framework** that predicts how blockchains enable a shorter and more direct *chain of command* between principal and agent, an algorithmically enforced *unity of direction*, and a hierarchy-free *span of control* among all actors • **Research agenda** connecting fundamental concepts of agency theory and the recent phenomenon of the use of blockchains for internal purposes	**Conceptual**	**Published** *Journal of Business Research* [3] EJL Ranking: **S**
4	**Hierarchies in Hierarchy-Free Systems:** Understanding the Antecedents of Consortia Formation in Enterprise Blockchains	Transaction cost economics	• Examine the trade-offs whether the blockchain governance layer should be supplemented by costly administrative controls • Explore the role of administrative controls in the blockchain context	• **Conceptual framework** that predicts blockchain *consortia* as hybrid forms of administrative control in response to costs of coordination and opportunism • **Qualitative comparative analysis** of the *governance determinants* and *choice configurations* that are present when blockchains are discontinued	**Quantitative** Probit regression; Qualitative comparative analysis **n=128** blockchain projects 335 organizations	**Submitted** *STAR Journal* [1] [2]

5	**The Lead Organization Paradox:** How Blockchain Founders Navigate Trust and Control Tensions in Interorganizational Networks	Paradox theory	• Study the paradoxical situation faced by lead organizations in competitive interorganizational networks • Explore how the ability of lead organizations to attract followers due to their prominent position is offset by the fear of domination, thereby inhibiting further adoption	• **Process model** explaining the *tensions* and *temporality* of the lead organization paradox • **Conceptual framework** highlighting how lead organizations balance the competing demands of focalizing *trust* and *control* or devolving them to the network	**Qualitative** Case study **n=66** executives 792 pages of interview transcripts	**Submitted** *STAR Journal* [1] [2] * SMS
6	**Beneath the Surface:** How Imprints Shape the Governance of Enterprise Blockchain Networks	Organizational imprinting	• Study the intersection of governance and imprinting • Uncover how subconscious, latent, and persistent mechanisms influence governance decisions	• **Conceptual clarity and integration** of key governance and imprinting concepts • **Process model** explaining how initial imprints play a significant role in initial governance choices, maladaptation problems, and the success of interorganizational blockchain networks	**Qualitative** Comparative case study **n=57** blockchain executives across three cases 414 pages of interview transcripts	**Submitted** *STAR Journal* [1] [2] [4] * AOM * SMS
7	**The Boon and Bane of Blockchain:** Getting the Governance Right *doi:10.1177/0008125622 1080747*	–	• Study why enterprise blockchains fail to live up to high expectations through the lens of governance • Offer a comprehensive guide for blockchain scholars and practitioners	• **Typology** of four blockchain governance modes (*chief*, *clan*, *custodian*, *consortium*) based on coordination and control challenges • **Process model** incl. four strategic moves (*connecting*, *isolating*, *loosening*, *tightening*) to navigate blockchain governance challenges	**Qualitative** Case study **n=153** blockchain executives	**Published** *California Management Review (CMR)* EJL Ranking: **M-STAR**

Notes:
[1] Presented at the *Academy of Management* Annual Meeting (AOM) 2021/2022/2023
[2] Presented at the *Strategic Management Society* (SMS) 2021/2022/2023
[3] Presented at the *European Academy of Management* (EURAM) 2022
[4] Presented at *Strategy Science* Conference 2023
* Best paper award

1.5 Conclusion

This dissertation set out to understand how digital technologies affect the governance of intra- and interorganizational relationships and the strategic trade-offs involved in their design. First, I uncover that digital technologies (including blockchains) indeed affect governance, most notably, in the way that governance mechanisms—such as control, coordination, incentives, and trust—become increasingly augmented or automated. For example, *control* becomes decentralized, as it is exercised through autonomous checks-and-balances algorithms (e.g., blockchain-based smart contracts); *coordination* turns omnilateral, enabled by algorithmic definition and task allocation (e.g., decentralized autonomous organizations); *incentives* are set and reevaluated by a self-adapting algorithm in a feedback loop where outputs serve as inputs (e.g., cryptocurrency proof-of-stake); and *trust* is based on algorithmic systems and consensus mechanisms (e.g., blockchain-based cryptocurrency such as Bitcoin). Therefore, digital governance constitutes a pivotal domain for studying the mechanisms that can streamline exchanges within and between organizations.

In the same vein, this dissertation explores several strategic trade-offs that governance orchestrators face in the design of digital governance solutions, including the choice determinants to introduce digital governance in the first place. In general, the choice of digital governance largely depends on the degree of *transactivity* (contributors, connections, consistency) in the exchange network. Should transactivity be high, digital governance will be more favorable (Chapter 2).

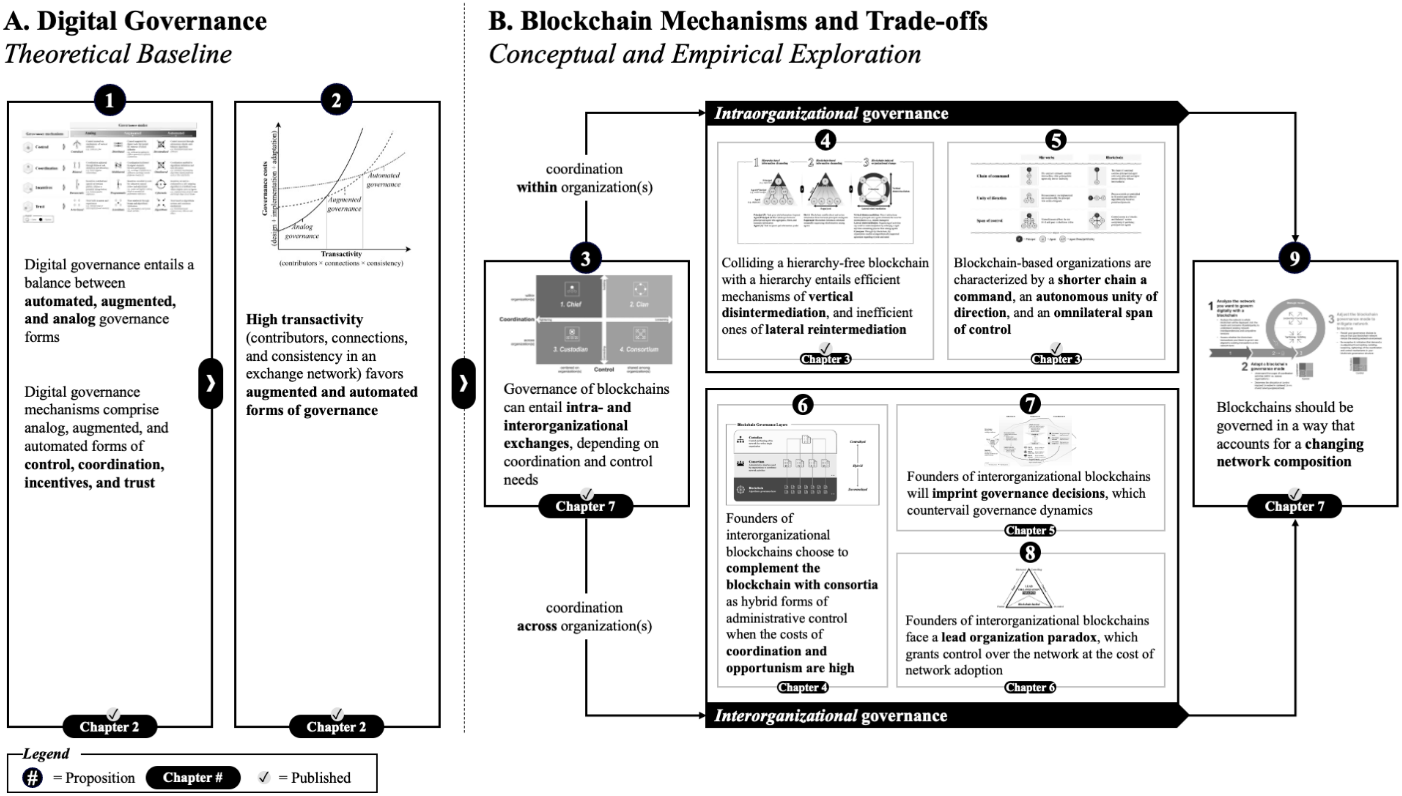
I then turn to blockchain technology to understand additional strategic trade-offs from intra- and interorganizational governance perspectives. From an *intraorganizational* standpoint, I argue that blockchains establish direct and sequenced information channels among principals and agents, leading to organizational reconfiguration through vertical disintermediation and lateral reintermediation. While vertical disintermediation brings a flatter organizational structure with increased efficiency, it also leads to higher cognitive load due to higher information volume. On the other hand, lateral reintermediation introduces new ways of monitoring and incentives for information sharing, but at the expense of rigidity and strict lateral sequencing of information (Chapter 3).

Exploring *interorganizational* trade-offs, I reveal a key challenge in complementing automated, blockchain-based governance solutions with analog ones to balance central and decentralized control. Specifically, founders tend to opt for consortia as “hybrids forms” that complement the blockchain in response to high costs of coordination and opportunism (Chapter 4). In another study, the trade-off of the "lead organization paradox" emerges. Specifically, this paradox is observed when founders dominate a blockchain network for rapid adoption, leading to alienated competition unwilling to participate (Chapter 5). Lastly, studying three blockchain cases (one discontinued, one continued, one stagnated), I highlight the trade-off between initial founder imprints and governance dynamics. Here, I show how deeply engrained founder imprints affect consequential governance choices and spark conflicts during adaptation processes (Chapter 6).

This dissertation also answers questions regarding the applicability of extant governance theories, such as TCE and agency theory, in novel digital governance contexts. Regarding *TCE*, a classic argument is that transactional attributes, particularly the “bilateral dependency [that] builds up as asset specificity deepens” (Williamson, 1991: 282), determine governance choices. However, this argument requires serious reconsideration in the digital age, where exchanges often occur between *multiple* parties simultaneously, the primacy of assets gives way to *digital data*, and reliance on institutional enforcement is supplanted by *algorithmic* rules. In relation to *agency theory*, this dissertation focuses on how blockchain, as a digital governance technology, impacts the way organizations are structured. I demonstrate that the relationship between those in charge (principals) and those carrying out tasks (agents) becomes more direct and sequenced. Moreover, agents can oversee other agents or principals, expanding the span of control. This differs from what agency theory typically assumes, as the theory emphasizes a top-down, bureaucratic structure in organizations (Monteiro & Adler, 2022).

Besides TCE and agency theory, this dissertation also incorporates ideas from paradox theory and organizational imprinting. These combinations highlight the value of studying digital governance alongside various management theories to derive rich and diversified insights. Figure 1.2 showcases the outcomes of each chapter and presents a stylized flow that interconnects the arguments presented in these essays.

Figure 1.2: Research Outcomes and Logical Relationships



1.5.1 Theoretical Implications

Collectively, this dissertation contributes a novel understanding of *digital governance*, a rich and novel field that merits greater attention in the cross-disciplinary study of organizations. I make three main contributions to the literature on (digital) governance, and the theories associated with them. First, I provide definitional clarity regarding the concept of digital governance, a distinct form of governance that has spawned a new field of research requiring a conceptual foundation (Hanisch et al., 2022; Vaia et al., 2022; Vasarhelyi, 2013). Hence, I answer recent calls for enhanced conceptual distinction of emerging digital phenomena and clarifying the extant understanding of corresponding analog phenomena (Adner, Puranam, & Zhu, 2019; Alvesson & Sandberg, 2023; Wessel, Baiyere, Ologeanu-Taddei, Cha, & Blegind-Jensen, 2021).

Second, the dissertation extends the conceptual foundation for enterprise blockchains, an emerging and impactful digital governance technology (Lacity, 2018; Lumineau et al., 2021), by examining the mechanisms underlying the use of blockchains for the purposes of intraorganizational governance. Most blockchain research has thus far focused on cryptocurrencies and interorganizational applications (Cheng, De Franco, Jiang, & Lin, 2019; Chod et al., 2020), while insufficient consideration has been given to understanding the governance mechanisms involved in the use of blockchains for intraorganizational purposes (Murray et al., 2021). I draw attention to the theoretical mechanisms associated with internal blockchains as a specific and less understood application of that technology by focusing on the firm’s internal processes, governance, and design (Lee, Ilseven, & Puranam, 2023).

Third, I advance the study of blockchain for interorganizational governance by highlighting three critical strategic trade-offs that founders are likely to face when introducing these digital governance solutions. Specifically, I uncover the trade-off involved in (1) selecting the ideal combination of analog and automated governance mechanisms, (2) the delicate balance between exerting tight control versus driving network adoption, and (3) the inherent trade-off between rigidity and dynamism that can arise from deeply engrained founder imprints. More broadly, this dissertation contributes to the wider discussion on digital transformation that has gained prominence in management and organizational research (Hanelt et al., 2020; Verhoef et al., 2021; Vial, 2019) by shifting the focus from organizational processes and business models to digital governance.

1.5.2 Practical Implications

For organizations to be successful in introducing digital governance solutions, it is paramount they have a digital governance strategy in place that assesses the current landscape of governance solutions and evaluates whether exchanges should be governed digitally for greater cost effectiveness. For example, organizations can start by assessing their exchange environment, which includes an understanding of *who* is participating (e.g., partners, competitors), *what* is being exchanged (e.g., private, public information), and *how* standardized the exchange is today (e.g., relational, system-based). Based on these parameters, decision makers can then assess whether a digital governance solution is viable and whether it might alleviate pain points for the organization. Managers are best advised to start by assessing specific use cases for digital governance (e.g., automating recurring transactions among competitors), and then selecting the technology most appropriate to realize the intended outcome.

In the specific example of blockchain technology, which are particularly beneficial in circumstances of low trust (e.g., competitive settings), it is crucial for decision makers to select the right governance form (Chapter 7). I propose four modes of blockchain governance—Chief, Clan, Custodian, Consortium—which depend on the coordination and control needs of the network. To make the right choice, managers should first analyze the network where the blockchain will be used. This involves considering the needs and concerns of those involved to grasp the existing connections and competition within the network. Second, managers should understand who will use the blockchain and why, so they can adjust the coordination and control mechanisms based on the network's structure and the participants' needs. Lastly, managers need to be aware of how the composition of the network changes over time, which might require them to keep adjusting the governance approach. For example, organizations might start out in a closed mode that pertains to coordination inside their organization (e.g., "Chief" or "Clan"), before expanding to a more decentralized mode once occurring higher costs of coordination and opportunism (e.g., "Consortium").

The future of blockchains hinges on managers' abilities to overcome salient governance challenges. While multiple technological approaches exist (e.g., permissioned or permissionless blockchains), governance is a factor that is embedded in *and* complementary to the blockchain. Findings from this dissertation show that it is often the intricate sociotechnical interplay between automated and analog governance that requires holistic management. To date, we are yet to see a breakthrough in the realm of blockchains for organizations that has managed to overcome all strategic design trade-offs related to governance, underscoring the ongoing need to study this important domain.

1.5.3 Societal Implications

Digital governance—and blockchains in particular—will have societal impact in the way they revolutionize transparency and accountability practices in organizations, with major implications for our supply chains, financial systems, and governments. For example, blockchain's societal benefits may range from improved financial reporting (e.g., Yu, Lin, & Tang, 2018) and more efficient internal supply chain management (e.g., Treiblmaier, 2018) to effective tools for marketing and sales (e.g., Tan & Salo, 2023). For example, blockchains can improve corporate governance in environmental social governance (ESG) reporting (Liu, Wu, Wu, Fu, & Huang, 2021), an area that has been historically plagued by greenwashing and a lack of transparency; and as an important tool in the marketing and sales process for gaining consumer confidence, e.g., through accurate carbon footprint labels. Moreover, for developing countries, the use of distributed ledger technologies can streamline settlements, serve as standardized communication channels, and consolidate data, all of which eliminate inefficiencies and foster financial inclusion (Giraldo, 2018). Finally, blockchains will have the potential to enhance government operations (e.g., Verma & Sheel, 2022) by fostering greater citizen engagement through simplified voting processes and reducing inefficiencies in public services, exemplified by improved allocation of tax resources.

While blockchains offer numerous advantages, they also present challenges to society. Energy consumption in some blockchain networks, such as Bitcoin, has raised environmental concerns (Sedlmeir, Buhl, Fridgen, & Keller, 2020), demanding the development of energy-efficient consensus mechanisms. Regulatory frameworks are evolving to address legal and ethical issues related to blockchain applications, such as GDPR (Rieger, Lockl, Urbach, Guggenmos, & Fridgen, 2019). Balancing the potential benefits with these challenges requires collaboration among governments, industries, and technologists to ensure that blockchain's transformative potential is harnessed responsibly and inclusively for the betterment of society.

CHAPTER 2.
DIGITAL GOVERNANCE: A CONCEPTUAL FRAMEWORK AND RESEARCH AGENDA

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The proliferation of digital technologies has expanded the opportunities for data and knowledge exchange (Hanelt et al., 2020; Verhoef et al., 2021; Vial, 2019), yet it also presents new challenges for governance. Digital exchanges, such as platform-based transactions and online communities, frequently occur in large networks with numerous simultaneous interactions, pushing analog governance mechanisms such as contracts and relational norms to their limits. For instance, it would seem almost impossible to negotiate a contract for every job performed via Amazon Mechanical Turk or to establish a trust relationship for every Airbnb home stay. Thus, it is crucial to better understand the governance mechanisms and choices that meet the demands of the digital age.

To enable large-scale digital exchanges, there is increasing reliance on *digital governance*, which leverages algorithmic protocols to automate control, coordination, incentives, and trust (Hanisch et al., 2022b; Vaia et al., 2022). Digital governance touches on fundamental issues of organizing, e.g., enhancing task programmability to improve process control, automating task division and allocation to facilitate coordination, conditioning incentives through dynamic inputs, and creating the transactional transparency required for trust. For example, digital governance can create verification mechanisms for transactions, e.g., oracles and consensus protocols, which are used in blockchain networks (Al-Breiki, Rehman, Salah, & Svetinovic, 2020; Zheng, Xie, Dai, Chen, & Wang, 2017). Similarly, artificial intelligence (AI)-supported analyses can enable automatic checks on accounting data and raise red flags early, thus enhancing firm monitoring (Commerford, Dennis, Joe, & Ulla, 2022; Möhlmann et al., 2021). These technological solutions are important precursors of new, data-driven business models that require the regulation of data ownership, storage, transfer, access, and use across individual, functional, and organizational boundaries.

We advance the debate on digital governance by developing a conceptual framework that distinguishes between analog, augmented, and automated forms of control, coordination, incentives, and trust. In particular, we show how 1) automated control no longer relies on hierarchical control but on decentralized checks-and-balances protocols; 2) automated coordination transforms bilateral agreements into omnilateral arrangements; 3) incentives transition from bureaucratic rules to cybernetic protocols that update autonomously via dynamic inputs; and 4) trust can be algorithmically enhanced by shifting from individual actors to a complete system. In addition to the poles of analog and automated governance, our model highlights augmented governance modes, which blend elements from both domains. Importantly, our framework does not suggest that analog governance is completely displaced by digital governance; rather, they complement and constrain each other.

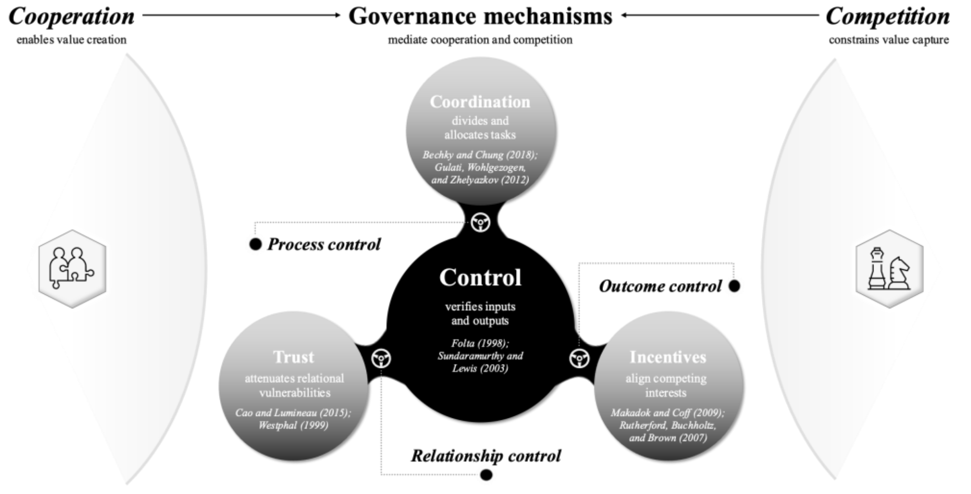
Our distinction between analog, augmented, and automated governance also informs a governance choice model that predicts the optimal governance mode as a function of transactivity and the resulting governance costs. Specifically, we predict that automated governance becomes more cost-efficient than augmented governance and, ultimately, analog governance as transactivity—defined by the number of contributors, connections, and level of exchange consistency—increases. More broadly, we facilitate a deeper understanding of the mechanisms and strategic trade-offs governance designers and exchange participants face when establishing effective governance solutions for the digital age. We conclude with an extensive research agenda and identify opportunities to study the governance by and of algorithms.

This paper makes three important theoretical contributions. First, we provide definitional clarity regarding the concept of digital governance, a distinct form of governance that has spawned a new field of research requiring a conceptual foundation (e.g., Hanisch et al., 2022b; Lumineau et al., 2021; Möhlmann et al., 2021; Vaia et al., 2022). Hence, we answer calls for an enhanced conceptual distinction of emerging digital phenomena and clarification of the extant knowledge of corresponding analog phenomena (Adner et al., 2019). Second, we extend previous governance research by unraveling the strategic decision-making parameters and trade-offs associated with digital governance, and we define relevant governance mechanisms associated with digital exchange that are critical in discussions of advanced system designs such as AI and blockchains (e.g., Chhillar & Aguilera, 2022; Goldsby & Hanisch, 2022). Third, our work contributes to the wider discussion on digital transformation that has gained prominence in management and organizational research (Hanelt et al., 2020; Verhoef et al., 2021; Vial, 2019) by shifting the focus from organizational processes and business models to how digital technology impacts governance.

2.1 Taking Stock of the Governance Literature

The need for governance arises from the division of labor and the associated dissipation of information and control of inputs and outputs (Gulati & Singh, 1998; Puranam, Alexy, & Reitzig, 2014; Sundaramurthy & Lewis, 2003). Ultimately, it entails creating and capturing value through exchange amid competition and asymmetric information (Gnyawali & Ryan Charleton, 2018). The governance challenge involves creating mechanisms that help integrate, direct, and monitor the distributed efforts in productive exchange relationships (Dekker, 2004). To meet this challenge, exchange partners must find ways to control relevant exchange processes (e.g., allocation of resources and tasks), outcomes (e.g., generation and distribution of financial, environmental, and social value), and relationships (e.g., opportunistic behaviors) (Goold & Quinn, 1990; Sundaramurthy & Lewis, 2003). The design of control mechanisms can be complemented and substituted by appropriate coordination (Bechky & Chung, 2018; Gulati et al., 2012b), incentives (Makadok & Coff, 2009; Rutherford et al., 2007), and trust mechanisms (Cao & Lumineau, 2015; Westphal, 1999) to achieve desired governance benefits. Hence, governance broadly concerns the establishment of rules that help verify inputs and outputs (i.e., control mechanisms), divide and allocate tasks (i.e., coordination mechanisms), align competing interests (i.e., incentive mechanisms), and attenuate relational vulnerabilities (i.e., trust mechanisms). Figure 2.1 summarizes these complementary and substitutive mechanisms that are central to the governance literature.

Figure 2.1: Governance as a Mediator between Value Creation and Value Capture



Governance research has identified various responses to the control, coordination, incentive, and trust challenges in transactions (Brown, Beekes, & Verhoeven, 2011; Furlotti, 2007; Hambrick, Werder, & Zajac, 2008). A first response lies in the creation of bureaucratic organizations that define and delimit transactions and provide mechanisms of hierarchical fiat and authority to improve control and coordination, set incentives, and ensure cooperation (Powell, Staw, & Cummings, 1990; Williamson, 1991). A second generic response involves using contracts as a means of codifying agreed-upon control, coordination, and incentive mechanisms, backed by institutional support, to enforce legal rights (Grossman & Hart, 1986; Hart & Moore, 1990; Tirole, 1999). Finally, a third response entails fostering relational bonds that emerge organically through social interdependencies and positive exchange experiences to provide a bedrock for the emergence of trust (Gulati, 1995; Uzzi, 1997). While these analog governance mechanisms are vital to organizational life and are likely to persist, emerging digital technologies present new challenges and opportunities for the design of governance mechanisms.

2.2 Facing Governance Challenges in the Digital Age

The need to revisit and advance governance theories in the digital age is closely linked to the novel challenges arising in this context. We examine these new challenges in terms of establishing / building, maintaining / adapting, and restoring / terminating exchange relationships. For each stage, we highlight exemplary new forms of competition and cooperation in the digital age (Figure 2.2) because a critical function of governance is to enable cooperation amid competing interests.

2.2.1 Establishing and Building Digital Relationships

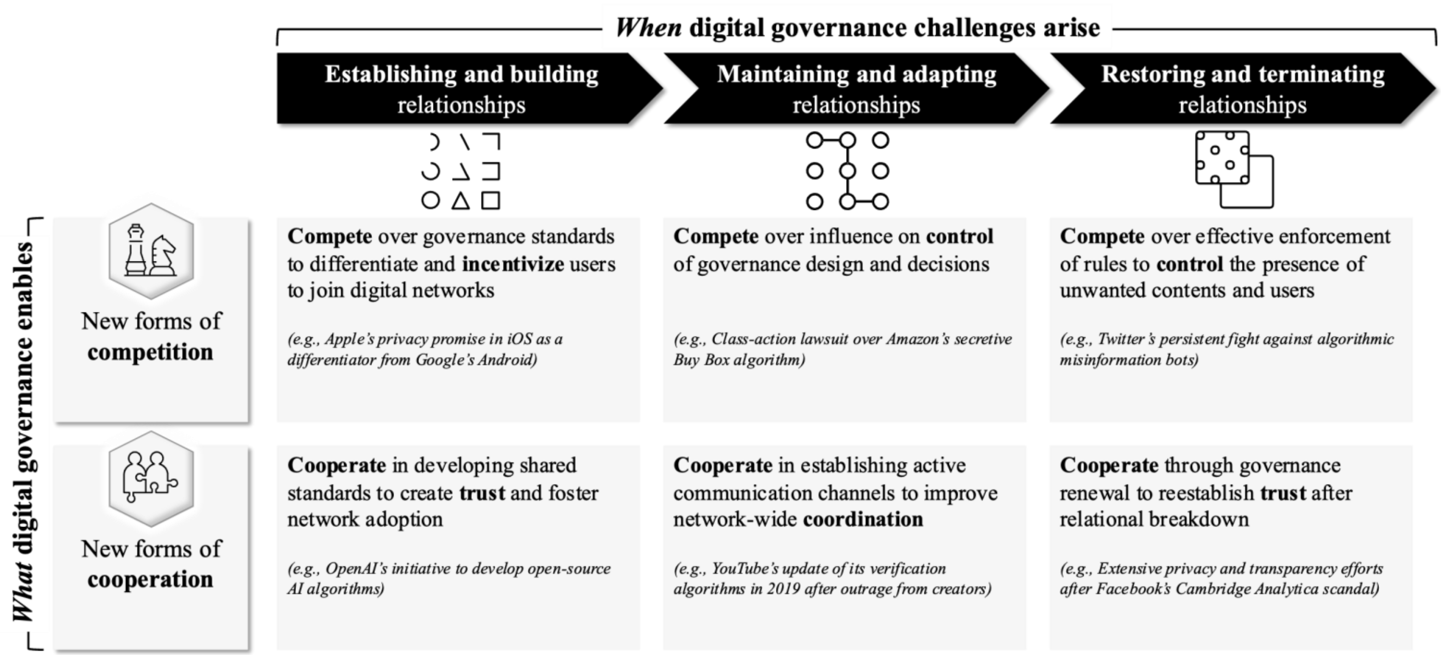
The strategic relevance of governance results from its ability to ensure and enhance performance in exchange relationships (Jones, 1983; Leiblein, 2003). This logic is subject to a new dynamic in the digital age, where governance serves as not only a performance enabler but also a strategic differentiator. Since the value of digital networks is heavily reliant on the realization of network effects (Shapiro & Varian, 2008), companies are increasingly recognizing that their governance decisions strongly influence the overall attractiveness of their network (Chen, Tong, Tang, & Han, 2022). In light of this, Apple markets its privacy policy across the ecosystem as a strategic differentiator from its competitor Google.

As organizations have begun to compete for governance, there is also growing evidence of novel collaborative dynamics, e.g., the transparency movement concerning governance decisions via the publication and development of algorithmic protocols using open-source software code. Organizations such as OpenAI develop open-source AI to promote transparency, while decentralized autonomous organizations (DAOs) discuss algorithmic governance choices publicly in Discord forums (Taulli, 2022). These collective efforts represent new forms of collaboration largely absent from the analog world, where governance choices (e.g., contract design) have typically been negotiated behind closed doors.

2.2.2 Maintaining and Adapting Digital Relationships

The transition from analog to digital governance shifts the locus of decision-making from the actors involved in the exchange to those who develop digital governance tools (Benlian et al., 2022).

Figure 2.2: Exemplary Governance Challenges in Digital Exchange Relationships



In the analog world, the governance mode is primarily negotiated and agreed upon by the exchange participants. However, in the digital world, decisions are often made by those who develop digital tools, disconnecting them from the parties that execute the transaction (Renwick & Gleasure, 2021). This warrants the need for stronger consideration of the governance setters and principal actors and the processes necessary for alignment. Failing to align exchange participants and governance setters can lead to serious tensions (Huber, Kude, & Dibbern, 2017), as evidenced by Epic's lawsuit against Apple over its pricing policies on the iOS platform. These tensions can also bring new forms of collaboration, such as solidarity among content creators expressing their dissatisfaction with governance decisions (Ricart, Snihur, Carrasco-Farré, & Berrone, 2020).

2.2.3 Restoring and Terminating Digital Relationships

The termination of interorganizational and interpersonal relationships has been extensively studied in the context of strategic alliances (e.g., Asgari et al., 2017; Bakker, 2016) and CEO dismissals (e.g., Marcel, Cowen, & Ballinger, 2017; Oehmichen, Schult, & Wolff, 2017). However, comparatively little is known about participants' departure in predominantly digital exchange relationships (Shah, 2006; Tiwana, 2015). This termination can be attributed to various factors, one of which is the design of governance mechanisms. Well-designed governance and increased trust between parties in platform markets can paradoxically lead to a platform's disintermediation as users seek to bypass platform fees and continue their transactions (Gu & Zhu, 2021). Governance choices regarding the interoperability of digital platforms can also raise coordination costs for developers and increase the likelihood of platform abandonment (Tiwana, 2015). Finally, the addition of non-human agents through governance choices can alienate human participants (Newlands, 2021). For instance, the use of algorithms to control information presentation on social media platforms presents challenges in designing governance mechanisms that avoid negative consequences and potential legislative interventions (Riemer & Peter, 2021). Hence, preventing activities that drive human participants away is a crucial challenge in digital governance.

In the most extreme cases when governance decisions are met with widespread resistance, a coordinated campaign can lead to mass platform exit, as Facebook experienced after the Cambridge Analytica scandal (Zhang, Wang, Karahanna, & Xu, 2022), or the concerted effort by major consumer products companies to stop advertising on Twitter when new CEO

Elon Musk decided to reinstate the accounts of individuals previously banned for violating Twitter's policies. Thus, exchange participants can pressure governance designers by employing exits as effective strategies to undermine the size and value of a network. Recognizing these novel exigencies, scholars have begun to identify and explore the mechanisms and tradeoffs of governance in digital contexts across disciplines.

2.3 Recognizing the Potential of Digital Governance

Digital governance is facilitated by digital technologies, i.e., different combinations of information, communication, and other connectivity technologies (Bharadwaj et al., 2013). In digital governance, there is a strong focus on digital technologies that can process data relevant to value-added exchanges (e.g., advanced databases such as blockchains; Lumineau et al. (2021)) and the heuristics that can make autonomous decisions to support exchange continuity (e.g., complex algorithms such as matching algorithms and AI; Malgonde, Zhang, Padmanabhan, and Limayem (2020)). Such digital technologies permit a shift toward automated modes of governance, which differ radically from their analog counterparts (Strich et al., 2021; Tarafdar et al., 2023). Hence, we view digital governance as a distinct governance category that sustains novel forms of organizing, value creation, and value capture, and thus goes beyond the digitization of existing analog governance mechanisms.

The extent to which digital technologies are used to govern exchanges can range from augmenting to fully automating governance (Raisch & Krakowski, 2021). On the one hand, digital governance can *augment* aspects of governance, reducing reliance on human intervention. For example, classic exchange relationships between buyers and sellers can be augmented by digital governance in the form of digital platforms that act as intermediaries connecting buyers and sellers (Constantinides, Henfridsson, & Parker, 2018; de Reuver, Sørensen, & Basole, 2018). On the other hand, technological solutions can help organizations *automate* governance. For example, algorithmic surveillance in the gig economy allows platform firms to automate control of their workforce and complementors (Bellesia, Mattarelli, & Bertolotti, 2023; Möhlmann et al., 2021; Newlands, 2021). The advantage of augmenting and / or automating governance through digital technologies is that these digital governance structures can drive efficiency (e.g., through repeat, rule-based transactions) and transparency between exchange participants (e.g., recommender systems and digital identities). Additionally, digital governance structures can have formally superimposed controls (e.g., role management and access rights) that increase certainty and reduce tolerance for erroneous transactions (e.g., through approval systems, voting rights, and rigorously programmed workflows).

Nevertheless, augmented and automated governance are often complemented and constrained by analog governance, which balances technological affordances with its strong focus on interpersonal and contractual mechanisms. For example, machine learning algorithms, while able to automate workflows such as content review processes, are prone to biases and therefore require human oversight in certain circumstances (Akter et al., 2022; Kordzadeh & Ghasemaghaei, 2022). In other cases, algorithmic governance is simply undesirable, especially in regard to assuming significant responsibilities. For instance, corporate legislation generally prohibits non-human representatives from assuming a supervisory role on the board of directors. Consequently, digital governance relies heavily on the complementary and constraining influence of analog governance to mitigate the pitfalls of fully automated governance.

One limitation of automated governance can arise when its highly programmatic nature promotes rigidity and thereby harms adaptability (Zhu, Kraemer, Gurbaxani, & Xu, 2006). A related downside is that automated governance requires explicit information, while governance may involve tacit information that are difficult to codify. Furthermore, automated governance can quickly succumb to compliance and regulation, as seen with the European Union's General Data Protection Regulation (GDPR), which strictly regulates personal data storage and may conflict with the append-only nature of blockchains (Rieger et al., 2019). Thus, automated governance must be carefully constrained and complemented with analog governance to overcome its shortcomings. Automated governance alone cannot be considered a cure-all solution.

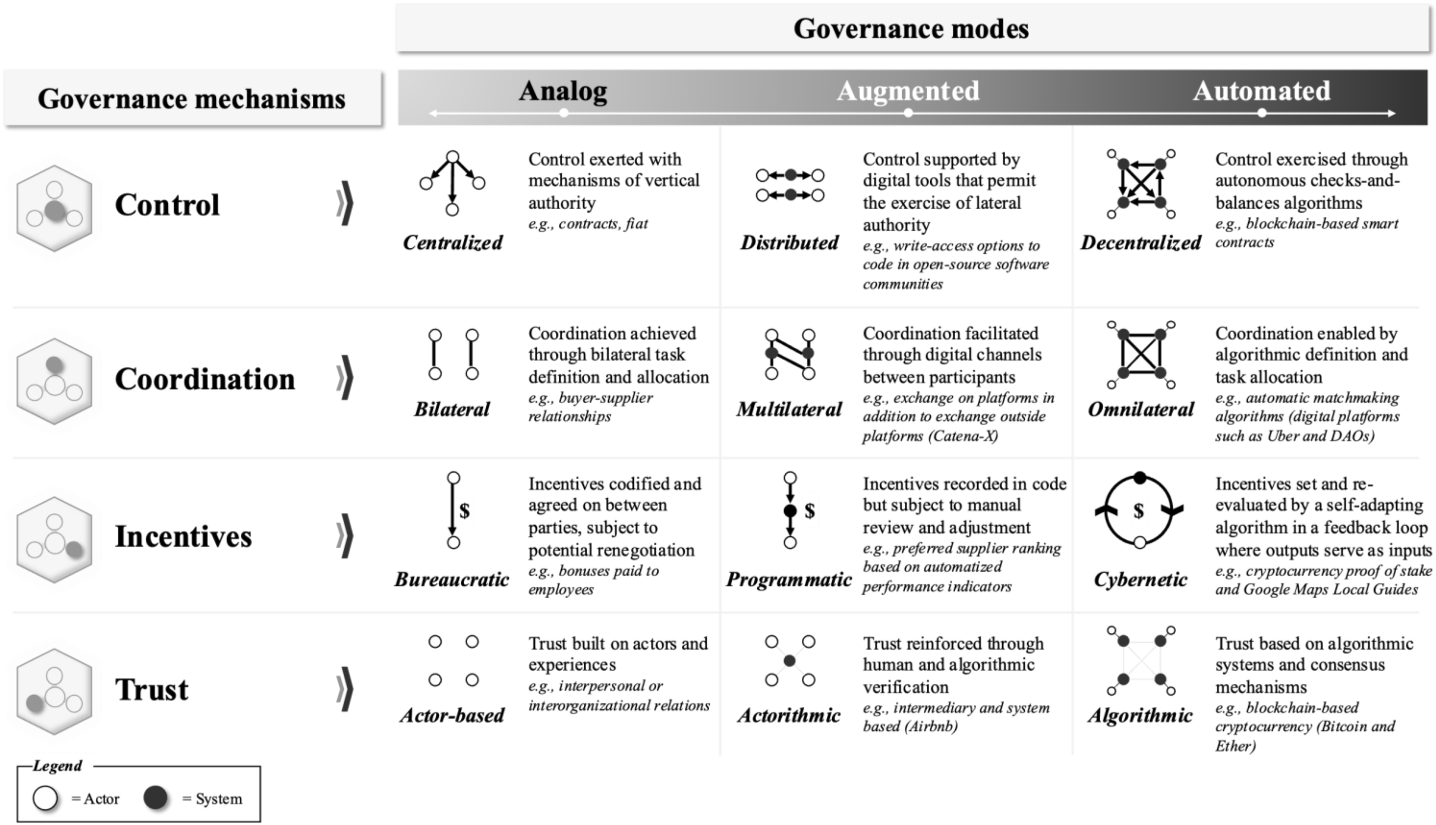
To theorize about the role of analog, augmented, and automated governance mechanisms, we consider them to be interrelated and complementary. Our goal is to comprehend how digital governance can augment and automate analog governance, such as administrative procedures, contracts, and relational norms, thereby establishing digital mechanisms of control, coordination, incentives, and trust. It is crucial to emphasize that analog governance plays a significant role in complementing and constraining digital governance mechanisms where they fall short.

2.4 Understanding the Shift from Analog to Automated Governance

Ongoing digital transformation is leading to profound changes in the governance of exchange relationships, with analog forms of governance being supplemented and, in some cases, replaced by automated forms. Here, *analog* governance refers to instances when governance is predominantly based on *centralized* control structures, *bilateral* task coordination, *bureaucratic* incentives, and *actor-based* relational trust. In contrast, *automated* governance entails that governance is based largely on *decentralized* control, *omnilateral* coordination, automatic *("cybernetic")* incentives, and *algorithmic* system trust. Given these two extremes, an intermediate mode is *augmented* governance, where actors and algorithms intertwine. *Augmented* governance involves *distributed* control, *multilateral* coordination (assisted by digital channels), *programmatic* incentive structures, and *actorithmic* trust. Below, we elaborate on these generic governance modes (analog, augmented, and automated) and provide a comprehensive definition of the underlying four governance mechanisms—(1) control, (2) coordination, (3) incentives, and (4) trust.

Figure 2.3 illustrates how each of the three governance modes manifests across the four mechanisms. When using the terms "analog," "augmented," or "automated" governance, we refer to discrete, pure sets that exist within the broad spectrum of the combinations of these endpoints of the multidimensional space we depict. In general, we view the transition between analog and automated governance as a fluid, multilevel continuum that allows decision-makers to automate certain governance mechanisms individually or in conjunction with others. Thus, it is possible to "mix and match" analog, augmented, and automated governance mechanisms in various hybrid forms of governance. For parsimony, we focus our theorizing on discrete points in the option space; however, we fully recognize the configurational logic underlying this framework (Furnari et al., 2021). Thus, in practice, we expect to observe configurations that blend analog governance (e.g., for control) forms with elements of augmented governance (e.g., for coordination) and automated governance (e.g., for incentives).

Figure 2.3: Configurational Building Blocks of Governance Mechanisms and Modes



2.4.1 Control: From Centralized to Decentralized

In analog governance, control is *centralized* through contracts and fiat (Williamson, 1991). Centralized control relies on mechanisms of vertical authority and primarily focuses on behavior and outcome enforcement (Eisenhardt, 1985; Ouchi & Maguire, 1975). Outcome-based contracts formalize agreed-upon metrics, such as product sales, and behavior-based contracts improve adherence to performance-related metrics, such as task completion time. Both types of contracts are typically supported by vertical authority mechanisms, such as hierarchical fiat and institutional power, to enforce outcomes or behaviors.

Automated governance in the form of *decentralized* controls replaces vertical authority with autonomous algorithms that improve outcome certainty and enforce rigid behavioral control. These algorithms can be used to monitor a workforce (e.g., Amazon’s fully automated warehouses; Baraniuk (2015)) or user-generated content in social networks (e.g., Gilbert, 2021). Decentralized control systems have several advantages, such as following preprogrammed rules that are automatically executed (e.g., through smart contracts) and not requiring enforcement by vertical authority (Murray et al., 2021). Additionally, they structure a checks-and-balances system that increases certainty through transaction and information validation by each participant in the control structure. Furthermore, decentralized information systems, such as blockchains, can digitize routinized workflows, providing stricter process control and increasing behavioral certainty.

In addition to centralized and decentralized control, digital tools can enable the emergence of *distributed* control mechanisms. Distributed control is a form of control that operates through lateral authority and is enabled by digital tools. For example, open-source software development relies on distributed controls among developers that regulate access to read, write, or contribute code (Dahlander & O'Mahony, 2011). This type of control is anchored in the developer community and digital tools such as GitHub or Bitbucket. The advantage of distributed control is that it gives partial control over bureaucratic tasks, such as version control, to an automated and decentralized system while accounting for contingencies beyond the program code.

2.4.2 Coordination: From Bilateral to Omnilateral

In the analog context, coordination occurs *bilaterally*, which means that an actor divides labor into tasks that can be assigned to and performed by another party, as would be the case in buyer-supplier relationships (Jones, 1984). One benefit of this type of coordination is that task assignments are usually routinized, leading to increased reliability and efficiency in organizational performance (Cohen & Bacdayan, 1994). However, this type of procedural memory can also be inarticulate and challenging to transfer between actors.

In contrast, *omnilateral* coordination relies on mechanisms where a system divides labor into tasks that can be assigned to any party automatically. Importantly, omnilateral mechanisms do not rely on implicit procedural memory but on rigid task codification, division, and assignment, which are fully autonomous. For instance, platform firms such as Uber, Lyft, Deliveroo, and GrubHub extensively adopt algorithmic coordination to manage task allocation, goal setting, and scheduling for their workforce (Tarafdar et al., 2023). Another example of omnilateral coordination concerns DAOs, whose first use cases (e.g., MakerDAO, a stablecoin issuance platform) illustrate how fully autonomous task division and task allocation occur through on-chain voting (Zhao, Ai, Lai, Luo, & Benitez, 2022). As routines are considered dynamic (Feldman, 2000), a risk of any omnilateral coordination is that its assisting algorithm does not persist over time and cannot account for possible changes in the organization's task environment, which can impede overall task division and assignment.

Between the extremes of bi- and omnilateral coordination mechanisms, coordination can take an augmented form of *multilateral* coordination where tasks are divided and assigned by physical actors through digital channels. The advantage of multilateral coordination is that digital channels partly codify routines that would otherwise be stored in procedural memory. For example, the Catena-X network, which fosters cross-company data exchange in the automotive industry, relies on an open data ecosystem where parties use network services to share data and on an actor-based consortium to coordinate its development. Simultaneously, with multilateral coordination, direct actor involvement helps account for salient routine instability (Pentland, Hærem, & Hillison, 2011). Using multilateral coordination through digital channels, parties can better anticipate when a change in routine is required and whether a bypass of automatic task division and allocation is warranted.

2.4.3 Incentives: From Bureaucratic to Cybernetic

In the analog world, incentives are *bureaucratic* in the sense that they are set in contracts that align the objectives of the partners, such as explicit compensation arrangements between owners and managers (Oehmichen, Jacobey, & Wolff, 2020). Incentives are important complements to controls; they can help reduce conflicts between parties, e.g., agency problems due to the separation of decision- and risk-bearing functions (Fama & Jensen, 1983). In their bureaucratic form, incentives are agreed upon by parties and subject to potential renegotiations. For example, when a bonus is paid to an employee, this is an incentive that rewards the employee with variable compensation that is typically agreed upon contractually (Shaw, Gupta, & Delery, 2000).

Bureaucratic mechanisms differ sharply from *cybernetic* incentives, which are set and re-evaluated by a self-adapting algorithm in a feedback loop where outputs continuously serve as inputs (Green & Welsh, 1988; Vergne, 2020). For example, an increasingly popular cybernetic incentive mechanism is "proof-of-stake" rewards in cryptocurrencies. Here, network participants serve as "validators" by staking their cryptocurrencies or tokens for a set period, which is documented in a smart contract on the blockchain (Edelmann, 2022). In return, when participants validate new block transactions, they are rewarded for their validation efforts with cryptocurrency. Another example of a cybernetic incentive is Google Maps Local Guides; contributors to Google Maps who share reviews, photos, and knowledge are rewarded with points, which can be exchanged for rewards or used in exclusive community events (Tajedin, Madhok, & Keyhani, 2019). Underlying these cybernetic incentive systems are algorithms that automatically distribute and adjust rewards when certain input conditions (e.g., price levels, demand) are achieved.

In addition to the range of bureaucratic and programmed incentives, *programmatic* incentive structures that are recorded in code but subject to manual review and adjustment could become the norm. In contrast to cybernetic incentives, programmatic incentives are predefined, rigid, and automatized rules that do not work in a constant feedback loop. An example of programmatic incentives is preferred supplier programs: Sourceability, a global distributor of electronic components, has developed an automatized supplier rating system that scores each supplier and prefers high-quality, timely suppliers, incentivizing suppliers through the communication of rank order and related order placement.

2.4.4 Trust: From Actor-Based to Algorithmic

In the analog world, trust is *actor-based* and describes the expectation that an exchange partner will not behave opportunistically, even when the affected party has limited abilities to detect such behavior (Mayer, Davis, & Schoorman, 1995; Puranam & Vanneste, 2009). In interorganizational collaboration, trust can be built between partners that engage with each other repeatedly, where each delivers the outcomes expected of the other, and where each entity behaves responsibly toward the other, which can ultimately build trust in competence and goodwill (Das & Teng, 2001; Gulati, 1995).

In automated contexts, trust resides in the *algorithmic* system itself and is not dependent on personal relationships (Lumineau, Schilke, & Wang, 2023). Rather than relying on the (unobservable) actions of partially known exchange partners, trust can be placed in a system that automatically validates each party without having to reveal its identity. For example, cryptocurrencies, such as Bitcoin and Ether, rely fully on transactions based on automated consensus mechanisms, eliminating the need for trusted intermediaries to help safeguard against opportunistic behavior (Seidel, 2018; Werbach, 2018). In enterprise applications, blockchain technologies such as IBM Food Trust enable information in the food sector to be stored on an immutable blockchain, allowing customers to track their entire value chain while increasing confidence in the product's provenance and quality (IBM, 2022). Trust in the system, rather than in the actors, is particularly crucial in digital exchange (Ba & Pavlou, 2002).

Along the spectrum of actor- and system-based trust, an augmented mode of trust can emerge as a principal form that is *actorithmic* in nature, where actor-based trust is algorithmically enhanced. In other words, actorithmic governance emerges when trust depends partly on the actions of the parties involved in an exchange and partly on digital technologies. Actorithmic governance is evident in digital marketplaces and platforms such as eBay and Airbnb, where trust between unacquainted transaction parties is partially established through the parties fulfilling their agreements and partially through digital technologies. The necessary trust building is facilitated by the recommender systems of these platforms, which assess parties based on their transaction performance, combining human evaluation with automated ranking systems (Malgonde et al., 2020).

2.4.5 Combining Analog, Augmented, and Automated Governance Forms

Governance designers can blend control, coordination, incentives, and trust mechanisms from analog, augmented, and automated governance to create new governance configurations that can be gradually implemented. In many organizational settings, some governance mechanisms are usually analog, while others are augmented or automated. As an illustration, the Linux kernel development community utilizes a combination of analog and augmented governance. Control is augmented through write access granted solely to maintainers (authorized developers) who formally approve patches reviewed by the community. Coordination is facilitated through digital mailing lists. Incentives are augmented by a repository that stores version copies and developer names, allowing for credit attribution. Finally, trust is placed in "trusted lieutenants," who work closely with founder Linus Torvalds (Lee & Cole, 2003). Another example that leans more strongly toward automation are DAOs, where control is automated through voting rights and code-embedded rules; coordination is augmented with digital tools such as Discord; incentives are automatically distributed through consensus mechanisms and smart contracts; and trust is fully automated using blockchain technology (Hsieh & Vergne, 2023; Kaal, 2021). This combinatory power of digital governance enables designers to experiment with various configurations before making a commitment or opting for partial automation of governance.

Notably, governance choices are dynamic and adaptable. In fact, each of the four governance mechanisms may experience a dynamic development; a shift from analog to automated ways of governing exchanges, or vice versa. However, it is unlikely that automated forms of governance will emerge as the only dominant form. Rather, the dominant governance mode may gradually stabilize in augmented forms of governance, where analog and digital forms overlap and fill each other's voids. In the next section, we describe a heuristic for determining when analog, augmented, or automated forms of governance are best suited for exchange.

2.5 Making the Right Governance Choice

An important consideration when evaluating governance choices concerns the associated governance costs of designing, implementing, and adapting the necessary control, coordination, trust, and incentive mechanisms. Each of the three focal governance modes (analog, augmented, and automated) generates specific costs. From an efficiency perspective, the governance choice should provide the desired benefits at the lowest possible cost.

2.5.1 A Governance Choice Framework for the Digital Age

A classic argument of transaction cost economics is that transactional attributes, particularly the “bilateral dependency [that] builds up as asset specificity deepens” (Williamson, 1991: 282), determine governance choices. However, this argument requires serious reconsideration in the digital age, where exchanges often occur between *multiple* parties simultaneously, the primacy of assets gives way to *digital data*, and reliance on institutional enforcement is supplanted by *algorithmic* rules. Moreover, digital exchanges often occur outside the spectrum of markets and hierarchies, generating new forms of organizing as in blockchains, digital platforms, and online communities (Benkler, 2002; Puranam et al., 2014). We are interested in an extension of the classical governance choice model, taking into account augmented and automated forms of governance in addition to the analog form as well as a discriminant logic concerning when and why each form of governance is chosen.

To better explain digital governance choices, we introduce the notion of *transactivity*—a composite construct that encompasses the overall extent of contributors (i.e., participants), connections (i.e., relationships), and consistency (i.e., flows) in an exchange network. In network terminology, the first element concerns network size (i.e., number of nodes) and the second concerns network density (i.e., realized connections between nodes), two important network governance determinants (Provan & Kenis, 2008). The third element, consistency, indicates whether exchanges occur in a standardizable or homogeneous manner rather than a customized or idiosyncratic fashion. Notably, a linear increase in the number of contributors (i.e., network size) can induce exponential growth in the number of connections (i.e., network density), which puts particular strain on any analog governance design. In contrast, consistency acts as a critical boundary condition for the scalability of any automated governance solution; algorithmic solutions require predictability and reliability for seamless execution.

Since the three elements that constitute transactivity strongly interact with each other, very high transactivity values occur when all three elements take on high values. However, low transactivity values can occur if only one element has low values while the others have high values. This would apply to a large network (e.g., hundreds of members) with low connectivity (e.g., a density of ten percent) and high consistency (e.g., all exchanges are similar in nature). In this setting, most interactions occur on a bilateral basis with little external exchange interdependency, fostering a dispersed network structure that reduces the need for a unified and integrated governance solution. In formal terms, the multiplicative nature of the interrelationship between these three elements can be expressed as follows:

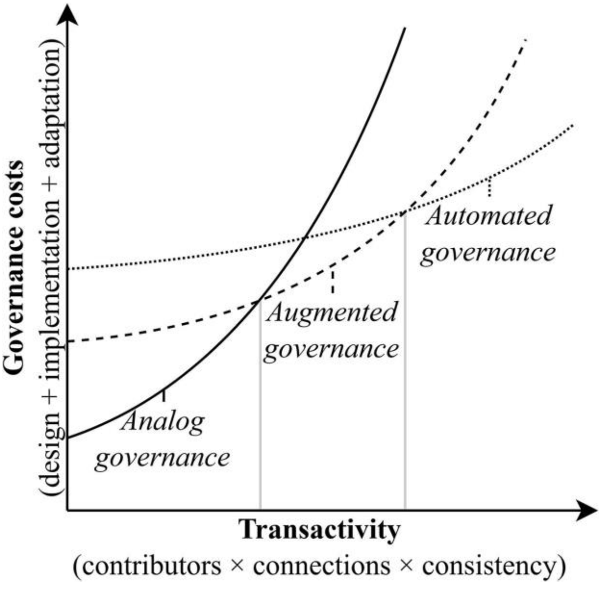
$$transactivity = \text{contributors} \times \text{connections} \times \text{consistency}.$$

We expect the costs of each governance alternative (analog, augmented, and automated) to increase exponentially as a function of transactivity but at different rates. Analog governance mechanisms are particularly cost-effective for low transactivity as the necessary arrangements can or must be negotiated bilaterally, taking into account specific transactional attributes. Here, the parties select a combination of transaction-specific relational and contractual agreements, e.g., in strategic alliance agreements or mergers and acquisitions. However, the costs of analog governance become particularly punitive as transactivity increases because the number of agreements to be negotiated increases at a strong exponential rate.

In contrast, for automated governance, the setup costs tend to be much higher than analog solutions because the required algorithms are expensive to design, implement, and adjust (Rimba et al., 2020; Zhu et al., 2006). However, they become comparatively low when they can be spread across a large number and volume of similar exchanges because digital solutions can be scaled at low marginal costs. Therefore, automated governance solutions have a relative cost advantage over analog governance options in settings with high transactivity, as is the case with many financial transactions, standardized service contracts, and small purchase agreements involving many parties.

Finally, the augmented governance solution falls between the two extremes; it incurs costs on both the analog and algorithmic sides. Augmented governance involves the combination of analog and augmented governance solutions. The associated costs tend to be comparatively low at medium levels of transactivity, which might be the case in small, high-density networks where some customization is required but many exchange attributes are standardized, e.g., a supply chain network where certain facets require specific relational and contractual governance (such as discussing product specifications and agreeing on relationship scope), but many aspects can be transferred to fully automated solutions (e.g., delivery, pricing, and orders). In Figure 2.4, we illustrate the general logic underlying the relationship between transactivity (horizontal axis) and governance costs (vertical axis) as well as the resultant governance choice.[2]

Figure 2.4: Governance Choice Framework



2.5.2 A Contingency Perspective on the Benefits and Costs of Digital Governance

Our analysis has focused primarily on governance costs, but in practice, it is important to weigh a complex set of costs and benefits for different stakeholders, particularly governance designers and exchange participants. For governance designers, the toolbox of automated governance

[2] Moreover, augmented governance often permits a transition from analog to automated governance and allows certain governance voids within each pure governance mode to be filled. For example, when programmatic errors or cyberattacks undermine algorithmic protocols, analog governance mechanisms can provide valuable contingency plans and help restore the system. Thus, regarding these potential cost inefficiencies entailed by a combination of governance modes, the benefits of redundancy and associated system stability may outweigh them.

offers many benefits, such as better insight into user behavior, improved unwanted action monitoring, and greater efficiency, especially in scaling operations (Benlian et al., 2022). Such benefits are offset by significant upfront costs when designing, implementing, and adapting automated governance solutions, which can hinder their deployment for small-scale transactions. Hence, organizational characteristics may play an important contingency role; smaller organizations may lack requisite funds for designing and implementing automated governance modes. Moreover, lawmakers worldwide are increasing pressure, demanding greater accountability for online activities (e.g., fake news and illegal activity) and putting bounds on the use of governing algorithms (e.g., the AI Act in the European Union).

While it is useful to consider the perspective of governance setters in analyses, notably, exchange participants' perceptions of the costs and benefits of digital governance may be different. For participants, automated governance offers many promises, such as increased predictability through technologies such as smart contracts, improved inclusivity due to the low barriers to participation in the digital economy, and a high level of reliability in conducting transactions based on transparent rules (Santana & Albareda, 2022). Nevertheless, automated governance solutions can also be abused, leading to a loss of autonomy through surveillance, a sense of voicelessness amid quasi-monopolistic digital incumbents, and dependencies on specific services with high switching costs (e.g., Möhlmannn, Alves de Lima Salge, & Marabelli, 2023). Another contingency for participants extends from network effects; they may be coerced into accepting certain governance modes due to peer pressure and the network effects that simultaneously increase switching costs and create a pull effect.

In Table 2.1, we provide an overview of some of the key benefits and limitations of digital governance from the perspectives of governance designers and exchange participants. We also elaborate on these issues below in our future research agenda.

Table 2.1: Benefits and Costs of Digital Governance for Orchestrators and Participants

***Whom* digital governance impacts**		***How* digital governance impacts**	
		Benefits	*Costs*
	Governance designers	✓ **Insight:** e.g., behavioral data analytics in real time, latent pattern analysis ✓ **Oversight:** e.g., automated fraud detection, transparent operational data ✓ **Efficiency:** e.g., low costs per transaction, easy scalability	× **Design:** e.g., programming efforts, testing algorithms × **Implementation:** e.g., infrastructure set-up, conversion of IT systems × **Adaptation:** e.g., bug corrections, feature updates
	Exchange participants	✓ **Predictability:** e.g., clarity of incentive mechanisms ✓ **Inclusivity:** e.g., opportunities for individuals to contribute economically ✓ **Reliability:** e.g., high standardization, clear if-then conditions	× **Policing:** e.g., loss of autonomy, surveillance of behavior × **Impotence:** e.g., lack of influence on governance decisions × **Dependence:** e.g., lock-in effects due to peer pressure and network effects

2.6 Developing a Research Agenda on Digital Governance

We propose a research agenda with two avenues through which scholars can deepen and broaden their understanding of digital governance. The first avenue adds to our focal discussion and highlights the governance challenges posed by digital technologies (governance *by* algorithms). The second avenue extends our discussion and addresses the accountability of digital governance (governance *of* algorithms). Table 2.2 and Table 2.3 provide a summary of these future research opportunities and key research questions.

2.6.1 Avenue 1: Governance by Algorithms

Our study underscores the nature of digital governance, a shift toward using digital technologies to provide automated mechanisms of control, coordination, incentives, and trust. Consistent with findings on other digital technology-driven phenomena such as digital transformation (Hanelt et al., 2020; Verhoef et al., 2021; Vial, 2019), important questions arise regarding the broader implications of such technological changes. While algorithms enable the control of numerous participants and foster perceived fairness and impartiality within organizations (Dolata, Feuerriegel, & Schwabe, 2022; Fu, Aseri, Singh, & Srinivasan, 2022), their use also promotes rigid standardization and the risk of losing sight of the social side of organizations, e.g., human cognition and emotion (e.g., Massey, 2002). Thus, insights into the cognitive, emotional, and organizational processes that accompany the introduction of digital governance are needed.

Cognition and emotions. The use of digital governance raises concerns about the role of “soft factors” such as emotions (e.g., enthusiasm or frustration) and perceptions (e.g., valuation or sensemaking), and whether people are comfortable being monitored, controlled, and potentially challenged by algorithms. Previous research highlights the impact of technology on customer emotions and discomfort, suggesting the importance of emotions in digital interactions (Holthöwer & van Doorn, 2023). The use of algorithms can also result in frustration when they challenge human intuition and compromise accountability in the workplace (Allen & Choudhury, 2022; Lebovitz, Lifshitz-Assaf, & Levina, 2022). These examples illustrate the need to consider the impact of digital governance on human emotions and perceptions to ensure its effective and responsible use.

Table 2.2: Future Research in Digital Governance: Governance by Algorithms

Governance by Algorithms	*Emotions and cognition*	• Does digital governance lead to a "switching off" mentality (similar to a loss of orientation due to using Google Maps), and if so, how can it be prevented? • When do digital governance mechanisms harm vigilance? • When and why does digital governance affect human emotions, either positively (e.g., empowerment, trust, and confidence) or negatively (e.g., fear, frustration, and helplessness)? • How can digital connections and identities strengthen or weaken relational ties between network participants?
	Standardization and biases	• How can organizations reap the benefits of digital governance (e.g., efficiency and standardization) while minimizing its costs (e.g., rigidity and technological dependencies)? • Are organizations losing their "human touch" as a result of increasing digital governance? • What are the limits of digital control and programmability of (inter)organizational processes? • How does digital control influence social and creative tasks in organizations, e.g., the formation of friendships and innovation activities?
	Contingency and boundary factors	• When is augmented and automated governance superior to analog governance and vice versa? • How can digital technologies enable forms of process controls that relieve the oversight role of managers? • What is the optimal balance between digital and analog governance? • When do the costs of digital governance outweigh its benefits, and when is "no governance" a better solution?

The role of fairness in determining people's compliance with algorithmic solutions highlights the importance of a sociotechnical perspective in evaluating the interplay between technology and society (Dolata et al., 2022; Lee, 2018). Research has shown that individuals engage in complex sensemaking processes to interpret algorithms and their perceived fairness, and optimize their behavior based on incentives set by the algorithms, leading to widespread behavioral adaptation (Bellesia et al., 2023; Cameron & Rahman, 2022; Möhlmannn et al., 2023). In light of the behavioral changes that may accompany the deployment of digital governance, it is crucial for further research to investigate the broader societal consequences of digital governance from both a research and a policy perspective.

Standardization and biases. While some arguments suggest that more technology and governance produce linear benefits, marginal returns could decrease over time due to increasing technological saturation (Karr-Wisniewski & Lu, 2010). Therefore, digital governance implementation evokes fundamental discussions in the management literature when increasing formalization is beneficial or harmful to organizations (Walsh & Dewar, 1987). Further research is needed to determine whether digital governance promotes increasing "hyperbureaucratic" organizations where every step is mapped digitally. Consequently, hyperbureaucracy may hinder creativity and innovation in such ventures, negatively impacting organizational performance (Adler & Borys, 1996; Pesch, Endres, & Bouncken, 2021). Furthermore, digital technologies can create barriers between an organization and its customers. For example, research on chatbots (which are based on algorithms and AI) as mediators in customer interactions shows that technology can effectively serve as a barrier, impacting customer satisfaction (Crolic, Thomaz, Hadi, & Stephen, 2022).

A particularly critical issue is built-in biases in the algorithms (Akter et al., 2022). Research has provided disturbing evidence of how machine learning algorithms, if not carefully trained, can reinforce and proliferate malicious gender and racial stereotypes (Hundt, Agnew, Zeng, Kacianka, & Gombolay, 2022). Future research should therefore deepen our knowledge of how organizations can use digital governance to counter biases and ensure safe and inclusive digital environments (see Bolukbasi, Chang, Zou, Saligrama, and Kalai (2016) for an example of a gender debiasing algorithm). This also applies to the risk of misinformation triggered by algorithmic systems: The OpenAI-developed chatbot, ChatGPT, was banned from Stack Overflow and faced restrictions on being listed as an author by academic publishers due to concerns about its potential for producing incorrect answers (Sample, 2023; Vincent, 2022).

Contingency and boundary factors. Finally, the contingency and boundary factors of digital governance require elaboration. This aspect concerns the normative question of whether companies should embrace the further digitization of their governance. For instance, Griesbach, Reich, Elliott-Negri, and Milkman (2019) uncover irritating forms of "algorithmic despotism" in food delivery platforms where algorithms essentially dictate coworkers' schedules and activities. Finally, the motivation for adopting digital governance is not only a firm-internal consideration but may also be influenced by interorganizational ties (e.g., supply chain interdependencies) and the institutional environment (Aguilera & Jackson, 2003; Oehmichen, Schrapp, & Wolff, 2017). Understanding organizational embeddedness, such as through regulations, cooperative, and competitive dynamics, can help explain variance in digital governance adoption. For instance, digital governance may be adopted due to mimetic pressures and because it has already been adopted by other firms (Mithas, Tafti, & Mitchell, 2013; Wang, 2010).

2.6.2 Avenue 2: Governance of Algorithms

In addition to recognizing the potential of automation, digital governance necessitates discussion of responsibility and accountability, affirming our second research avenue concerning the governance *of* algorithms (Haenlein, Huang, & Kaplan, 2022; Haenlein & Kaplan, 2021; Kaplan & Haenlein, 2020; Loebbecke & Picot, 2015; Martin, 2019). Insights into who designs algorithms and oversees the parameters of digital governance are important (see Chhillar and Aguilera (2022) for a review in the AI context). While this issue is important from a societal perspective, it also involves legal considerations as long as the algorithms are not considered legal entities that can be held accountable for their actions (Drummer & Neumann, 2020). Moreover, from a legal perspective, it is critical for policymakers to understand the implications of digital governance and its potentially detrimental effects on society. Finally, the shift toward algorithmic and internet-based technologies also has implications for cybersecurity and how organizations can protect themselves against cyberthreats.

Design and responsibility. The definition of responsibilities for the design and consequences of digital governance remains a largely unexplored area. The impact of ambiguous responsibilities is exemplified in the Bitcoin protocol, kickstarted by Satoshi Nakamoto, who remains anonymous and cannot be held accountable for the abundance of illegal activities that this cryptocurrency enables (Foley, Karlsen, & Putniņš, 2019). From a corporate point of view, the question arises whether digital governance should be viewed as a technical matter for IT departments or whether it requires the involvement of top management, such as the Chief Digital Officer (Firk, Hanelt, Oehmichen, & Wolff, 2021). In addition to new roles such as the CDO, specific expertise can play a role, such as how the digital expertise of managers and board members influences the development and use of algorithms (Fabian et al., 2022). The shift toward algorithmic modes of management also presents opportunities for exploring the cognitive capabilities of managers (Helfat & Peteraf, 2015) because using automated governance technologies requires a new set of skills to effectively utilize them. From an alliance perspective, further research is needed on how to govern collaboration with algorithm providers such as AI startups (Oehmichen, Schult, & Qi Dong, 2023) and AI-as-a-service providers (Zapadka, Hanelt, Firk, & Oehmichen, 2020).

Accountability and regulation. With the advent of digital governance, the question of control is critical for organizations (Kellogg, Valentine, & Christin, 2020). If algorithms lead to adverse consequences in established organizations (e.g., discrimination), who ultimately bears responsibility for them? If the shift toward decentralized and transparent blockchain-based systems continues, how can actors within such systems be held accountable, especially if online and legal entities remain separate (Sun Yin, Langenheldt, Harlev, Mukkamala, & Vatrapu, 2019)? These questions suggest that digital governance presents macrolevel challenges that are relevant for policy-makers (Nambisan, Wright, & Feldman, 2019). If governance is increasingly becoming more automated, what policies should be designed to protect network participants and how? How can algorithms be designed to comply with national and supranational regulations such as those enacted by the European Union? Interestingly, many large technology firms are calling for regulation at the national and supranational levels (Bajarin, 2020; Knight, 2019), raising the intriguing question of whether these digital incumbents are truly interested in ethical digital governance or whether they are primarily trying to devolve responsibility.

Table 2.3: Future Research in Digital Governance: Governance of Algorithms

Governance of Algorithms	*Design and responsibility*	• Where do organizations locate the responsibility for designing (e.g., setting the parameters) digital governance mechanisms (e.g., internal development vs. outsourcing)? What are the decision parameters? • Who takes responsibility and checks for biases and technical errors in technical governance solutions? • How can consensus mechanisms be designed to provide security and effective dispute resolution? • How do algorithms automate or complement digital governance design?
	Accountability and regulation	• Should policy-makers actively regulate digital governance? • Should digital board members and auditing firms (e.g., AI-based accounting controls and blockchain-based transparency mechanisms) be allowed, and if so, when? • With whom and under what circumstances should the algorithms and data underlying governance decisions be shared or even made public? • How can digital governance mechanisms contribute to or prevent antitrust problems? • In large digital networks where pseudonymity prevails, who is responsible for illegal activities, biased decision-making, and technical errors?
	Cybersecurity and risk	• How can companies increase their resilience against malicious attacks and hacking? • How can cybersecurity become a strategic issue? • How can companies maintain their strategic autonomy as digital technologies require ever more expertise, which often resides outside the organization? • How can companies secure their critical infrastructures amid increasing data integration and processes?

Cybersecurity and risk. As organizational processes and decision-making are increasingly reliant on algorithmic protocols, the supporting infrastructure has become an attractive target for malicious attacks that compromise the operations of an organization and sensitive data (Angst, Block, D'Arcy, & Kelley, 2017). For example, the cloud company Akamai reported the largest DDoS attack ever launched against a European customer—an aggressive attempt to cripple the operations of the business (Sparling & Gebhardt, 2022). Given such vulnerabilities, companies are called upon to develop appropriate security measures to protect their IT infrastructure from them, entailing critical tradeoffs between a higher level of automation, which enables greater efficiency, and vulnerability to cyberattacks, which can cause severe reputational damage (Triche & Walden, 2018). With the rise in digital governance and the growing importance of data, cybersecurity is becoming a strategic issue for organizations, requiring careful consideration not only to prevent malicious attacks, but also to avoid reputational damage.

2.7 Conclusions

In this paper, we provide a new perspective on governance in the digital age. As organizations are coalescing into ever-larger value networks, we argue that governance mechanisms for mitigating the tension between cooperation and competition between different exchange participants in digital environments are crucial. Our research emphasizes the critical importance of regulating control, coordination, incentives, and trust in ways that enable new forms of organizing, value creation, and value capture. Hence, we define digital governance as one of the long-term cornerstones of management in the digital age.

CHAPTER 3.
AGENCY IN THE ALGORITHMIC AGE: THE MECHANISMS AND STRUCTURES OF BLOCKCHAIN-BASED ORGANIZING

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3.1 Introduction

Blockchains are being increasingly recognized as a governance mechanism in various contexts, encompassing both permissioned and permissionless networks (Beck et al., 2018; Cennamo, Marchesi, & Meyer, 2020). On the one hand, permissionless blockchains, including decentralized autonomous organizations (DAOs) and cryptocurrencies, rely on radical decentralization to establish systems without (or very limited) hierarchical structures, providing anonymity and unrestricted access to all transactions (Goldberg & Schär, 2023; Zhao et al., 2022). On the other hand, permissioned blockchains, such as IBM Food Trust and PharmaLedger, have garnered significant attention due to their efficacy in regulating interorganizational relationships and optimizing supply chain management through partial automation while preserving a level of security requisite for safeguarding the confidential and proprietary data of participating entities (Hanisch, Goldsby, Fabian, & Oehmichen, 2023; Treiblmaier, 2018). As of late 2021, 81 of the 100 largest publicly traded companies have been using (mostly permissioned) blockchains (Blockdata, 2021). Both permissioned and permissionless blockchains have thus emerged as potential solutions to governance problems of accountability, transparency, and trust in different domains, offering the potential for novel forms of governance that can enhance existing structures or create entirely new systems of governance (Rossi, Mueller-Bloch, Thatcher, & Beck, 2019). As such, the study of blockchain technology from a governance perspective represents a burgeoning field of research, with implications for a broad array of fields and industries (Lumineau et al., 2021; Tan & Saraniemi, 2022).

One area of blockchain governance that has received surprisingly little attention is its use within single organizations. Indeed, most of the literature on blockchain governance has focused on permissionless networks (e.g., Hsieh & Vergne, 2023) or permissioned interorganizational networks (e.g., Shew, Snell, Nayga Jr, & Lacity, 2022), but few studies have examined how blockchains can be deployed within organizations (e.g., Murray et al., 2021; Sharif & Ghodoosi, 2022; Yermack, 2017). However, as mentioned by the founder of Advatech Pacific, Deepanshu Khandelwal, "before thinking of achieving interorganizational efficiencies using blockchain, companies should look at leveraging blockchain for intraorganizational efficiencies, which will be a tremendous use of this technology." Studying how blockchains integrate within hierarchical organizations is of considerable conceptual interest due to the clash between the decentralized nature of blockchains and the centralized structure of hierarchies. Additionally, hierarchical organizations scale vertically by adding more layers to the chain of command (Astley, 1985; March & Simon, 1958), while blockchains scale laterally by adding more blocks to a chain of data validated by network nodes, a fundamental difference in the scaling mechanisms of these two systems. In view of the technology's potential for intraorganizational governance and the inherent theoretical tension, there is a clear need for theoretical advancement that integrates blockchain into the debates on intraorganizational governance while studying the implications for organizational design.

Agency theory offers a suitable lens for examining blockchain technology in terms of intraorganizational governance by studying the potential conflicts and misalignments from information asymmetries between principals and agents. Through this theoretical lens, we provide a nuanced study of blockchain governance in intraorganizational settings, shedding light on its potential to reduce information asymmetries, complement and even substitute hierarchy-based process controls and fiat through its transparent and decentralized nature. We thus conceptualize blockchains as an algorithmic form of process control and argue that they can facilitate information distribution and sequencing, enabling organizational members to avoid information concentration while ensuring a continuous record of information. Additionally, we suggest that the blockchain consensus mechanism can alleviate the pressure on organizational supervisors to exercise hierarchical authority, that is, the formal authority that principals have over agents (Reitzig & Maciejovsky, 2015) to resolve conflicts via fiat, resulting in a potent form of internal digital governance (Hanisch et al., 2023). Our microlevel perspective of intraorganizational blockchain governance therefore suggests that blockchains can enable direct vertical information channels, flatten organizational hierarchy through *vertical disintermediation*, and create a process-oriented alignment based on a strict sequencing of agent tasks that can cause inefficient *lateral reintermediation*. Thus, blockchain technology can address crucial governance issues within organizations and facilitate new organizational structures, which come with potential downsides.

Our paper makes three main contributions to the field of blockchain research in business and management (e.g., Hsieh & Vergne, 2023; Lumineau et al., 2021; Zhao et al., 2022). First, we provide a microlevel theory of how intraorganizational blockchains impact the principal-agent relationship, focusing on the unique governance mechanisms within organizations. We explore the implications of introducing a peer-to-peer system in hierarchical settings, examining the role redefinition of intermediaries such as middle managers in a digital governance context. Second, we advance discussions of blockchain governance by investigating how blockchains facilitate information channeling and rechanneling within organizations (Murray et al., 2021; Sharif & Ghodoosi, 2022; Yermack, 2017). Specifically, we address information distribution in hierarchical settings and highlight the benefits of reducing reliance on information aggregators through direct chains between principals and agents. Third, we contribute to the literature on organizational design (e.g., Huber, 1990; Puranam et al., 2014; Zammuto, Griffith, Majchrzak, Dougherty, & Faraj, 2007) by demonstrating how blockchains reshape organizational structures, connecting actors in direct ways that align with organizational processes and transcend traditional hierarchies. Overall, our paper deepens the understanding of how firms can leverage decentralized technologies such as blockchains to enhance accountability, transparency, and trust while retaining the benefits of hierarchical organizing.

3.2 Blockchains and Information Asymmetry in Organizations

Governance in organizations refer to the rules, procedures, and processes that are used to control and coordinate the actions of its members—namely, principals and agents—to achieve their goals and objectives amid asymmetric information (Aguilera, Desender, Bednar, & Lee, 2015; Jensen & Meckling, 1976). Thus, the need for governance aimed at effective control and coordination stems from the prevalence of information asymmetries and agent opportunism present in organizations (Gittell, 2000; Moon et al., 2004; Sharma, 1997; Sundaramurthy & Lewis, 2003). In organizational settings, information asymmetries result from the division of labor between task-giver (principal) and task-performer (agent), creating monitoring difficulties and potential incentive misalignments (Eisenhardt, 1989a; Thiel, Bonner, Bush, Welsh, & Garud, 2021). Information asymmetries can significantly harm organizations. For instance, *information concentration*, which can occur when "those who have valuable information are incentivized to invest in safeguards" to advance their self-interests (Bergh, Ketchen, Orlandi, Heugens, & Boyd, 2019: p. 134), may lead to biased decision-making or suboptimal strategic decisions (Beck & Plowman, 2009). Similarly, the absence of *information continuity* across organizational silos and functions may result in organizational inefficiencies (Lessard & Zaheer, 1996), such as duplicate work and misunderstandings. *Information conflict*, whereby actors face contradicting information and disagreements on how to interpret it (Cronin & Weingart, 2007), can lead to erroneous communication or biases that influence the effectiveness of strategic decision-making (Nguyen, 2007; Papadakis, Lioukas, & Chambers, 1998).[3] Amidst these information

[3] These terms related to information asymmetry are similarly used in the extant agency theory literature. For example, "information concentration" has been studied in the agency context using the concept of "information diffusion" (Altay & Pal, 2014) and "information distribution" (Parks & Conlon, 1995) as the opposite effect to concentration. Moreover, "information continuity" has been commonly referred to as "information flow," which can describe *hierarchical* information flow (Sundaramurthy & Lewis, 2003), or *horizontal* information flow (Jacobides & Croson, 2001), the latter of which refers to our choice of term. Finally, "information conflict" is often synonymously referred to as "objective conflicts" that stem from highly subjective information (Cuevas-Rodríguez, Gomez-Mejia,

asymmetries within hierarchies, governance is a countervailing force that aligns interests, fosters cooperation, and enables coordination among organizational actors.

3.3 Blockchains as Algorithmic Process Controls

In light of the governance challenges in organizations, blockchains offer an enticing opportunity to partially or fully automate governance and address the critical problems of information concentration, continuity, and conflict via algorithmic process controls (Hanisch et al., 2023). Blockchains are characterized by peer-to-peer validation and the immutable storage of transactions in a shared, distributed ledger (Schmeiss et al., 2019; Yuan & Wang, 2016). The *distributed* nature of blockchains reduces the likelihood of information concentration and tampering by storing information in a network-managed database accessible on every node in an organization's network (Chod et al., 2020; Vergne, 2020). Additionally, blockchains *sequence* information and thus track missing data, ensuring an immutable and append-only database that facilitates sequenced workflows (Clohessy, Treiblmaier, Acton, & Rogers, 2020). Finally, the *consensus-based* approach of blockchains enhances process monitoring via agreement across the nodes in a system, verifying information and executing smart contracts programmatically (Murray et al., 2021). Notably, to achieve such automated governance, blockchains require explicit information, such as financial data, contracts, and formal workflows, but have lesser utility for tacit information that involves context-specific knowledge or interpretation (Lumineau et al., 2021).

BMW's collaboration with DHL on an internal blockchain project provides a practical example of how blockchains can automate internal governance through process controls (BMW, 2020). Specifically, BMW sought to address the concentration of information on parts supply in certain departments and the lack of communication regarding supply disruptions across all its production units. By using blockchain technology to track such internal processes, BMW enhanced the visibility of its Asia Pacific supply

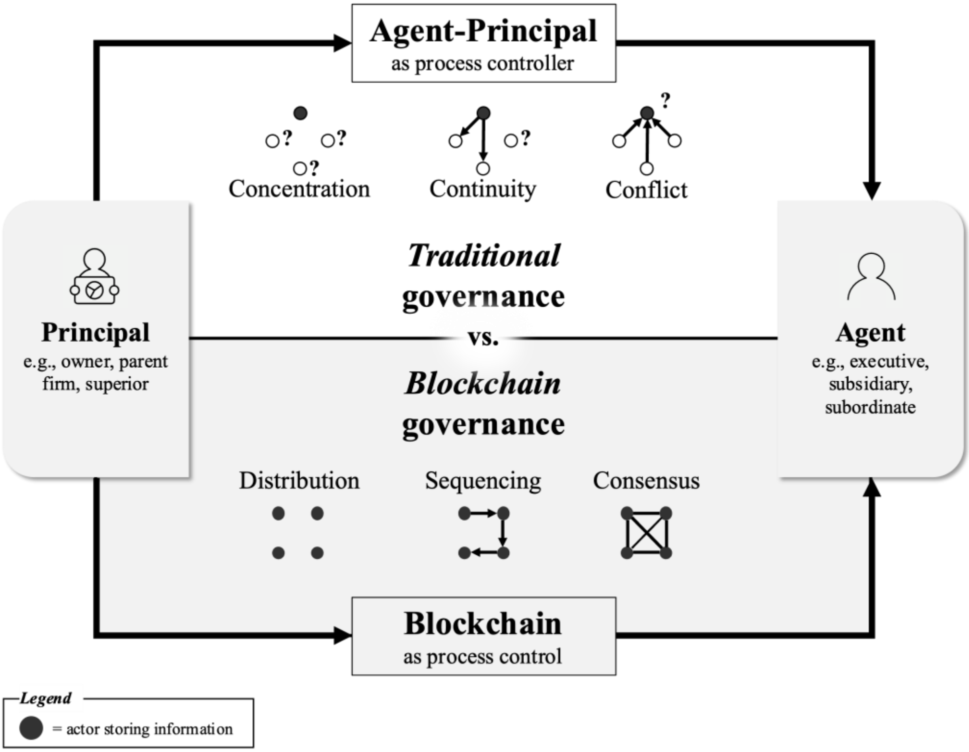
& Wiseman, 2012), "inaccurate" and "malevolent" information (Altay & Pal, 2014), and "information congruence" as the opposite effect of information conflict (Jacobides & Croson, 2001). As these papers related to agency theory have not used these terms consistently, we introduce a simplified convention.

chain operations, reducing the need for manual reporting, especially concerning delayed part shipments. This meant that stakeholders could access the data they needed, resulting in improved process transparency and faster problem resolution. This successful implementation highlights the potential of blockchains to improve information sharing and organizational efficiency (Ledger Insights, 2019c).

Figure 3.1 illustrates the contrast between traditional governance at the top and blockchain governance at the bottom conceptually. Specifically, it presents the theoretical logic of how blockchains can help address the information challenges encountered by organizations, such as concentration, continuity, and conflict, stemming from their distinctive characteristics of distribution, sequencing, and consensus. The shift toward blockchain governance chiefly affects those who act as "agent-principals" (e.g., middle managers) who report up and delegate work down the hierarchy (Dutton & Ashford, 1993; Van Doorn, Georgakakis, Oehmichen, & Reimer, 2022). These roles serve as human process controls that aggregate, filter, and transmit information between the principal and the agent; all of these functions are increasingly transferred to blockchain technology. Although blockchains can enhance accountability and transparency within organizations, it cannot alter the intrinsic motivations of principals and agents, such as self-interest and opportunism. Nonetheless, it can introduce an algorithmic process control that reduces the wiggle room for action on tangential motives. By offering an immutable record of transactions and interactions, blockchains can expose and thereby prevent fraudulent or unethical conduct.

As a result, agents may be encouraged to share even more information to demonstrate compliance and diligence in their duties. Furthermore, the blockchain's smart contract capabilities can provide a level of automation and transparency that can reduce the potential for errors or intentional misrepresentations. Thus, while blockchain technology cannot alter individual motives, it provides a digital governance layer that can help curb the consequences of self-interested and opportunistic behavior.

Figure 3.1: Blockchain vs. Traditional Governance



The case of Ericsson—a communications company based in Stockholm—is especially apt to explain how blockchains can be used to solve efficiency issues internally (Day, 2023). Ericsson deployed an internal blockchain to facilitate the invoice process across the company's units. Specifically, the company encountered inconsistencies in the flow of purchase orders against the flow of invoices, which had been cumbersome given the many legal entities under the same corporate umbrella: "Basically, there are two flows of information that at the end have to reconcile somehow," in the words of the head of blockchain at Ericsson, Giovanni Franzese. An internal blockchain allowed various entities within Ericsson to increase trust among each other and improve the traceability and visibility of the inter-company invoice process. "For the first application we developed, it was 95% of savings by lead time," explained Giovanni Franzese. What stands out in the Ericsson case is their decision to use blockchain internally: "There is a level of centralization. But this is perfectly right because otherwise you could not prevent a loss of control if you had full decentralization within companies where you're using a blockchain solution." Similar to the Advatech Pacific case above, Ericsson is currently leveraging blockchain governance internally with plans to expand the technology to an interorganizational network in the future: "You need to start humble; you need to start with some control and then as long as you take heart, then you release control in a more decentralized way."

3.4 How Blockchains Rechannel Information

The blockchain's unique characteristics offer new ways of addressing the information challenges that arise between principals and agents that are not possible when employing traditional approaches to governance based on relational mechanisms, contracts, or enterprise resource planning (ERP) systems. In this section, we emphasize the ways in which the distributed, sequenced, and consensus-based nature of blockchains differs substantially from the diffused, disconnected, and fiat-based mechanisms of relational and contractual governance in the context of principal-agent exchanges. Similarly, we contrast the features of blockchains to those of ERP systems and demonstrate how the former's consolidated, interfaced, and synchronization-based nature nonetheless allows for information asymmetries in organizations. For instance, our discussions with managers indicated that blockchains can "make the exchange of information between participants more efficient," (manager of a blockchain in an electrical company), which sparked our interest in how blockchains differ from other forms of governance. In the following section, we therefore incorporate relevant quotations from our interviews with managers of internal enterprise blockchain networks to illustrate the mechanisms underlying the use of blockchains in organizations and support our theorizing, highlighting the key differences between blockchains and traditional governance approaches.[4]

[4] From July 2019 to March 2023, we conducted managerial interviews regarding 18 projects on internal enterprise blockchain solutions to identify the specific governance mechanisms that are relevant in our theoretical context. Moreover, we have conducted an extensive search of leading blockchain outlets (e.g., Ledger Insights, CoinDesk) and scanned press releases of Global 500 companies (e.g., Allianz, Coca-Cola, Ericsson, IBM) to include cases of internal blockchain governance that are valuable for our theoretical context. Although our paper is primarily conceptual in nature, we found it useful to include the voices of practitioners to establish common ground and showcase the growing cross-industry interest in this novel topic.

3.4.1 Information Concentration: Distributed Information Dispersed Across Nodes

In practice, managers often struggle with the problem that information is scattered throughout the organization and is thus difficult to access reliably; it is also challenging to determine whether the stored information is accurate and up to date. This problem can be solved through the blockchain's distribution of information (Akoramurthy & Kumar, 2020). For example, one manager of a blockchain in the oil and gas industry mentioned how "the idea was a reduction in the existing processes and hydrocarbon reconciliation time and then, more importantly, to secure an immutable ledger of all quantities that are recorded in the distributed ledger." Another manager of a blockchain for military purposes explained how "[the blockchain] was tracking aircraft parts across internal organizations and systems as they moved throughout their lifecycle to provide a single source of truth regarding the status and life span of an aircraft part at any given time to relevant parties and to secure the audit trail for an aircraft part."

From a conceptual perspective, when organizations rely primarily on relational (e.g., Claggett & Karahanna, 2018; Fahn & Zanarone, 2021) and contractual governance mechanisms (e.g., Jensen & Meckling, 1976; Magelssen, Rich, & Mayer, 2022), information is *diffused* in the form of organizational routines and experiences and stored in procedural memory (Cohen & Bacdayan, 1994; Howard-Grenville, 2005; Omidvar, Safavi, & Glaser, 2022), which can be supplemented by *consolidated* and centralized records in ERP systems that store, integrate, and control certain kinds of information (Berente, Lyytinen, Yoo, & King, 2016; Morton & Hu, 2008). A negative consequence of these two mechanisms is that information can be transmitted inaccurately (e.g., parties can have their own interpretation of information), or it can be manipulated in centralized systems by authorized actors (e.g., data can be overwritten). In contrast, blockchains offer a solution to concerns regarding such information concentration because the information is *distributed* across multiple nodes in the system, thus eliminating the need to rely on widely diffused and inaccurate experiences or information contained in centralized systems that are prone to tampering.

Such a blockchain has been deployed by Coca-Cola, which depends on the reliable exchange of information among bottling companies to fulfill orders (Business Insider, 2021). Together with the technology provider SAP, Coca-Cola has created a platform that enables the sharing of stock supply, order information, and delivery times in a transparent and immutable manner. By testing this platform with Coke One North America (CONA), Coca-Cola aimed to reduce its reconciliation times from an average of 50 days to less than a week (Bitvalex, 2019). The success of this implementation has led CONA to extend its use of blockchain technology to a larger audience. The company now utilizes the Baseline Protocol to establish a frictionless network joining process among Coca-Cola Bottling's suppliers, providing benefits not only to internal bottlers-suppliers but also to external suppliers of raw material. The Baseline Protocol heavily relies on Zero-Knowledge Proofs (ZKP), a type of encryption that verifies information without exposing it, ensuring that competitors cannot access smart contract contents or volume discount details (Cacioli, 2020). Hence, by using blockchain technology, Coca-Cola has created tamper-evident records of all transactions, providing efficient and cost-effective algorithmic process controls.

3.4.2 Information Continuity: Sequenced State-Based Information Across Units

In addition to addressing the challenge of information concentration, blockchain technology can facilitate coordination within organizations that have internal boundaries separating different departments and functions (Wang, Lumineau, & Schilke, 2022). By using blockchain technology, organizations can create a shared, tamper-proof ledger that all parties can trust and use to track their interactions. This can help to break down organizational silos and promote transparency, accountability, and collaboration across different units. With the use of blockchain technology, managers can ensure that information flows accurately from one unit to another and leaves a comprehensive audit trail that is accessible by all parties involved. Accordingly, this can help prevent information leakage or quality deficiency and provide a secure channel for organizations to collaborate and improve their processes.

From a theoretical perspective, information continuity in analog organizations is complicated by the facts that information is often *fragmented* across compartmentalized organizational units and that such organizations require dedicated *interfaces* in the case of ERP-based information sharing (Barki & Pinsonneault, 2005; Garvin, 1998; Morton & Hu, 2008). Blockchains solve the problem of information gaps because different pieces of information build sequentially on top of each other (i.e., the input order is controlled). Thus, the order, adherence, and interdependence of processes can more easily be controlled. For example, Chem-Corp (a pseudonym), a medium-sized chemical company in the northern Netherlands, implemented a blockchain solution to organize its internal processes based on the internal blockchain technology developed by NorthChain (2021).[5] Part of this solution involved modeling Chem-Corp's internal processes through a flowchart and using a proprietary blockchain code compiler to translate this process diagram automatically into blockchain code. An immediate consequence of using a blockchain and the strict control, transparency, and immutability that this approach facilitates was the realization that production frequently deviated from the laboratory's chemical formulations, resulting in more than ten percent of production going to waste. With the introduction of the immutable logs recorded by the blockchain, these issues were quickly detected and traced to their origin, and production waste was reduced to zero after production fully adhered to the laboratory's prescriptions.

3.4.3 Information Conflict: Automatically Enforced Consensus-Based Resolutions

Third, managers tend to face conflicts when multiple records of information exist and they are unsure which information to believe in. Blockchains can create machine-based consensus (Lumineau et al., 2021), which helps resolve conflicts and misalignments. In one interview, it became apparent that NorthChain had improved the way one of its construction clients addresses information conflicts. Previously, the client had relied on inefficient weekly management meetings to review project status, during which "the CEO would ask middle managers questions like 'are there any problems?', and these middle managers would go to their project managers and ask [the same question]." This led to delayed, conflicting, and vague information sharing regarding all the client's projects. Instead, the construction client "wanted to have real-time information on the status of

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[5] In the following, we continue to intersperse quotations and anecdotal evidence drawn from NorthChain, a pioneer in the design and implementation of internal blockchains, to make our ideas more tangible and to shed light on a relatively recent phenomenon. These quotations serve as examples and illustrations rather than a case study, as we wish to emphasize the conceptual rather than the empirical contributions of our study. The interviews were conducted in person over three rounds to gather comprehensive information. To ensure accuracy, the interviews were recorded, transcribed verbatim, and reviewed by our interviewees to verify the quotes.

each project at all times, and [it] wanted to prevent issues exceeding time and budget," according to Herman Balsters from NorthChain. Thus, by using blockchain-based smart contracts that automatically execute payment transfers once specific milestones in the construction process are reached, the construction firm could rely less on conflicting information from middle managers and, rather, ensure that payments were made directly, promptly, and accurately, reducing the risk of payment dispute and promoting timely project completion.

In conceptual terms, information conflicts in the organizational hierarchy are resolved through *fiat* (Williamson, 1991), such that the principal enforces the information record based on authority or via centralized ERP systems that *synchronize* information, which can reveal conflicts but nevertheless require decisions concerning how to resolve those conflicts. Blockchains resolve information conflicts such as double-spending problems (e.g., a budget is inadvertently expended twice by different individuals) because each transaction on the blockchain is validated by a peer-to-peer network that by design prevents a transaction from being executed twice. This blockchain-native feature is already being used in many interorganizational contexts. For example, the blockchain-based solution for automotive supply parts, Vinturas, solves the problem of information conflicts between automotive suppliers and original equipment manufacturers (OEMs) by producing an immutable log of parts logistics, which is updated in real-time and communicated between logistic service providers and OEMs (Vels, 2021). The fact that all information is recorded in the Vinturas blockchain improves the reliability of the data as well as the transparency of the business process for all involved parties.

In Table 3.1, we offer a comprehensive overview of this situation, illustrating the fundamental differences of blockchains from relational, contractual, and ERP-based governance mechanisms.

Table 3.1: How Blockchains Address Three Central Information Challenges

Information challenges		Relational / Contractual	Traditional ERP*	Blockchain
	(1) Concentration	**Diffused** *information stored in memory and documents*	**Consolidated** *information stored in central system*	**Distributed** *information dispersed across nodes*
	(2) Continuity	**Disconnected** *information dispersed across units*	**Interfaced** *information shared through dedicated interfaces*	**Sequenced** *state-based information across units*
	(3) Conflict	**Fiat-based** *resolution enforced via principal*	**Synchronization-based** *reconciliation via system*	**Consensus-based** *resolutions enforced automatically*

* Enterprise Resource Planning

As an additional, practical example, HerenBouw, an Amsterdam-based building company, has leveraged blockchain-based project management to improve its building development efficiency in commercial real estate (Blockchain Magazine, 2022; Tapscott & Vargas, 2019). Particularly, blockchain was used in a large harbor development project to register transactions and ensure accuracy and auditability. One of the challenges in the sector is the management of large teams of contractors and subcontractors, building codes, safety regulations, and standards. To address this, HerenBouw used a blockchain to track subcontractors and their tasks through a “reputation ledger,” which served as a benchmark for the recruitment process. Moreover, a lifecycle ledger was used to store warranties and certifications, protect the construction process from tampering and fraud, and maintain a record of events in the lifecycle of the building. As Bassem Hamdy, CEO of Brickschain Construction Blockchain Inc., noted, “the power of [the] blockchain is that it creates very powerful standards, in a simple-to-adopt way that doesn’t interfere with current processes” (Lopes, 2019).

3.5 Blockchain-induced Mechanisms of Disintermediation and Reintermediation

We continue our theorizing by examining the ways in which the implementation of intraorganizational blockchains affects the information channels between principal and agents and, consequently, the organizational configuration in which these actors operate. Specifically, internal blockchains introduce vertical information channels that link principals and agents directly, as well as sequenced horizontal information channels that arrange agent tasks in a chained lateral process. These omnidirectional information channels (Romme, 1999, 2004) are expected to reconfigure the focal organization in terms of *vertical disintermediation* and *lateral reintermediation*, respectively. We demonstrate how, taken together, these two reconfigurations create a structure that facilitates *organization-wide consensus*. By connecting the organizational information channels enabled by blockchains with organizational structure, we lay the foundation for a more profound understanding of the implications of blockchains for organizations. In the following, we describe the reasoning underlying our claims and display the identified mechanisms visually in Figure 3.2.

3.5.1 Direct Information Channels and Vertical Disintermediation

To study the implications of blockchains for organizations, we must first understand the prevalent information channels in archetypical hierarchical organizations. Conventionally speaking, a hierarchy is constructed in a way that enables “top down” information channeling across multiple actors. Information channeling refers to the active, bidirectional provision of information and its subsequent receipt, processing, and storing in the relationship between principal and agent. For instance, a typical hierarchy includes a principal, such as a superior, who transmits information (e.g., work, tasks, states) to an agent. As the amount and scope of such information grows, a typical organizational response is to institute additional levels of the hierarchy, thereby simultaneously introducing more intermediary principals and agents to manage the newly emerging complexity (Astley, 1985; Lawrence & Poliquin, 2023). As a result, hierarchical growth inevitably leads to an “agent-principal duality” among some roles, e.g., for middle managers (Dutton & Ashford, 1993; Van Doorn et al., 2022), who report to *their* superior (the principal) and simultaneously delegate work to subordinate agents, e.g., regional sales managers or plant managers. The hierarchical organization embeds such dual roles as critical nodes to process information provided by principals and to translate it into coordinated work for agents as well as to communicate aggregate status and process information from the agent back to the principal to facilitate further review and decision-making (Rouleau, 2005). Hence, hierarchies tend to create top-down information channels flowing from principals who assign the task to agent-principals who assume responsibility for bidirectional information processing and then to the agents who ultimately carry out the work.

Blockchain enables principals and agents to exchange information directly, reducing the need for human-mediated information processing and providing the capacity to eliminate information asymmetries. Typically, "agent–principal" roles are responsible for information processing as well as gathering and interpreting agent information, in addition to translating principal information into manageable tasks for agents to accomplish. These roles thus become increasingly obsolete when the blockchain stores all relevant information in a tamper-evident, distributed ledger, which entails that principals can retrieve status-related information and validate it directly in the blockchain (e.g., quality gate approvals, legal signatures), while the agents input information directly to the blockchain as their work progresses. In doing so, the blockchain guarantees that information is channeled directly between principals and agents, even in large organizations (Tourish, 2005; Tourish & Robson, 2006). The use of an internal blockchain without intermediaries grants the principal access to an unbiased and undistorted view of the organization's state, facilitating processes or the reconstruction of events during crises (e.g., product recalls, customer complaints). One partner at NorthChain, Herman Balsters, expressed this situation as follows:

> *"In a certain way, the blockchain is the middle manager. Because the blockchain is consistently controlling and steering what happened and will happen. […] Middle managers tasked with coordination and control responsibilities for these types of activities and processes can be replaced to a certain extent."*

Blockchains therefore enable improved vertical information channels, which in turn leads to a reconfiguration process of vertical disintermediation (Chircu & Kauffman, 1999; Clohessy et al., 2020). Two areas of such disintermediation can be expected. First, blockchains render dual agent-principal roles, such as middle managers as information processors, obsolete, leading to the downsizing of organizational hierarchy (Balogun & Johnson, 2004; Kohli & Liang, 2021). Second, by translating all information for storage into blockchain records, organizations can identify and address structural gaps that produce redundancies, leading to the elimination of inefficient or useless roles or groups of roles (Pinsonneault & Kraemer, 1997). This transparency achieved through direct information channels allows organizations to uncover redundant roles and departments, such as those that exist solely for the purpose of auditing the practices of other departments. As Stefan de Ruiter, partner at NorthChain, explained, these direct, peer-to-peer connections among agents could eliminate certain business functions:

> [Using the blockchain], it is easier for higher managers (e.g., the CEO or line managers) to get their KPIs and other management information directly. It is easier for them to acquire that information. And, depending on the firm's needs and wants, it is no longer required for subordinates to report to managers, as managers automatically have access to this information. […] We did see the elimination of almost an entire department.

However, while blockchain-induced vertical disintermediation provides transparency and efficiency benefits, its append-only and immutable nature may cause information overload, leading to decision paralysis and negatively affecting decision-making processes (Junge, Luger, & Mammen, 2023; Reutskaja, Iyengar, Fasolo, & Misuraca, 2020). That is, as Simon (1971: pp. 40-41) famously indicated, "what information consumes is […] the attention of its recipients." By eliminating the role of information processors, who filter and transmit relevant information (Beck & Plowman, 2009; Guth & Macmillan, 1986; Schilt, 1987), a blockchain thus transmits all information in an unfiltered fashion. According to NorthChain, this impairment can only be resolved at the application level: "managers only see the actual workflow being done; not the technical details of the underlying blockchain implementation." Failure to address this issue could obstruct decision-making by increasing the difficulty for managers to acquire and process the most relevant information, which could impact strategic, private, or political decision-making (Aldrich & Herker, 1977; Stevenson & Gilly, 1991). Additionally, the lack of middle management for information filtering and transmission may impede agent execution at the operational levels of the focal organization because agents often rely on intermediary roles for clear and prioritized instruction to achieve strategic goals (Shi, Markoczy, & Dess, 2009). Finally, downsizing the organization can result in less "issue selling" from middle management toward top management (Dutton & Ashford, 1993: 407), which, in a blockchain scenario, rests solely on agents or principals that might lack the time, resources, knowledge, skill, or motivation to drive strategic initiatives themselves. Ultimately, while blockchain-induced vertical disintermediation holds promise for a flatter and more efficient organizational structure, it may come at the cost of increased cognitive load for organizational actors due to its higher information volume.

3.5.2 Sequenced Information and Lateral Reintermediation

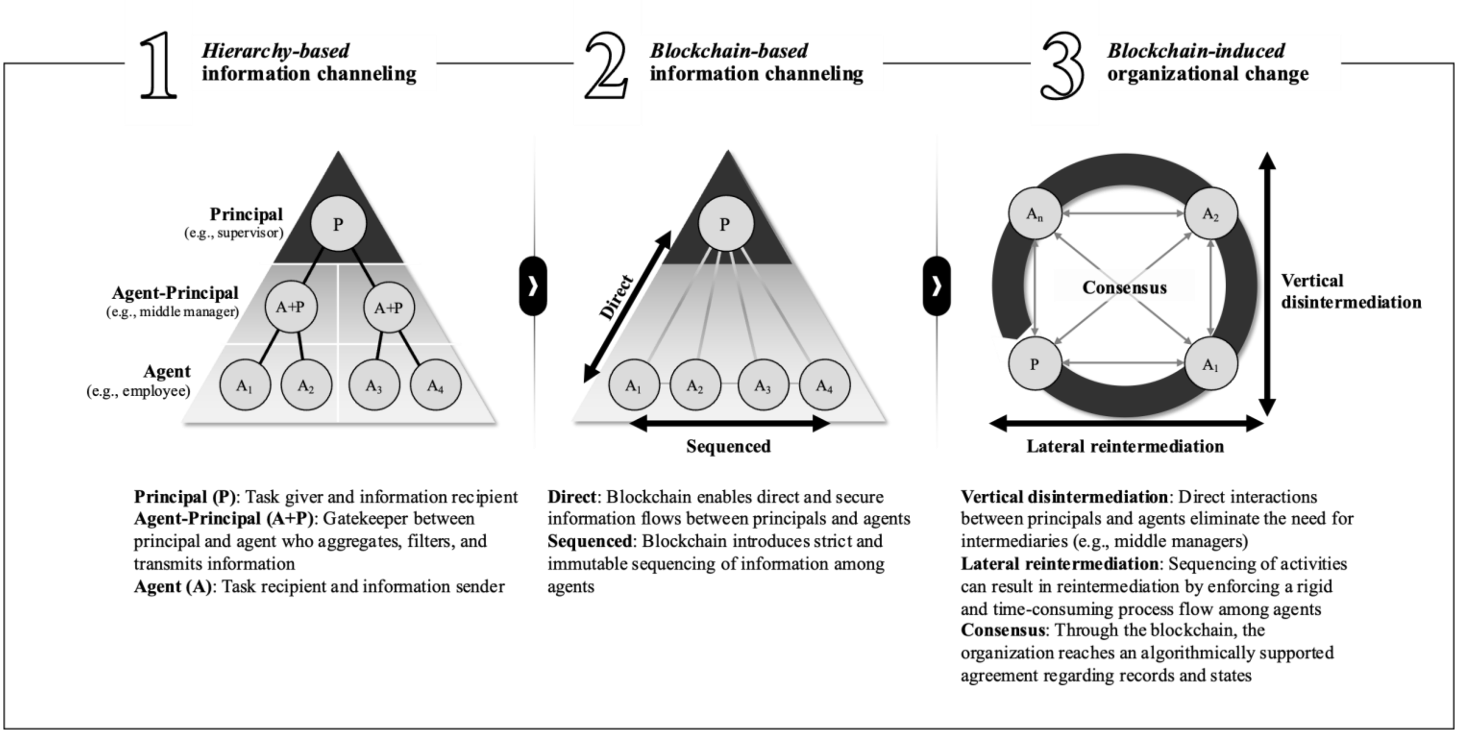
The top-down, vertical information channeling that occurs in the hierarchy discussed previously demonstrates a second important characteristic of hierarchies, namely, the fact that the hierarchy is structured in a way that constrains *horizontal* information channeling (Knight, 1976; Lu & Wedig, 2013). Because the hierarchy relies on information channels between principals and agents and because agent information needs to be reported back to principals, the archetypical hierarchy does not facilitate or reward sideways information channeling among agents. This lack of communication can result in missed opportunities for synergistic agent-to-agent exchange, which could improve the overall process. Even though the principal may assume that they know all the information that is required to make the best decision for both agents, the principal cannot know what is not shared or what is withheld by noncollaborating agents or what those agents may have gained by working with each other. Since they tend to facilitate top-down and bottom-up information channels, hierarchies tend to understimulate the diversified information sharing among agents that is necessary for cross-functional alignment (Aalbers, Dolfsma, & Leenders, 2016).

A blockchain has the potential to connect agents directly via a peer-to-peer network, which can promote horizontal information channeling across functional silos (Akoramurthy & Kumar, 2020). Specifically, blockchains connect each actor involved in a given process using *permissions*, which are programmatic ways of assigning roles, responsibilities, procedures, and objectives to physical human agents via the blockchain. In our interviews with NorthChain, such permissions in the internal blockchain context were viewed as "a certain authorization to perform some step in the process." By connecting agents directly and enabling the required level of agent authority, the blockchain improves the channeling of horizontal information, as agents are not disconnected via the mediation of a principal but are rather tied together systemically for equivalent or related business processes. Herman Balsters further explained that "the process model will be the organizational blueprint of how you are going to work […]. So, the process model is going to be all-important if you are going to do this horizontal integration." This horizontal agent tie in the context of common business processes is particularly valuable when the agents could benefit from project-specific but relevant knowledge (Hansen, 2002), when agents are associated with competing units (Tsai, 2002), to reduce the distortions in communication between various units (Albaum, 1964), or simply when increased information diversity is a relevant aim (Aalbers et al., 2016). A blockchain can even automate step-by-step progression from agent to agent, e.g., when a task is verified as complete and not missing additional input, which renders agent communication near-autonomous (e.g., via smart contracts that are automatically executed given predefined conditions). Thereby, the blockchain improves agent information channeling and interdependence in a horizontal fashion and reduces the need to assign this capability of facilitating information flows among agents to a middleman.

Paradoxically, while vertical disintermediation results from direct information channels, a blockchain can introduce a novel form of *lateral reintermediation* among agents who are separated by mediating agents in the context of a formalized workflow. Lateral reintermediation occurs when agents in the blockchain are obligated to collaborate due to the rigid programming of the blockchain, even if the agents in question are organizationally separated by their inclusion in different segments of the hierarchical strata (Dahlander & O'Mahony, 2011; Galbraith, 1994; Hinds & Kiesler, 1995). This situation occurs because a blockchain operates in sequential phases, such that each task performed and recorded by one agent is reviewed and continued by other agents. Herman Balsters from NorthChain explained this rigidity as follows: "everybody involved agrees on how the process is to be executed […] and no deviation from the agreed upon process is possible." In some instances, such horizontal ties may facilitate peer-to-peer interactions that would not have occurred naturally, which may prove to be useful. For example, if agents work in different geographical locations and if the output of one production plant serves as input for another, a blockchain could provide a reliable line of rich information exchange among agents, whereby prior to the implementation of the blockchain, direct interactions would have been rare. Although a blockchain can be used to transmit richer information from agent to agent, which offers clear benefits, an inflexible development process may emerge, such that it is difficult for agents to skip steps in the process and thereby bypass predesignated agents (Downs, 1967; MacCormack, Verganti, & Iansiti, 2001). In neglecting these often invisible and informal "behind the scenes" processes, blockchains fail to account for informal organizational structures (Soda & Zaheer, 2012). Consequently, blockchain-induced lateral reintermediation can ultimately prolong organizational processes and increase inefficiencies.

While lateral reintermediation has certain downsides in terms of the rigidity and strict lateral channeling of information, the blockchain that enables it provides new ways of monitoring and enables novel incentives for information sharing among agents. On the one hand, blockchain-induced lateral reintermediation facilitates a form of "agent-to-agent" monitoring (Homburg, Vomberg, & Muehlhaeuser, 2020; Varian, 1990) that shifts monitoring activities away from principals and toward agents who have a clear stake in the information chain. This can lead to an increase in agent accountability and reduce monitoring costs for principals. On the other hand, blockchain technology allows for clear identification of which agent contributed what information, promoting transparency, reducing subjective performance measures on which agent incentives are based (e.g., Baker, Gibbons, & Murphy, 1994), and reducing wiggle room for free riding (e.g., Jones, 1984). For example, the use of smart contracts in a blockchain can incentivize agents to share information by automatically rewarding them for their contributions to the collective effort (i.e., "who did what and at which time," in the words of Herman Balsters). Hence, by facilitating diversified information sharing among agents, the lateral reintermediation of blockchains can help achieve cross-functional alignment, which is essential for the efficient and effective functioning of an organization (Aalbers et al., 2016).

Figure 3.2: Information Channeling and the Resultant Organizational Reconfiguration



3.5.3 Organization-Wide Consensus

As a result of vertical disintermediation and lateral reintermediation, the blockchain's algorithmic transaction protocol increases organization-wide consensus (i.e., an algorithmically supported agreement regarding records and states), ultimately contributing to the alignment of organizational processes and facilitating goal pursuit. On the one hand, vertical disintermediation produces a bidirectional line of reporting that principals can use to align and update information. Vertical disintermediation creates consensus because the relevant information becomes more transparent, reliable, and constantly monitorable by all parties (we illustrate this point in the networked structure displayed on the right side of Figure 3.2). On the other hand, lateral reintermediation establishes a sequenced flow of information among agents, which the principal can use to initiate a workflow and agents can use to advance the workflow in a sustained matter without having to rely on further guidance or approval from principals. Similarly, lateral reintermediation contributes to the organization's level of consensus because the desired workflow is programmed into the blockchain, which limits deviations from the intended processes. In simple terms, a blockchain increases organization-wide consensus because it distributes information and reorders the ways in which organizational actors work to achieve a common outcome. In the words of Herman Balsters from NorthChain, "[the blockchain] amounts to a transparent, traceable, safe, and logged process. The involved parties work in networked setting, with no need for hierarchy."

We conclude our argument with the example of Allianz, a global insurance company that has successfully implemented enterprise blockchain technology to improve its claims management processes (Ledger Insights, 2021). This insurer chose blockchain technology because it provides controls that naturally align with its needs in internal claims processes, e.g., to codify, audit, and mandate the reconciliation of claims. For example, without the blockchain, a customer insured by Allianz Hungary involved in a car accident in France would trigger a cumbersome back-and-forth email process among Allianz' legal entities taking weeks to resolve. With its blockchain technology, when a customer submits an automobile accident insurance claim, Allianz can log data such as policy number, claim number, countries involved, and other details on the international claims portal connected to the country's node on the blockchain network, spurring cross-border collaboration and breaking down otherwise siloed entities. The blockchain also streamlines governance among legal entities through smart contracts, which automatically determine how claim costs are to be shared across organizations (i.e., "burden-sharing") in accordance with local tax law. By deploying Hyperledger Fabric across 23 internal companies, Allianz has thus ensured a single source record of any decision on each claim, significantly reducing administration times from weeks to minutes and providing faster claim settlement for customers. While introducing this technology has presented several challenges to Allianz, such as ensuring internal stakeholder alignment and raising awareness for the technology, the company intends to open its blockchain network to external organizations in the future.

3.6 Implications for Agency Theory

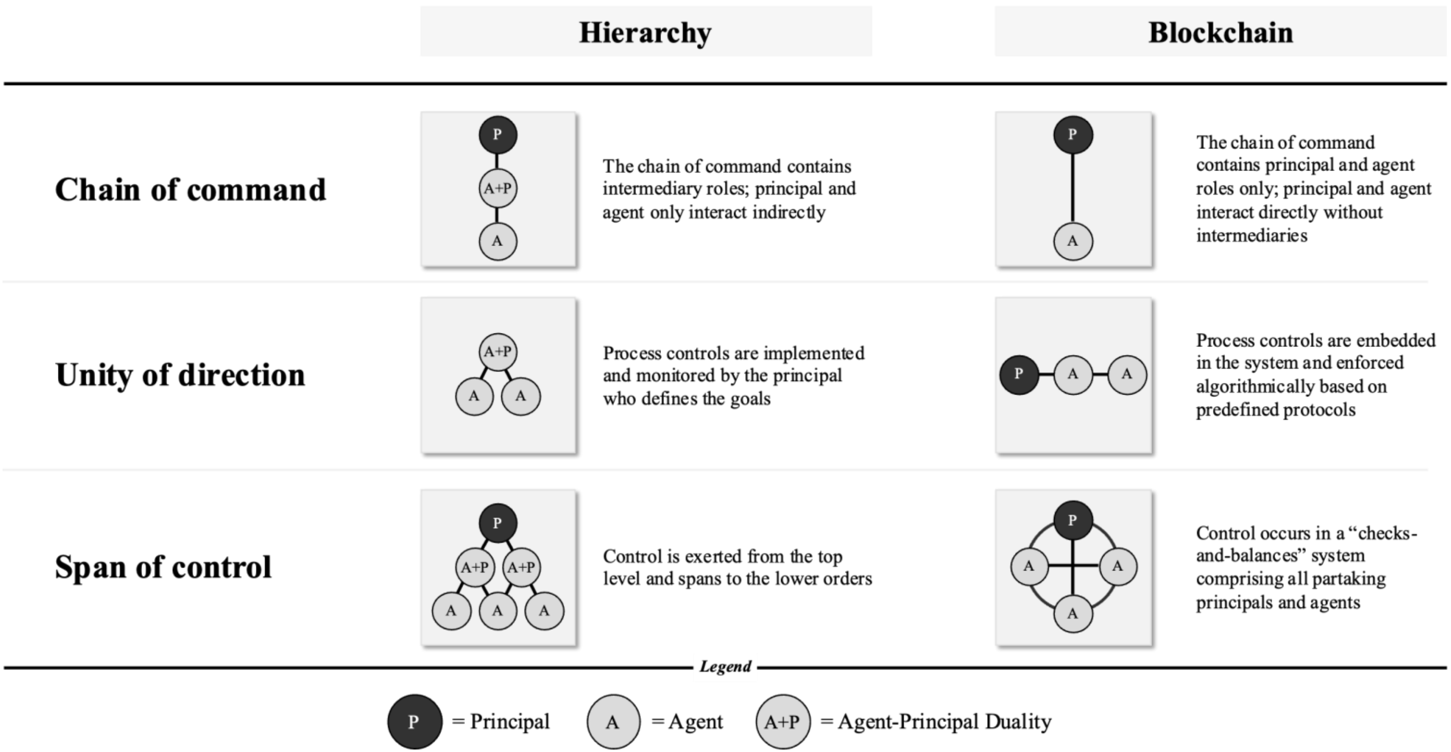
In the previous section, we explored the ways in which blockchains facilitate unobstructed channels of information within the organization, thereby enabling an organizational reconfiguration that features elements of vertical disintermediation and lateral reintermediation. We now examine how blockchain-based organizing may advance, challenge, or extend agency theory, which has focused on the hierarchical and bureaucratic organization as the predominant organizational form (Monteiro & Adler, 2022). Because organizations are essentially multiagent systems that have system-level goals, it is important to understand the context in which principals and agents work together to achieve their systemic goals (Puranam et al., 2014). Extending our prior arguments, we explore three possible changes with respect to the organization's (1) *chain of command*, (2) *unity of direction*, and (3) *span of control*. Figure 3.3 presents these implications visually.

First, a blockchain-based perspective on organizing deviates from the traditional view of organizing proposed by agency theory in that the *chain of command* becomes significantly flatter in the former case, thus reducing the number of contracts that govern the individuals within the organization (Dutton & Ashford, 1993; Jensen & Meckling, 1976). By definition, the chain of command in an organization ensures that principals can divide and assign tasks to agents and provide the information necessary to complete these tasks. In conventional hierarchies, the chain of command is constructed to contain intermediary roles, such as those of middle managers, who are responsible for aggregating and disseminating information (in both top-down and bottom-up ways), which is an important aspect of such hierarchies that allows them to manage complexity. In contrast, the blockchain's chain of command contains the principal and agent roles only due to vertical disintermediation. Accordingly, principals and agents can interact directly without any intermediaries. The upside of this difference is that information can be transmitted in an unfiltered way to allow the principal to select the information on which they should act. The downside is that the principal's cognitive load increases with each additional agent reporting to them via the blockchain, hence slowing both strategic and tactical decision making. Overall, the chain of command becomes flatter following the implementation of a blockchain since fewer intermediary roles are required to reach the same organizational outcome.

Second, a blockchain-based perspective on organizing presents a challenge to agency theory because the *unity of direction* in blockchain-based organizations is far more autonomous and less dependent on principal intervention. The unity of direction ensures that agents work together cross-functionally to reach a desired organizational outcome. In a prototypical hierarchy, the unity of direction is established by the principal, who institutes process controls that are continuously monitored (Wiseman & Gomez-Mejia, 1998). Ultimately, it is the principal who monitors the progression and alignment of agents within the hierarchy and who shares with agents a variety of information that is necessary for cross-functional alignment (Aalbers et al., 2016). By introducing a blockchain-enabled process, the unity of direction is embedded in the system directly and enforced algorithmically based on predefined protocols. Accordingly, agents are incentivized by blockchain-based controls to act responsibly, as the embedded contract becomes more process-oriented. The upside of the blockchain in this context is that agents are connected to one another directly (i.e., due to lateral reintermediation) and hence do not require constant input from the principal to complete tasks and pass on state-based information. A critical downside is that agents rely less on human interaction and thus may become repetitive with regard to their routines, leading to a more monotonous, less creative organizational environment. In summary, the unity of direction becomes more self-sustaining due to the implementation of a blockchain because less direction from principal roles is required for agents to sustain their workflow and reach outcomes in a self-sufficient manner.

Finally, a blockchain-based perspective on organizing extends agency theory by demonstrating how the *span of control* in organizations governed by blockchains can reduce principals' control and increase agents' control in the form of a peer-to-peer network. The span of control refers to the way in which control is exerted to ensure that principal and agent outcomes and behaviors are consistently optimal. Hierarchies typically allow principals to exert control from the top, which extends to the lower orders of the hierarchy and ensures that agents comply with the principals' expectations. Blockchain-based organizing enables both principals *and* agents to exert control in the form of a "checks-and-balances" system in which all relevant actors participate, demonstrating the fact that this logic does not apply exclusively to principals. A checks-and-balances system emerges because the blockchain includes embedded consensus mechanisms that must operate over multiple nodes, and principal nodes alone would likely not suffice to meet the verification needs of an entire organization. The upside of such blockchain-based organizing is that the organization, as the sum of its actors (principal and agent nodes), is constantly monitored by all participants regardless of their rank in the organization, which can reveal suboptimal behaviors at all levels. The downside is that accountability in a blockchain-based organization can continue to be unequally distributed (e.g., via a proof-of-authority consensus mechanism), which gives higher weight to principals' votes and lower weight to agents' votes and effectively preserves an unbalanced hierarchy in the design of the organization's consensus mechanism. In fact, a senior manager implementing an internal blockchain for an automotive client highlighted the "challenges of identifying neutral nodes required for consensus mechanisms within the hierarchy" due to status and role identities and questioned whether "[…] neutrality is even wanted by managers." Overall, however, the span of control becomes more multilateral following the implementation of a blockchain, giving less voice to principals alone and offering more room for agents to hold principals and peers accountable.

Figure 3.3: Implications of Blockchain-Based Organizing for Agency Theory



3.7 Discussion and Implications

Our theorizing has highlighted the implications of using blockchain in organizations for their governance and design. Broadly speaking, we build on the notion that the distributed, sequenced, and consensus-based nature of blockchains has the potential to reduce information asymmetries within the organization, which in turn mitigates principal-agent problems and enables new organizational structures. Building upon agency theory (Eisenhardt, 1989a; Jensen & Meckling, 1976; Mitnick, 2021), we propose a fresh interpretation of blockchains that shifts the focus from the conventional interorganizational perspective to a microlevel, intraorganizational outlook, which distinguishes our work from previous blockchain-related research. We demonstrate how blockchains can resolve specific challenges related to information concentration, continuity, and conflict and explain the ways in which these challenges are provoked through principal-agent information asymmetries (Figure 3.1). We also elaborate on how blockchains can address governance-related information challenges differently compared to relational / contractual and ERP-based governance mechanisms (Table 3.1). On this basis, we show how principal-agent information channels change due to the blockchain's distributed and sequenced nature and demonstrate how these changes ultimately lead to organization-wide information consensus among principals and agents and impact organizational design (Figure 3.2). As our final contribution, we highlight the key implications of blockchain-based organizing for agency theory (Figure 3.3).

Theoretical Implications

Most importantly, our study extends the conceptual foundation for enterprise blockchains, an emerging and impactful technology (Lacity, 2018; Lumineau et al., 2021), by examining the mechanisms underlying the use of blockchains for organizational governance. We justify this extension on the grounds that most blockchain research has thus far focused on cryptocurrencies and interorganizational applications (Cheng et al., 2019; Chod et al., 2020); insufficient consideration has been given to understanding the governance mechanisms involved in the use of blockchains for intraorganizational purposes (Goldsby & Hanisch, 2022; Murray et al., 2021). We wish to draw attention to the theoretical mechanisms associated with internal blockchains as a specific and less understood application of that technology by focusing on internal processes and governance of the hierarchical firm. As blockchain technology matures, we also expect to see an increasing number of applications of internal blockchains in the business world with potentially significant implications for organizational structures. By linking blockchains to firm-internal governance problems, we also transform our understanding of governance as a “nexus of contracts” (Jensen & Meckling, 1976: p. 311) by developing the conceptual basis for an interpretation according to which blockchains can form the basis for a “nexus of smart contracts” that mitigates alignment and contract enforceability problems (Magelssen et al., 2022).

On a broader note, blockchains are part of a larger trend of digital transformation driven by a variety of different and complementary technologies (Hanelt et al., 2020: 13). Next to blockchain, AI is another example of how digital transformation is shaping organizations. For example, Dixon, Hong, and Wu (2021) have studied how adoption of automated processes inside organizations can lead to a decrease in the total number of managers, and that those managers who are retained in the organization increase their span of control, which speaks to our propositions of vertical disintermediation, and opposes our propositions with regard to the span of control, which shifts toward agents and does not solely rest on managers. Moreover, new forms of opportunism are set to emerge in the AI context as well. For example, Kellogg et al. (2020) study the concept of noncooperation in the AI context, by which employees develop new ways of engaging in psychological, social, temporal, or physical niches in their workplace to avoid algorithmic control. The authors discuss the opportunistic notions of foot-dragging, gaming the system, open critique, and leveraging or bypassing algorithms to resist control, which speak to the blockchain’s new forms of opportunism regarding algorithm tricking, validator persuasion, and off-chain foregoing (we expand on these terms in our detailed research agenda as part of our Online Appendix). Despite their potential to yield similar outcomes, AI and blockchain are characterized by different technological attributes, with AI being a probabilistic technology and blockchain a deterministic one. Especially in governance contexts, where control and certainty are paramount, blockchains have the potential to cultivate stability and predictability—an aspect that probabilistic AI models inherently lack.

3.8 Blockchains Inside Organizations: Avenues for Future Research

We recommend several important avenues for future research that connect fundamental concepts in the organization literature and the recent phenomenon of the use of blockchains for internal purposes. In our Online Appendix and summarized in Table 3.2, we offer a research agenda for blockchains in organizations that is organized into three levels of inquiry: (1) Individuals, (2) Teams, and (3) Organizations. Even though our theory focuses most prominently on the organizational level of inquiry, we see clear implications for related issues at the individual and group levels. Specifically, the network perspective that we propose on the organizational level can similarly be used at all other levels (individual, group), meaning that multiple units of analysis are theoretically compatible when studying blockchains. In the Online Appendix, we elaborate on each avenue and provide examples.

Table 3.2: Avenues for Future Research

Blockchains Inside Organizations	*(1) Individuals*	• ***Blockchains as a superseding role***: What are the factors that determine the suitability of human tasks for blockchain governance? What are the implications of blockchain governance for task performance and outcomes? • ***Blockchains as an incentive scheme***: How do intraorganizational blockchains enable agents to monitor whether principals honor their incentive agreements? • ***Blockchains as a breeding ground for new forms of opportunism***: How do intraorganizational blockchains entice employees to engage in new forms of opportunism (e.g., algorithm tricking, validator persuasion, off-chain foregoing) that pose threats for principal monitoring?
	(2) Teams	• ***Blockchains for team organizing***: How do intraorganizational blockchains influence the dynamics of lateral team relationships? • ***Blockchains for interteam coordination***: When and why do blockchains improve interteam coordination? How do blockchains complement or substitute for the roles of lateral and hierarchical authority? • ***Blockchains for team performance***: Under which conditions do intraorganizational blockchains improve team performance?

(3) Organizations	• ***Blockchains and organization design***: How do intraorganizational blockchains change the design of organizations? • ***Blockchains and stakeholder transparency***: To what extent do intraorganizational blockchains prevent potential negative societal effects (e.g., insider trading, top management scandals, structural exclusions) that result from a lack of stakeholder transparency? • ***Blockchains and information processing***: Under what circumstances do blockchains complement and substitute for managerial experience and intuition? How do blockchains as information structuring tools and artificial intelligence as information processing tools influence strategic decision-making in firms?

Future research could leverage our conceptual framework through various empirical methods. To study the impact of intraorganizational blockchains on the relationship between principals and agents, researchers can use experimental research methods to understand the behavioral patterns, responses, and changes of employees who use blockchains in their workflows compared to a control group that does not use blockchains. Such experiments may shed light on the technostress that blockchains create (e.g., cognitive load) in contrast to the value that they add (e.g., efficient routines). Additionally, researchers can use blockchain transaction data within organizations to track the flow of information. This analysis can provide insights into the patterns of information distribution, sequencing, and access on the blockchain, as well as identify potential issues or conflicts that arise. By combining qualitative and quantitative data, researchers can gain a comprehensive understanding of the effects of intraorganizational blockchains on governance and organizational design.

Overall, our paper offers a new perspective on governance in the algorithmic age. We show how blockchains are a valuable tool that allows managers to make organizational processes more transparent and secure, which has implications for both organizational structures and for an organization's relationship with its stakeholders. Hence, we view our paper as a starting point for a fruitful debate concerning blockchains as forms of organizational knowledge engineering, with ample opportunity to connect with various academic conversations in the field of management.

CHAPTER 4.
HIERARCHIES IN HIERARCHY-FREE SYSTEMS: UNDERSTANDING THE ANTECEDENTS OF CONSORTIA FORMATION IN ENTERPRISE BLOCKCHAINS

Embargoed due to chapter being under review at an academic journal

CHAPTER 5.
THE LEAD ORGANIZATION PARADOX: HOW BLOCKCHAIN FOUNDERS NAVIGATE TRUST AND CONTROL TENSIONS IN INTERORGANIZATIONAL NETWORKS

Embargoed due to chapter being under review at an academic journal

CHAPTER 6.
BENEATH THE SURFACE: HOW IMPRINTS SHAPE THE GOVERNANCE OF ENTERPRISE BLOCKCHAIN NETWORKS

Embargoed due to chapter being under review at an academic journal

CHAPTER 7.
THE BOON AND BANE OF BLOCKCHAIN: GETTING THE GOVERNANCE RIGHT

Goldsby, C.M., *Hanisch, M. (2022). The Boon and Bane of Blockchain: Getting the Governance Right.* ***California Management Review****,* *64(3):141-168.*

7.1 Introduction

> Blockchain is all about getting into an agreement with different partners, […] having the power of influencing, and the power of establishing governance. – Manager of an oil and gas blockchain

Enterprise blockchains are hailed as the key to secure and transparent processing of complex transactions within and between organizations (Lacity, 2018). Enterprise blockchains are a peer-to-peer technology for validating and immutably storing transactions on a shared ledger that is distributed to participating enterprise nodes. While enterprise blockchains are increasingly recognized by managers as effective governance tools that reach far beyond the cryptocurrency domain, frustration is growing over the question of *how* to govern such blockchain networks. In the business context, the governance question around blockchains is often more critical and complex than the decisions to use and implement the technology. In fact, choosing the appropriate governance mode early on is crucial for the success of enterprise blockchain initiatives, especially when managing complex transactions with many parties (Zavolokina et al., 2020).

While recent research has highlighted the potential of blockchain technologies to govern complex business transactions in secure and transparent ways (Clohessy et al., 2020; Hanisch et al., 2022b; Trabucchi et al., 2020), the practical challenges that come with implementing a digital governance system have been largely ignored. An implicit assumption in existing research is that blockchains are self-sufficient forms of governance that run more or less “autonomously” (Lumineau et al., 2021). However, in practice, this idealized view of blockchain is rarely tenable, as managers often face significant challenges in coordinating and controlling joint actions of a blockchain network (Chen et al., 2021b). Therefore, managers need to be aware that blockchains typically require governance mechanisms that are layered on top the technical foundation provided by blockchains to achieve desired business objectives and avoid serious conflicts that could hinder adoption and success. Managers would strongly benefit from systematic approaches to blockchain governance that allow them to achieve a good fit between the blockchain as a generic technological solution and the specific needs that arise in the organizational context. At the same time, very little guidance exists for managers on how to deal with the issue of blockchain governance, as most existing blockchain research is rather technical and does not directly focus on managerial implications beyond the adoption decision (Ziolkowski et al., 2020). Creating a strong alignment between technological solution and organizational needs is thus very challenging and could explain the limited success of enterprise blockchains thus far (Gartner, 2019).

To provide clearer governance guidelines for managers seeking to implement enterprise blockchain solutions, we combine insights from governance research (Lumineau et al., 2021; Ziolkowski et al., 2020) and our analysis of publicly documented blockchain use cases with rich findings from 153 expert interviews with blockchain executives and our case studies on IBM Food Trust™ and TradeLens. A central finding from the analysis of our extensive interview material is that blockchain initiatives are most successful when the underlying coordination and control issues are clearly understood and accounted for at the onset. To facilitate this important governance decision, we derive a corresponding framework that yields four generic blockchain governance modes: (1) chief, (2) clan, (3) custodian, and (4) consortium. We show which of these modes is best suited for what type of projects and give examples from blockchain use cases to illustrate each mode. Since networks are often dynamic and necessitate adjustments in governance, we further devise four strategic moves (connecting, isolating, loosening, tightening) to channel directive actions around blockchain governance adaptations. Our overview can assist managers navigating the complex governance choices and dynamics inherent to enterprise blockchain networks to fully leverage the technology's potential.

We integrate our governance typology with a three-stage process model that summarizes the critical decisions involving blockchain governance: (1) analysis, (2) adoption, and (3) adjustment. First, to identify the most appropriate blockchain governance form, managers need to carefully analyze the network in which blockchain will be deployed, taking into account the needs and concerns of participants, to understand existing network interdependencies and competitive tensions. Second, managers should seek to understand for whom and for what purpose the blockchain is being used to tailor the coordination and control mechanisms to the network structure and the needs of the participants. Finally, managers must be aware of governance dynamics in the network that may require continuous governance adjustments. Therefore, managers may need to adapt blockchain governance over time to allow for dynamic growth of the network. This process-oriented view of blockchain governance provides the flexibility needed to steer digital organizations. Taken together, our strategic framework can help managers navigate the governance challenges around enterprise blockchains and provides a useful theoretical foundation for the emerging scholarship on blockchains.

7.2 How Firms Respond to the Blockchain Governance Challenge

The origins of digital blockchain networks can be traced to the cryptocurrency Bitcoin, which introduced modern distributed ledger technologies (Nakamoto, 2008). In essence, blockchain technologies provide decentralized and immutable transaction records that enable so-called "smart contracts" (Cong & He, 2019) that execute, track, and validate transactions among peers without relying on intermediaries (Androulaki et al., 2018). In other words, blockchains are decentralized databases (transparency) where new data can only be appended if there is consensus on the new record among participants (validation), and where no data can be deleted once it is registered in the database (immutability). Given these technical features, blockchains are particularly effective for securing information flows where network participants may not fully trust each other and the risk of fraud or opportunistic behavior is high (Babich & Hilary, 2020; Beck et al., 2018; Werbach, 2018).

Since their inception, blockchain technologies have evolved far beyond the cryptocurrency domain and have expanded to the enterprise domain.[15] Enterprise blockchains are featured in many applications across industries including the automobile, energy, food, global trade, government services, healthcare, and real estate industries. Blockchains promise significant economic benefits due to their ability to cut out the "middleman" without sacrificing security (Chod et al., 2020; Lemieux et al., 2020), which permits direct transactions among business partners, faster and cheaper settlements, tracking and tracing of assets, data provenance, and tamper-proof security models (Hastig & Sodhi, 2020). However, as blockchain efforts among enterprises grow, so do the challenges in orchestrating the technology effectively within and across organizational boundaries (Cennamo et al., 2020).

Blockchain technologies offer an exciting opportunity to digitally manage large intra- and inter-organizational networks (Halaburda & Mueller-Bloch, 2019; Vergne, 2020; Yermack, 2017). As companies operate in increasingly large and interconnected networks of customers, partners, subsidiaries, suppliers, and regulators, the need to manage these transactions efficiently and securely has also increased (Jones et al., 1997; Provan & Kenis, 2008; Uzzi, 1997). It has long been recognized in the management literature that network governance is central to business success, as companies operate in value networks that can only create value through the interplay of cooperation and competition (Jarillo, 1988; Nalebuff & Brandenburger, 1997). At the same time, managing large networks presents managers with significant challenges, as they must bring together and align different actors with sometimes shared, sometimes competing goals.

[15] The main differences between enterprise blockchains and traditional blockchain applications used for cryptocurrencies relate to the access restrictions and verification mechanisms. While traditional blockchains are permissionless and have algorithmic validation mechanisms (e.g., proof-of-stake or proof-of-work), enterprise blockchains are usually permissioned, i.e., access is regulated by one or a group of authorized entities and validation is often ensured by the same entity. However, both blockchain types have in common that they provide high levels transparency through a decentralized database coupled with immutable append-only data records.

Blockchain technologies thus provide only the bedrock of digital network governance and require careful design.

To illustrate how successful blockchain networks approach governance, let us consider the example of IBM Food Trust™, which used two different governance modes during its evolution to accelerate growth.[16] IBM Food Trust™ aims to offer its network participants (e.g., farmers, truckers, and retailers) greater traceability, transparency, and efficiency for food provenance. IBM Food Trust™ was created by the technology firm IBM, in collaboration with the global retail giant Walmart, after a successful proof-of-concept with Tsinghua University in 2016 (Allison, 2021b). In this blockchain project, IBM retained control over most strategic decisions and tightly coordinated activities with Walmart, who provided industry-specific knowledge and resources to develop the solution for its own inter-organizational supply chain network (Banda, Hamilton, Lowry, & Widdifield, 2020). However, it soon became clear that the blockchain's ultimate success would depend on attracting many more network participants who were critically important in the food industry: "We saw that a lot of the stuff that we had developed was really tailored towards one kind of retailer […]. We quickly realized that if everybody was supposed to participate—and even though in the supply chains the retailer is king—you still really have to give everyone value," a program director at IBM recalled.

IBM and Walmart had to pivot, proving that competitors could collaborate in the same network. With Walmart as its primary trust anchor, the blockchain solution was successfully piloted among the retailer, some suppliers, and trucking companies, which represented only a small fraction of the industry. After fruitful pilots with Walmart, additional key players from the industry, including Carrefour, Dole, Kroger, Nestlé, and Unilever were eager to join in. "Together, powerful retailers and food manufacturers can do a whole lot more," said Kroger VP Howard Popoola when interviewed on Food Trust (Teicher, 2021). To accommodate competitors' skepticism about the blockchain's organization that was geared toward Walmart, the governance mode assumed in the beginning had to give way to a new structure. The addition of large players called for a more decentralized

[16] The authors have conducted extensive qualitative study of IBM Food Trust™, TradeLens and related enterprise blockchain platforms as part of their academic research.

governance approach to reflect the increasing interdependencies across organizational boundaries. In response, IBM decided to introduce coordination mechanisms designed for multiple retailers—such as Carrefour and Kroger—that were competitors to Walmart. This new coordination structure manifested in the introduction of guidelines for decentralized data ownership, clear rules of engagement, and advisory councils (IBM, 2020c). In the words of the IBM General Manager of Blockchain Ecosystems, Raj Rao, "the advisory council is basically a convening initiative where IBM plays the role of a convener to bring together the industry while they have competing businesses and often different viewpoints on challenges in the industry. They also share a lot of the same challenges: data security, trust in data, the ability to have systems that can interoperate with one another, the ability to agree to common standards for sharing data. These are things that everyone in the food industry, or even in the logistics industry tends to agree are universal challenges. […] Being able to use a platform that solved the majority of the challenges, I think, was the most interesting aspect of driving it forward."

Today, IBM Food Trust™ is one of the largest and most active enterprise blockchain networks (IBM, 2018). This telling example of a successful blockchain governance implementation holds many important lessons for managers. Most importantly, IBM Food Trust™ has managed to design effective governance structures and adapt them over time. In the following, we systematize the underlying strategic rationales and provide a guide for managers charged with blockchain governance.

7.3 A Strategic Guide to Enterprise Blockchain Governance

When it comes to deploying blockchains in a business context, managers should think far beyond the mere technical aspects. Most importantly, managers need to establish clear governance structures for blockchains that closely align with the overall vision for the network and reflect the parties' roles in the transaction network. Previous research has begun to recognize the importance of blockchain governance to the overall success of blockchain initiatives (Hsieh, Vergne, & Wang, 2017; Pelt, Jansen, Baars, & Overbeek, 2020). An important insight from this emerging scholarship is that blockchains do not represent a self-sufficient governance mode but need to be complemented by a well-balanced governance structure that is layered on top of the technical solution to ensure that the blockchain solution addresses the desired business needs (Chen et al., 2021b). In particular, this includes the careful consideration of the coordination and control challenges that arise when blockchains connect multiple actors. To provide managers with a guide to these challenges, we complement existing insights and the experiences of blockchain experts who we interviewed to focus attention on the most pressing and common issues in establishing enterprise blockchain networks.

"It is important to realize that blockchains are typically used for business processes where trust is critical. Because of this sensitivity, it is a highly strategic, highly political technology decision to adopt blockchains." – CEO of blockchain service provider

Research Methods

Our findings originate from extensive qualitative, in-depth interviews about blockchain governance and adjacent themes with 153 blockchain executives worldwide. The sample covers most major sectors, including industrial, consumer goods, financial, information technology, telecommunication, and utilities. The interviews took place between 2019 and 2021. Each interview lasted between 25 and 90 minutes and was recorded and transcribed verbatim for subsequent qualitative analysis using Atlas.ti. In the analysis of our interview material, we followed established research methods (Miles, Huberman, & Saldaña, 2014). The findings for this article are based on direct quotes from practitioners that we aggregated to overarching themes and dimensions (Gioia, Corley, & Hamilton, 2013). The insights presented here reflect a synthesis of the most salient topics described by managers, which appear to be of particular practical relevance. All company and individual information in this article is drawn from publicly available sources or we have obtained explicit permission to use them. At the request of some interviewees, we anonymized some of the quotes to protect blockchain projects that were considered highly confidential. We supplement our interview material with our extensive analysis of blockchain use cases that are publicly documented as a means to balance and triangulate our interview material. Details on the methods and supporting interview quotes can be found in our Online Appendix.

7.4 Coordination and Control in Blockchain Networks

A recurrent theme in the governance literature and our interviews relates to the management of the coordination and control challenges presented in blockchain networks (Iansiti & Lakhani, 2017; Lumineau et al., 2021). These challenges arise because blockchains often forge new connections and change the way transactions are carried out. From a technical perspective, this reorganization occurs because blockchains enforce radical peer-to-peer interactions in a decentralized way, which departs from the traditional hierarchical forms of organizing and the reliance on intermediaries (Chircu & Kauffman, 1999; Williamson, 1991). The shift gives rise to coordination and control concerns that are unique to the blockchain context, and which pose a critical managerial challenge. Table 7.1 highlights these coordination and control challenges of blockchain governance, along with illustrative evidence from our interviews.

7.4.1 Coordination

> We told our blockchain client from the beginning: ‘you need to set up structured governance processes. We need to *coordinate* more,’ and they always refrained from including additional parties in their process. – Architect of a construction blockchain

Coordination refers to the management of interdependencies that exist within and across organizations (Gittell, 2000; Schepker et al., 2014). Since blockchains are often used in environments with high organizational interdependencies, there are numerous coordination tasks that occur over the lifecycle of a blockchain. Our research identified three distinct coordination challenges that are elemental to the design of blockchain governance: (1) alignment and interfaces, (2) resource deployment and operations, and (3) mutual adjustments. Regarding the first challenge, our interviewees highlighted how coordination was often needed during initial project phases to align the high number of interdependent organizations around a common purpose while simultaneously getting organizations to use the same (technical) language. Next comes the problem of coordination during the execution phase, when there is typically a strong need to coordinate the effective use of resources and the ongoing operation of the blockchain. A third major coordinative task surfaces during the adjustment phase that demands a form of coordinated adaptation among network members, especially when new members join or existing members exit.

Table 7.1: Coordination and Control Mechanisms of Blockchain Governance

Blockchain Governance Theme	**Blockchain Lifecycle** *Initiation*	*Execution*	*Adaptation*
1. Coordination	**Alignment & interfaces**	**Resource deployment & operations**	**Mutual adjustment**
Why it is important	Describes the number of interdependencies among organizations in the blockchain that require alignment around its purpose and success factors, onboarding and integration (including standards).	Details how day-to-day operations in the blockchain take place among onboarded / integrated network participants.	Defines collective response strategies to changing circum-stances related to the blockchain (e.g., when new members join or existing members exit).
Illustrative quotes	"So, the real objective here is to have more information shared around the table than information not shared, to make sure that everyone has a set of alignment in term of strategy of the initiative and a way to operationalize that." – Manager of mobility blockchain	"[The client] decided to take charge of the resources needed to 'blockchainize'" – Project manager of blockchain for food retail	"I would add being really agile. Pivoting along the evolution, with many, many things that none of us could ever anticipate because we are entering new grounds." – Architect of governmental blockchain
	"The technology was very new and was unfamiliar to the parties involved. Subsequently, some of the challenges are […] the difficulty in implementing requirements with asynchronous	"And then what we did was we ended up forming the subcommittees, and we had one for the technical stream, the business and operations stream, and the legal streams, and those	"By making the shift, they had to make some adjustments in their existing supply chain and [the client] thought of a combination of blockchain with IoT sensors monitoring

Blockchain Governance Theme	**Blockchain Lifecycle** *Initiation*	*Execution*	*Adaptation*
	programming interfaces." – Project manager of banking blockchain	sessions would run at a bare minimum once a week." – Project manager of banking blockchain	the conditions, as well as predictive analytics or AI, to maximize freshness, minimize waste and support their customers switch from frozen to fresh." – Project manager of blockchain for food franchise
2. Control *Why it is important*	**Participation & information sharing** Assures the permissioning / access of the overall blockchain and its data to participating organizations, including data management, privacy, and ownership.	**Funding & decision authority** Delineates the decision-making authority for and funding of blockchain-related activities (e.g., feature updates, architectural overhauls, data model updates), along with ownership of intellectual property.	**Dispute resolution** Regulates how disputes between two or more network organizations outside the blockchain are handled, including liability attribution, funding, and conflicts of interest.
Illustrative quotes	"We were connecting a bunch of disparate sources of data in a way where we needed to have trust and privacy of the permissioning, as well as being able to agree on the consensus mechanisms." – Project manager of pharmaceutical blockchain	"The greatest challenge is funding. From a business perspective, just getting the organization off the line is getting someone to commit to funding." – Project manager of governmental blockchain	"The practice I have is base yourself upon industry standards […]. That really helps the discussion between the product owners because you have a reference in case there are disputes or things that you should resolve. So, you avoid yes / no discussions between

Blockchain Governance Theme	**Blockchain Lifecycle**		
	Initiation	***Execution***	***Adaptation***
			different parties.” – Project manager of banking blockchain
	“So, they wanted to make sure that they are not sharing sensitive information to one of their competitors or many of their competitors. And I’m not talking about information in the solution, but during discussion talks on the project.” – Manager of mobility blockchain	“At the current time, it’s a business process where decisions are made by the deciding bodies that have authority within organizations, but at the end of the day, all organizations need to go back to their respective legal counsel and get approval from them.” – Project manager of higher education blockchain	“What we ended up doing was just taking the more conservative path to ensure that every participant in the network would be comfortable with what we ended up designing. What we did was to model our privacy structure very closely off of what the industry is like today.” – Manager of pharmaceutical blockchain

Our findings further reveal that these coordination challenges can either exist *within* a given organizational hierarchy or can be transferred to a dedicated interface where coordination is orchestrated *across* organizations. This locus of coordination is a critical determinant of the governance mode. For instance, if coordination primarily pertains to activities within an organizational hierarchy, this warrants a more concentrated governance mode compared to transactions involving interdependencies with other organizations. Coordination that takes place across organizational boundaries increases governance complexity, as aligning interests in “politically” charged settings incurs significant administrative costs. Coordinating activities across organizational boundaries may also involve aligning with competitors whose goals and incentives may differ. Therefore, it is crucial that managers consider coordination early in the process to account for the evolution of the blockchain network and whether it might expand to external organizations.

7.4.2 Control

"Companies simply do not want to give up control. If anything, they want to usurp more of it. The simple answer is to recognize this fact – central authority is here to stay in the enterprise. But that doesn't mean centralized organizations cannot embrace decentralized applications wrapped by their centralized services." – Avivah Litan, Analyst at Gartner Research (Kuhn, 2021)

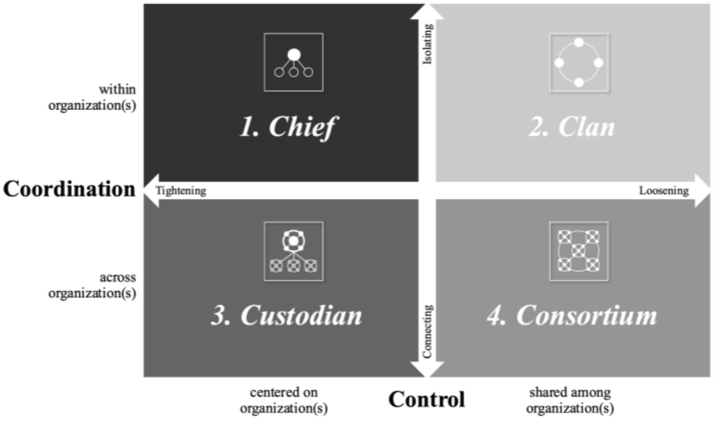
Control relates to the allocation of decision-making authority in relation to the blockchain network (Gittell, 2000; Provan, 1983). Maintaining control serves to enforce collective action over the lifecycle of a blockchain network. Overall, three salient control challenges emerged from our interviews: (1) participation and information sharing, (2) funding and decision-making authority, and (3) dispute resolution. For example, our interviewees mentioned that approval rules for the blockchain and its data are an important control consideration to initiate a blockchain network. Another control issue is the delineation of decision-making for blockchain-related activities (e.g., feature updates, architecture overhauls, data model updates) that are critical to moving a blockchain project beyond the initial phase. Finally, arrangements need to be made for how disputes between network participants are resolved (e.g., regarding funding or conflicts of interest) and who holds the final decision-making authority in case of a deadlock.

Control comes in different facets. In most governance structures of enterprise blockchain networks, control is either *centered* on specific organizational actors or is *shared* between organizations. The locus of control has direct consequences for blockchain governance. If control is centered, one organization in charge calls the shots for the network. If control is shared, organizations need to agree on matters such as the future direction and funding of the blockchain, permissioning rules, data visibility of transactions, and dispute resolutions. Such control matters are distinct from coordination activities in that control enforces and regulates elements of the blockchain governance structure through formal decision-making authority (Leifer & Mills, 1996). Control is an important lever to understand for blockchain governance because it determines how much sovereignty organizations retain in defining their network strategy. For instance, a large industry player with a vast supply network may find it easier to impose a tightly controlled governance mode with strict decision authority due to its market share compared to a small, new entrant that might have to share control among various industry organizations. Together, coordination and control make up the two overarching axes that shape blockchain governance.

7.5 The Four Modes of Governance for Blockchains Explained

The decision on the loci of coordination and control described above translates into four generic governance modes: chief, clan, custodian, and consortium. Each of these four modes has certain characteristics, advantages, and disadvantages and it is important that managers be aware of them in reflecting on their preferred governance mode. The governance modes illustrated in Figure 7.1 are explained and illustrated in more detail below.

Figure 7.1: Four Modes of Governance for Blockchains



7.5.1 Chief

> Blockchain really makes things easier in this case, because it gives you the tracking of actions, auditing of the assets, and data integrity. That is for sure something good that blockchain delivers. But the network is related to the same organization. […] The solution was dedicated to an internal process among several different legal entities. – Manager of an oil and gas blockchain

The chief mode emerges when a blockchain is orchestrated and directed by the same instance, i.e., coordination and control reside "in-house." As such, it represents the most tightly organized and closed form of blockchain governance. The chief mode typically occurs when large corporations fund and control blockchain initiatives designed to administer relationships with customers (e.g., loyalty programs) or subsidiaries (e.g., internal transfer pricing) while restricting the scope to the narrow confines of their own organization. The chief mode has coordination activities that lie within the focal organization, which applies to stakeholder alignment and creation of inter-departmental IT interfaces, allocation of budgets and operational responsibilities, and communication and updating of project milestones. Similarly, control is centered on specific organizational actors as the chief mode has strict internal participation rules and information sovereignty, hierarchical funding decisions and centralized decision making, and escalation of disputes within the organizational hierarchy. This governance mode is especially beneficial for holding companies with many loosely coupled business units that engage in frequent interactions where transparency is critical. Because the blockchain initiator retains critical decision-making authority, the speed of execution can be quite high in this mode. The mode's downside is that the top-down governance approach often creates conflicts in intra-organizational settings because the needs of individual subsidiaries are not sufficiently accounted for in the network and thus clash with the strategic intent of the parent organization. For instance, power dynamics between strong and weaker subsidiaries—e.g., high- vs. low-performing geographies—can provoke boycotts if interest groups are not adequately represented.

The chief governance mode was adopted in a blockchain pilot project by Wells Fargo. The bank decided to introduce "Wells Fargo Digital Cash" to improve internal cross-border payments within the Wells Fargo Group (Wells Fargo, 2019). Wells Fargo Digital Cash is a tokenized currency that is run in the bank's private blockchain network. It is a classic example of a chief governance mode because blockchain transactions are bound to Wells Fargo as a focal actor in the network who coordinates activities and because the transactions are proprietary to the group and its subsidiaries for internal optimization. Lisa Frazier, head of the Wells Fargo Innovation Group, commented that the solution is "faster than SWIFT, cheaper and definitely more efficient," indicating that this governance mode can be encouraging for intra-organizational, tightly knit blockchains (Allison, 2021a).

Despite such positive pursuits of the chief governance mode, the mode can also meet resistance given certain conditions. In our interviews with a military organization that pursued a chief governance mode, the greatest challenge became expanding beyond their "proof-of-concept" phase and inviting external suppliers to join. The root cause of this issue was their rigid and hierarchical pursuit of standards and regulations for security purposes—applicable to their own organization—that made it near-infeasible and less alluring from an integration standpoint for other parties to join. As stated in an interview with a consultant working on the case, "the biggest lesson learned is that the proof-of-concept is usually the easy part. It goes off without a hitch, it can satisfy the customer's needs. But then getting to that next step of bringing in external partners, growing the network, expanding the scope of the use case, and the application on the blockchain, is the most difficult part of working with the technology."

7.5.2 Clan

> [We had] no external parties, but internal, in terms of an internal auditor. We did have an internal audit perspective on the project, but it wasn't a project consortium, just in terms of having oversight. For external… it didn't end up going there and I don't think it ever would have with the nature of the products that we were doing. – Manager of pharmaceutical blockchain

Similar to the chief mode, the clan mode coordinates activities within an organization but differs in that it permits shared control over the blockchain network. The clan is a blockchain governance mode that is often used when an organization and its subsidiaries, departments or internal auditors strive to optimize operations and share control over information sharing, funding, decisions, and disputes among functional departments or national subsidiaries. In rare instances, the clan mode can also involve external organizations, for instance, when multiple organizations decide to fund a blockchain and reign over its decisions but leave coordination of day-to-day activities to the organization that actually uses the solution. This means that while coordination activities in the clan mode (e.g., alignment, operations, and mutual adjustment) are still within an organizational hierarchy, control (e.g., participation, funding, and dispute resolution) is shared among participants. Typically, the clan mode enables shared control among organizations, with open participation guidelines, a consensus-based approach to internal information sharing, collective funding and decision-making concurrence, and shared liability attribution among entities. The clan mode shares common benefits with the chief mode, such as the possibility for organizations new to blockchain to first align their own purposes in tight internal collaboration before expanding to a broader inter-organizational network. Since decisions are participatory, this mode fosters a supportive, network-wide culture and drives solutions that are designed for all entities. On the other hand, we often see cumbersome attempts when this mode is expanded to a larger number of organizations (a strategic move we later refer to as "connecting") because coordination activities have been aligned specifically for one organization rather than multiple potential organizations in the network. Hence, process and data standards might be overlooked, and the internal focus might make it difficult for other organizations to join later on.

The clan mode was adopted by Coca-Cola for 70 franchised bottling organizations operating across its $21 Billion supply chain (Business Insider, 2021). The blockchain was formally announced and set up by Coke One North America (CONA) and SAP in 2019. CONA is the shared IT platform provider for 12 of the largest Coca-Cola bottlers in North America (Microsoft, 2021). CONA's Andrei Semenov explained how the decision to introduce a blockchain originated from a need for better coordination within Coca-Cola's own supply chain: "There are a number of transactions that are cross-companies and multi-party that are inefficient, they go through intermediaries, they are very slow. And we felt that we could improve this and save some money" (Ledger Insights, 2019b). Using blockchain in the Coca-Cola production line, bottling companies can fulfill orders for the brand more reliably and at a faster pace because inventory data is stored immutably and is transparently accessible. As a result, the firm hopes to see their usual 50-day reconciliation time drop to under a week (Coinspeaker, 2019). The beverage giant has started to consider expansion and integration with other players, including Walmart and Target (Ledger Insights, 2020; The Coca-Cola Company, 2021). At present, CONA focuses on the Coca-

Cola bottling franchises,[17] indicating that the clan mode can be used to effectively coordinate internal processes with a shared control structure.

Even though some firms fair well with the clan governance mode, it is not suited for all situations. From our interviews with an oil and gas giant, who built a blockchain shared among its subsidiaries using the clan governance mode, communication became a key struggle, as all subsidiaries (more than ten legal entities) had to align on the overarching goal of the blockchain. “It was not miscommunication but more messy communication, while internally it was really no communication at all in certain moments. So, we had to go with assumptions, and those assumptions caused us to rework,” a senior manager of the oil and gas blockchain recalled. Even though the use of blockchain was clearly advantageous in terms of traceability, immutable history, and data segregation, significant communication efforts were required as a result of the coordination within organizations in the clan governance mode to argue why traditional databases would show less of an impact compared to blockchain. This was amplified due to the shared control in the governance mode. According to the senior manager, there was “a typical battle between headquarter and operating companies. The operating companies have a lot of power because they are the ones producing all the oil and gas. Then the headquarter is where a lot of senior people are sitting, making policies and all of that. There was a natural friction […].” This friction of shared control led to sluggish decisions in how the blockchain would introduce a more modern way of working, “away from their traditional ways of doing things over email or Excel sheets.”

7.5.3 Custodian

> Currently, we’re thinking about a founder-led network for the first part. But we’re aiming to scale this once we are comfortable with the network status, and then scale it out to a consortium-based network. – Architect of construction blockchain

The custodian mode applies when coordination occurs across organizational boundaries and control of the network is centered on a single

[17] In some instances, network control can reside on two closely aligned, dominant actors. For instance, an industry heavyweight and a technology partner.

actor (TraceHarvest, 2020). In other words, the locus of coordination activity resides outside the organization's boundaries while the locus of control remains within the focal organization. Typically, a custodian mode is used when a large dominant organization in a network funds, designs, and implements a blockchain and leverages its existing network (e.g., suppliers and customers) to fuel growth. Contrary to the former two modes, coordination takes place *across* organizations, in that inter-organizational relationships must be synchronized around a common blockchain purpose and operation. However, not all aspects of the custodian mode are as open to outsiders. The custodian mode exercises hierarchical control through one organization, which means that there are closed book permissioning rules and central decisions for information sharing, hierarchical funding decisions and centralized decision making, and disputes that are mediated by a central body. The custodian mode has the clear advantage that speed is prioritized for the focal organization that launches the network. Instead of giving all network members a say in strategic decisions, the custodian mode prioritizes fast decisions and their execution based on sufficient blockchain "trial runs" by one or a few key organizations. If the focal organization has a suitable existing network, it can easily fuel initial growth by convincing allied organizations to join. The downside of the custodian mode is that it can alienate critical network organizations, and decisions made up front by the focal organization may need to be revisited or altered to accommodate such requests.

The custodian governance mode was successfully pursued in the IBM Food Trust™ case outlined above. This is a custodian governance mode because IBM coordinates blockchain-related activities with other network participants, such as farmers, truckers, and retailers, using a dedicated advisory council for industry alignment, operations, and mutual adjustments, but retains control over the blockchain's governance in terms of funding and decision authority. Another promising example of the custodian governance mode is the TraceHarvest Network, which similarly enables traceability of products through the food supply chain (Business Wire, 2020a). In this case, control lies with Bayer Crop Science in close collaboration with BlockApps. Bayer Crop Science served as a founding member and active user of the network for trial runs with live customers before they announced plans to open the network and expand globally (TraceHarvest, 2020). According to TraceHarvest (2020), cross-organizational coordination was intended from the start, so “any agriculture business or partner that wants to be part of the industry’s transformation is also welcome.”

Conversely, the custodian governance mode can also lead to difficulties in onboarding competing network participants. Many banks have become familiar with the issue. “Banks and other financial institutions have invested millions of dollars to test new blockchain systems aimed at reducing the costs and complexity of cumbersome processes […]. Few projects have been deployed at scale so far” (Irerra, 2019). One particular issue mirroring the pitfalls of custodian governance was witnessed recently in the “Quorum®” blockchain by JPMorgan, an enterprise variant of the Ethereum blockchain intended to facilitate collaboration across different blockchain networks. The network was launched and run by JPMorgan as the focal organization, intended for inter-organizational collaboration. Will Martino, former lead engineer for JPMorgan’s first blockchain Juno, points out that “if JPMorgan, one of the biggest companies ever, can’t drive adoption, even when they have a great internal use case, you have to ask yourself ‘why’?” (Thompson, 2020). JPMorgan struggled to onboard large incumbents such as Morgan Stanley, Wells Fargo, and Bank of America, given the tight control JPMorgan retained over the network. JPMorgan sold Quorum® to ConsenSys in late 2020 (Business Wire, 2020b).

7.5.4 Consortium

> I’m a big proponent of the idea that for each member type that’s involved in the network there should be at least two client representatives of each. Otherwise, if there’s just one, sometimes they think that they can exert certain control. – Manager of pharmaceutical blockchain

The consortium mode occurs when organizations come together to jointly control activities for a blockchain network across organizational boundaries. It thus represents the most open and collaborative governance approach. What makes up a “blockchain consortium” is still an ongoing debate (Zavolokina et al., 2020). Because consortia are founded for cross-organizational blockchain networks and are essentially an association of several companies, we often see this type of governance mode when large corporations come together in a blockchain network to solve pressing business problems for an entire industry. While the consortium mode enables coordination across organizations, it differs from the custodian mode in that control is shared among organizations as well. This means that a consortium favors consensus-based decisions regarding information sharing, reigns over funding and strategic decisions, and allows for collective handling of operational disputes. The consortium mode has the advantage that ideally all critical network organizations are at the table when decisions are being made. This early inclusion of key parties raises conflicts early and allows the network to address them collaboratively. A consortium mode will thereby facilitate consensus between organizations in crucial areas such as network intent, feature requirements, technology roadmaps, voting rights, advisory boards, and entry-exit criteria. The downside we have often witnessed with this mode of governance is a high level of bureaucracy over building a working solution. It can take years for large organizations to agree on key points, requiring iron clad contractual agreements to assure organizations that their confidential data and intellectual property are safe.

In general, consortia hold particular promise for businesses. Take the luxury watch brand Breitling, for example, which decided to contribute to a blockchain consortium to benefit its customers. The blockchain can be used to transfer ownership of Breitling watches by means of a secure blockchain transaction. As elaborated by Antonio Carriero, Breitling Chief Digital and Technology Officer, "transparency, traceability, and tradability are the key benefits for the happy owner of a Breitling watch. The history of the watch is forever connected to the watch certificate, supported by the blockchain's native capabilities." Breitling understood that their brand is one of several in the luxury space and that customers can engage with multiple brands. The consortium Breitling joined—powered by Arianee—holds the advantage that customers can enjoy the immutability and transparency features of blockchain for multiple luxury brands. For instance, next to Breitling, the consortium brings together luxury watch groups such as Richemont and Audemars Piguet (Arianee, 2020). "Arianee is a consortium that aggregates key players of the luxury industry," explained Carriero. Further, "watch owners do not have to share any personal details to entertain a relationship with the brand from which they own a product. And owners do not need to have any privacy and security concerns anymore." This is a classic example of a thriving consortium governance mode because large luxury players have found a way to come together "to share ideas and activate a global standard," as described by Carriero.

However, consortia are also ripe for antitrust, regulatory, and legal issues, as recently witnessed by member dropouts at Facebook Libra. Facebook attempted to pursue a "consortium" governance mode with coordination across organizations and control shared among organizations but failed due to regulatory challenges. Libra was a consortium model given that Facebook's governance role was "equal to that of its peers, and being fully subject to the voting cap of 1%" (Zetzsche, Buckley, & Arner, 2020). The "Libra Association" intended to offer a permissionless global currency whose value would be stabilized by a basket of assets. High-profile members of the Libra Association, including eBay, Visa, MasterCard, and PayPal faced governance tensions that spawned from uncertain regulatory jurisdiction and liability for financial crimes (Hecker, 2020). Many critical members left the consortium, as they were unwilling to define and assume responsibility for the many disputed matters in the context of their governance structure. As a result of the struggles, Libra was rebranded as Diem in December 2020 to attempt a fresh start.

Table 7.2: Overview: Four Modes of Governance for Blockchains

Governance mode	What it is / example	Used when the blockchain …	Strategic actions	
			Coordination	**Control**
Chief	The Chief mode centers blockchain coordination and control within an organization. As such, it represents the most tightly controlled and closed form of blockchain governance. WELLS FARGO; *Military org.*	• holds sensitive, internal information for which a central entity retains control • mainly enhances internal processes for a central entity • transaction features no or few interdependencies with other organizations	*within* organization(s) Stakeholder alignment and creation of inter-departmental IT interfaces Allocation of budgets and operational responsibilities Communication and updating of project milestones	*centered* on organization(s) Strict internal participation rules and information sovereignty Hierarchical funding decisions and centralized decision-making Escalation of disputes within the organizational hierarchy
Clan	The Clan mode focuses on intra-organizational coordination and enables shared control over the blockchain network. It represents the most open approach to intra-organizational blockchain governance. Coca-Cola; *Oil & gas org.*	• holds information which can be distributed internally upon agreement • enhances internal processes / collaboration for multiple internal entities • transaction features no or few interdependencies with other organizations	*within* organization(s) Stakeholder alignment and creation of inter-departmental IT interfaces Allocation of budgets and operational responsibilities Communication and updating on project milestones	**shared** among organization(s) Open participation guidelines and consensus-based approach to internal information sharing Collective funding & decision-making concurrence Liability attribution among internal entities
Custodian	The Custodian mode applies when coordination occurs across organizational boundaries and control of the network is centered on dominant actors. This is the most hierarchical form of inter-organizational blockchain governance. BAYER; TRACE; J.P.Morgan	• is funded, designed and implemented by a dominant organization in a network • growth can be fueled by the inclusion of the dominant organization's networks • transaction features interdependencies with other organizations	**across** organization(s) Alignment on blockchain purpose, success factors, and pursuit of mutual standards Administration of operational roles and responsibilities Discussion forums to disclose information and adjust to change	*centered on* organization(s) Closed book permissioning rules and central decisions for information sharing Hierarchical funding decisions and centralized decision-making Change / operational disputes mediated by central body
Consortium	The Consortium mode occurs when organizations come together to jointly coordinate and control activities for a blockchain network. It represents the most open and collaborative governance approach. BREITLING 1884; a; libra	• requires mutual decisions for information sharing • holds information that requires involvement of several industry actors • transaction typically features interdependencies with other organizations, incl. competitors, for an entire industry	**across** organization(s) Alignment on blockchain purpose, success factors, and pursuit of mutual standards Administration of operational roles and responsibilities Discussion forums to disclose information and adjust to change	**shared** among organization(s) Open permissioning rules and mutual decisions for information sharing Collective funding & decision-making concurrence Change / operational disputes addressed in unison

Each of the four governance modes for blockchains—(1) chief, (2) clan, (3) custodian, (4) consortium—comes with distinct coordination and control dynamics. The outline and illustrations above show that each mode has inherent advantages and disadvantages and that choosing a suitable governance mode can make or break blockchain success. Table 7.2 provides a comprehensive view of the four governance modes for blockchains and the strategic coordination and control actions associated with each mode.

7.6 Negotiating and Re-Negotiating Blockchain Governance

Choosing the right blockchain governance mode is just one component of successful enterprise blockchain governance. Governance choices are a series of events that can occur dynamically. To illustrate these complex governance adaptations, let us consider the example of TradeLens, a prominent blockchain network that faced a turbulent governance journey and managed to mitigate the challenges successfully. TradeLens, one of the largest blockchain networks for global trade, connects global supply chain organizations—such as shippers, ocean and inland carriers, freight forwarders, and logistics providers—in a blockchain network to facilitate secure data transactions and trade workflows (IBM, 2020a). TradeLens was formally launched in 2017 by the ocean carrier Maersk and the technology provider IBM.

When establishing TradeLens, Maersk and IBM started small by analyzing their networks and opting for a custodian governance mode, which brought important advantages but also set the course for future challenges. This governance mode is characterized by a focus of control on a small number of actors while coordination extends to many market participants. In adopting this governance mode, Maersk and IBM focused on creating a compelling use case rather than engaging in endless discussions with other stakeholders. For instance, the custodian mode enabled quick decisions concerning technology roadmaps, data sharing specifications, and branding since Maersk and IBM were running the show. IBM Head of TradeLens, Marvin Erdly, recalled that "we had a decision to make a few years ago on how we were going to do this. We could either take years and try to work out some really complex consortium model, or we could jump into the deep end with the largest player in the industry and hope we can work out a model that would bring along the rest of the industry. And we chose the second of those two."

Maersk and IBM initially fared well with the custodian governance mode when it was mostly Maersk's network that joined TradeLens. However, as the two founders sought to expand their network, their governance decision was met with increasing resistance from competitors, who were considered essential to the network and without whom growth would be virtually impossible to secure. To meet this challenge, Maersk and IBM decided to *loosen* control in their governance mode, in which the competitors of Maersk were involved in the decision-making processes. They achieved this governance shift through multiple activities, e.g., by seeking contractual agreement with ocean carrier competitors on issues such as founder status and legal / data ownership. Today, as a result of this strategic governance shift, TradeLens is attracting an increasing number of organizations, for instance with the addition of the ocean liners CMA CGM and MSC. IBM's Marvin Erdly said that "the initial challenge faced by the TradeLens network was reaching a critical mass. The more entities we have on the network, the more valuable the network becomes. Other entities will now want to join, ultimately creating a network effect. This is why CMA CGM and MSC joining is such an important milestone" (Wolfson, 2020). The TradeLens success story[18] has been one of dynamic blockchain governance, allowing tensions to be resolved through critical reflection and fast execution.

7.6.1 Blockchain Governance Dynamics

What we learn from the TradeLens case is that the initial governance mode is often only the starting point, and it is necessary to adapt the coordination and control mechanisms to dynamically changing circumstances. In the TradeLens case, we observed a shift from a centralized control structure to a more decentralized structure. However, reverse moves are also conceivable, in which managers react to possible decision impasses in a decentralized consortium by diverting control toward a single organization which can then act more quickly and effectively. This was the case, for example, with JPMorgan, which, due to decision conflicts in the

[18] Since the time of publication, TradeLens has been discontinued and announced its termination in late 2022. According to TradeLens (2023), the "vision centered on the ability to enable true information sharing and collaboration across a highly fragmented industry globally. Unfortunately, such a level of cooperation and support has not been possible to achieve at this point in time."

consortium "R3" around the use of the Ethereum network, decided to exit the established consortium and focus on its in-house distributed ledger "Quorum®", which would support Ethereum (Rolfe, 2017).

We conceptualize these possible governance sequences into four strategic moves as they may occur for blockchain networks: (1) connecting, (2) isolating, (3) loosening, and (4) tightening. Each of these strategic moves comes with distinct outcomes that managers of blockchains can expect as they choose and adapt to a given governance mode over time. Figure 7.1 highlights each of the four strategic moves managers can pursue.

(1) Connecting and (2) Isolating

> I think if I could have done this differently in the beginning, I would have some amount of focus on: 'how are we going to grow this blockchain into a widely adopted decentralized solution?' It wasn't something that we were being asked to do in the very beginning, but it's something I think you have to acknowledge in the beginning. – Manager of home appliances blockchain

"Connecting" is a common strategy in which the blockchain is extended to include and coordinate external organizations. From a technical point of view, this means setting up new nodes in the network. This strategic move is beneficial as a gateway for network effects, as other organizations can be integrated quickly through open standards. Connecting is valuable for obtaining feedback from participating organizations or simply for growing the size of the network once a desirable level of maturity is reached. Since connecting involves external organizations, it is important to keep in mind that the alignment of activities, processes, and adjustments becomes much more complex. Another disadvantage is that connecting can lead to conflicts around decisions previously made for an isolated organization, e.g., when defining common standards. Connecting is quite common, as shown by the example of the "Trust Your Supplier" blockchain, first built by IBM, before other organizations such as Anheuser-Busch InBev, Cisco, Lenovo and Vodafone were connected (Ledger Insights, 2019a).

In contrast, "isolating" is a strategic move that reduces dependencies of organizations on the outside and instead focuses future design and development on coordinative actions on the inside. Isolation has the advantage of allowing organizations to focus on their own operational needs first and pause expansion to others. This strategy is useful for testing blockchain adoption internally before involving other parties. For example, after early test runs with a few organizations, it may be beneficial to return to using the blockchain internally before involving more external organizations. Managers who pursue an isolation move should consider that they are effectively foregoing growth potentials through network effects, as they are excluding other organizations from joining. Also, when multiple organizations pursue their own blockchains in isolation, they are contributing to market fragmentation, in which there are many small networks with proprietary standards rather than a single network that is interoperable and closely aligned. The move should also be taken with a grain of salt, as organizations that were previously involved in the network could be alienated if development work continues internally. For this reason, we see isolating as a more radical approach that only applies to certain contexts in early stages of blockchain projects. For instance, a manager of an early-stage healthcare blockchain relayed to us the difficulties in keeping organizations engaged, which warranted an isolation move. After the founder carried out initial tests ("pilots") with other prominent healthcare organizations, the organizations involved in the tests could not be converted to sponsors. The concerns of the involved organizations had to do with the founder's governance structure, i.e., "getting everyone to agree and setting up the governance based on our pilot," as the manager recalled. The founder then concentrated on activities in-house and continued working on the blockchain governance approach internally before approaching external organizations again.

(3) Loosening and (4) Tightening

> Some clients participated in the network to gain trust and transparency, but it is really difficult to get these clients to agree to share their data in any supply chain. I think from the start, it really should have been the expectation, if they want to be part of a blockchain network, where you're going to be increasing transparency and sharing data, that you will have to share it, obviously in a super secure way. That's definitely a key part of collaborating on the blockchain network. – Manager of travel and transportation blockchain

In addition to the connecting-isolating spectrum, strategic moves around "loosening" and "tightening" control are also conceivable. Loosening describes a move in which control is relinquished to other organizations in the governance structure, e.g., to facilitate more open, mutual decisions around participation and information sharing, funding and decision authority, and dispute resolution. This move is beneficial for giving network-critical organizations a seat at the table and ensuring that decisions gain consensus. Loosening also has the advantage of stopping siloed implementation activities that may not be appropriate for the rest of the network. However, loosening carries a general risk because each organization must disclose what is "under the hood" to participate. The decision also comes with the pitfall that once other entities are involved, the speed of implementation to get a working solution off the ground slows down due to communication costs. The loosening move is one we have seen with TradeLens, which relinquished control to a broader network of ocean carriers.

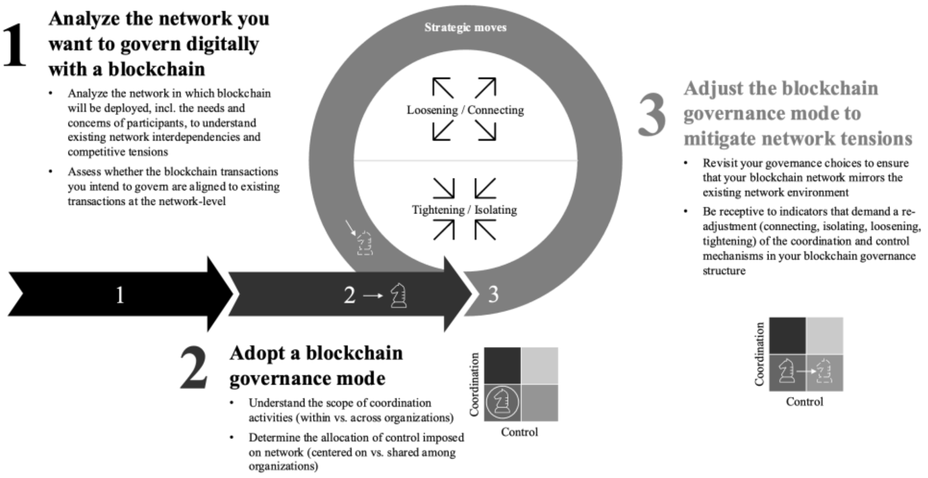
At the opposite end, "tightening" is a move in which control over blockchain activities is concentrated in one or a few network organizations. Tightening is advantageous in situations where organizations want to regain control over design, implementation, operation, or customization decisions, for instance when developments take unfavorable turns. Tightening can also contribute to higher implementation speed, as decisions can be made centrally and thus with higher autonomy. Yet, tightening control typically makes it more difficult for other organizations to integrate with a blockchain. This is because tightening control can lead to a lack of exchange and emerging friction between network participants—especially among competitors—which can prevent adaptation processes and joint value creation. Particularly problematic is that the focal organization with a firm grip on the blockchain network can more easily act opportunistically and prioritize its own interests (e.g., by preferring proprietary solutions) at the expense of other network participants. Fear of opportunistic behavior and lopsided value creation can alienate network participants, slow growth, and prevent the network from reaching its full value potential. This type of bias toward a single dominant entity can be criticized by external organizations that demand a neutral solution. Tightening control was used as a strategic move by a manager of a banking blockchain that decided to "run their own blockchain, internally for themselves under their control," after working with a consulting partner.

Each of these four strategic moves can be considered in certain combinations. For instance, loosening control may often coincide with connecting other organizations, as linking and coordinating more competitors to the blockchain might demand a shared control approach. Alternatively, tightening control can go hand in hand with isolating coordination activities. This may inherently occur when organizations drop out of a network and development activities continue internally. When combined, however, some of the moves can also become grounds for conflict. Take, for example, an organization tightening control of the network, while simultaneously connecting new organizations to it. In this case, the tight control structure would dilute the potential for other organizations to join, as new joiners could rally against the firm control structure and demand an equal seat at the table. It is important for managers to weigh the benefits and downsides of these possible moves and combinations as they approach blockchain governance strategically.

7.6.2 Bottom Line: The Blockchain Governance Journey

Notably, it is unlikely that there is a universal approach to blockchain governance, and managers must match governance decisions to the specific circumstances and dynamics they encounter. To support managers in making these complex decisions, we close by proposing an overarching process model that can help managers navigate their blockchain governance journey. We illustrate this process model in Figure 7.2 as a synthesis of the testimonies from dozens of managers who have gone through blockchain adaptation processes. It is important to note that the adjustments are primarily administrative changes, and the technical layer only needs to be adjusted in some cases, e.g., in the case where a blockchain needs to expand the intra-organizational focus to include inter-organizational collaboration and thus additional nodes need to be accounted for in the system. Or, in instances when selected governance issues happen “on-chain,” as is the case with token-weighted voting (Tsoukalas & Falk, 2020). Most of the time, however, the adjustments in the coordination and control mechanisms relate to the supporting administrative processes.

Figure 7.2: The Blockchain Governance Journey



1. Analyze the network you want to govern digitally with a blockchain

> I think it's more meaningful to look across the network that you're looking to establish. Who has the leverage, the influence, and the market share to be able to drive a change in the ecosystem? – Project manager of banking blockchain

Managers need to carefully analyze the existing network their blockchain is meant to govern to understand network interdependencies and anticipate possible competitive tensions in advance. While some networks might facilitate high dispersion of transactions, others might have few dominant players that absorb the majority of the transactions. Managers should account for these network dynamics early on to avoid choosing an inadequate governance mode that might alienate critical network participants. This can be achieved through in-depth analysis and mapping of existing network interdependencies within and across the organization that might conflict with the blockchain network. We also recommend assessing whether the blockchain transactions that will be governed are aligned to existing transactions at the network level. A lack of network analysis beforehand will lead to adverse effects, such as deficient or even failed blockchain governance with negative implications for network growth and performance.

2. Adopt a blockchain governance mode

> Right from the beginning, we made clear what information needs to be shared and what information should not be shared. So, that means that confidentiality and how to classify information were truly important things and [were discussed] upfront with all the parties. – Consultant of banking blockchain

Managers should introduce one of the four governance modes that ideally matches and corresponds to existing coordination and control dynamics. For instance, trying to introduce a custodian mode, even though there are plenty of powerful incumbents in the network, might jeopardize the network's success because crucial participants feel isolated and do not join. Instead, a consortium approach might be more suitable, as such an approach disperses control among more organizations that should have a voice. Choosing the appropriate governance mode requires two important activities at the top management level: first, understanding the scope of coordination activities (within vs. across organizations) and second, determining the allocation of control imposed on the network (shared among vs. centered on organizations). Trying to use a blockchain governance mode that does not match the underlying characteristics of a network often leads to debilitating bureaucracy, alienated network participants, antitrust and legal issues, and ultimately, lagging network growth.

3. Adjust the blockchain governance mode to mitigate network tensions

> The most important lesson I think I learned in this long project is that while it's nice to have a structure, it needs to be adjusted every time. – Manager of transportation blockchain

Blockchain governance is a dynamic game. Rarely will organizations have all the right information on network composition and governance expertise at hand to make the perfect governance call at the onset. Networks are dynamic by nature, which means that their governance should evolve along with them. In this regard, it is crucial that managers stay alert to changes and tailor blockchain governance to the shifting needs of the network. Organizations that start with a particular governance mode might find, after some time, that it is best to tighten or loosen control to better align to network requirements and to limit or expand the scope covered by the blockchain. Managers need to anticipate such dynamics and critically revisit their governance choices to ensure that they meet the requirements of the network environment and secure network growth. We recommend managers be receptive to indicators that demand adjustment and readjustment of the coordination and control mechanisms in the implemented blockchain governance structure, using our four strategic moves—connecting, isolating, loosening, tightening—as a baseline.

7.7 Conclusion

Blockchain is fraught with hype (Cheng et al., 2019; Madnick, 2019). As organizations test blockchain technology and learn how to apply it to their specific organizational contexts, a game of natural selection will reveal which solutions prosper and which solutions fail (Gartner, 2019). The governance of blockchains will be a critical factor in determining which companies benefit from the new technological opportunities. Regardless of whether organizations build or join blockchains (Rauchs, Blandin, Bear, & McKeon, 2019), or find themselves in a mélange of both, the governance of blockchains should always be seen as a strategic imperative; one that influences aspects such as blockchain investments, how they are made, and among which organizations they are best used. Blockchain initiators who pay careful attention to blockchain governance and thus are sensitive to the needs of participants can create higher network value. In doing so, they uncover potential conflicts between network members early, which they then collaboratively address with greater precision and economic efficiency. Organizations that manage to move from siloed and competitive thinking to cross-organizational collaboration have the best chance of successful blockchain deployment with enduring growth.

We believe that the governance of blockchain is one of the most critical ingredients to overall blockchain success. Using our framework, managers can assess how to address various blockchain governance challenges and choose the appropriate governance mode to support successful transactions. Most importantly, we urge managers to consider the governance mode that adequately reflects their coordination and control needs (chief, clan, custodian, or consortium) and be prepared to adjust their choice (by connecting, isolating, loosening, tightening) as the composition of the network changes.

Our framework also holds significant theoretical value for the emerging literature on enterprise blockchains in the management field. We advance the literature on blockchains by showing that blockchains are by no means self-sufficient governance solutions that exist independently alongside traditional governance forms such as contracts, administrative controls, and relational mechanisms such as trust (Chen, Yi, Li, & Tong, 2021a; Lumineau et al., 2021; Murray et al., 2021). Instead, blockchains require well-designed supporting governance structures, such as dedicated administrative interfaces and clear decision-making processes, to be viable solutions in the business contexts where permissioned blockchain solutions prevail (Hsieh et al., 2017; Zavolokina et al., 2020). Our framework can serve as a valuable typology in this regard, providing more nuance beyond existing technological distinctions such as those between permissioned and permissionless blockchains. Moreover, we highlight that blockchain governance is subject to frequent adjustments as the composition of the network changes over time, leading to mismatches between the evolved network and its original governance. Therefore, our study also invites scholars to revisit the blockchain phenomenon to understand the antecedents and consequences of blockchain governance decisions and adaptations (Clohessy et al., 2020).

We close by issuing a word of caution: Even though blockchain governance is a core component of overall blockchain success, the need to think about other intersecting areas, such as use cases, business value, and technological feature, remains critical (Schmeiss et al., 2019). We therefore propose that managers see our governance approach as a complementary framework to existing blockchain thought leadership. Regardless of where you stand in your blockchain journey, the governance challenge will remain vital.

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SUMMARY (ENGLISH)

Amidst the pressures and opportunities of digital transformation, organizations are embracing innovative governance forms that complement or automate existing ones. In response, the chapters that constitute this dissertation demark the critical role of *digital governance* in facilitating digitally enabled exchange relationships inside and across organizations. To provide a comprehensive framework for demystifying digital governance, I first present a typology of analog, augmented, and automated governance modes, each characterized by specific control, coordination, incentive, and trust mechanisms (Chapter 2).

Building on this conceptual groundwork, I then explore blockchain technology as a central opportunity for organizations to implement digital governance. By leveraging the transparent, immutable, and distributed nature of blockchain technology, organizations can arrange trustless exchanges, reduce transaction costs, and enforce rules and agreements in a more efficient and secure manner. My multifaceted investigation explores both intra- and interorganizational aspects of blockchain governance, revealing intriguing trade-offs in each setting.

From an *intraorganizational* standpoint, I argue that blockchains establish direct and sequenced information channels among principals and agents, leading to organizational reconfiguration through vertical disintermediation and lateral reintermediation. While vertical disintermediation brings a flatter organizational structure with increased

efficiency, it also leads to higher cognitive load due to higher information volume. On the other hand, lateral reintermediation introduces new ways of monitoring and incentives for information sharing, but at the expense of rigidity and strict lateral sequencing of information (Chapter 3).

From an *interorganizational* perspective, examining 128 blockchains, I uncover a critical trade-off faced by founders concerning the choice of hybrid governance solutions atop the algorithmic governance layer, offering a balance between centralized and decentralized control. Specifically, founders tend to favor consortia as hybrid forms of administrative control in response to high costs of coordination and opportunism (Chapter 4). In another study, I highlight the “lead organization paradox” observed when founders dominate a blockchain network for rapid adoption, leading to alienated competition unwilling to participate. Based on 66 interviews, an in-depth analysis of a prominent enterprise blockchain showcases the role of this paradox and the founders' failure to anticipate and address its effects, ultimately leading to a collapse (Chapter 5). Additionally, based on 57 interviews across three cases that discontinued, continued, and stagnated, I explore the impact of initial imprints from focal founders within blockchain networks, affecting consequential governance choices and sparking conflicts during adaptation processes (Chapter 6).

For managerial practice, interviews with 153 blockchain executives echo the importance of “getting the governance right” in intra- and interorganizational blockchain contexts. Based on these findings, I propose four generic governance modes—chief, clan, custodian, and consortium—to address coordination and control needs in blockchain networks, along with four strategic moves—connecting, isolating, loosening, and tightening—to navigate blockchain governance challenges (Chapter 7).

In sum, my studies advance the governance literature by defining digital governance as a distinct form and outlining key governance mechanisms and choices in the digital era. Moreover, my work constitutes a significant contribution to the field of intra- and interorganizational governance and the emerging blockchain literature, with valuable insights for both academics and practitioners navigating the complexities of governance in the digital age.

SUMMARY (DUTCH)

Te midden van de druk en mogelijkheden van digitale transformatie omarmen organisaties innovatieve bestuursvormen die bestaande bestuursvormen aanvullen of automatiseren. In antwoord hierop wordt in de hoofdstukken van dit proefschrift de cruciale rol van digitale governance bij het faciliteren van digitaal mogelijk gemaakte uitwisselingsrelaties binnen en tussen organisaties beschreven. Om een uitgebreid kader te bieden voor het demystificeren van digitaal bestuur, presenteer ik eerst een typologie van analoge, verrijkte en geautomatiseerde bestuursvormen, elk gekenmerkt door specifieke controle-, coördinatie-, stimulerings- en vertrouwensmechanismen (hoofdstuk 2).

Voortbouwend op deze conceptuele basis, onderzoek ik vervolgens blockchaintechnologie als een centrale mogelijkheid voor organisaties om digitaal bestuur te implementeren. Door gebruik te maken van de transparante, onveranderlijke en gedistribueerde aard van blockchaintechnologie kunnen organisaties vertrouwensloze uitwisselingen regelen, transactiekosten verlagen en regels en afspraken op een efficiëntere en veiligere manier afdwingen. Mijn veelzijdige onderzoek verkent zowel intra- als interorganisatorische aspecten van blockchain governance en onthult intrigerende afwegingen in elke setting.

Vanuit een *intraorganisatorisch* standpunt stel ik dat blockchains directe en opeenvolgende informatiekanalen tot stand brengen tussen principalen en agenten, wat leidt tot organisatorische herconfiguratie door

verticale disintermediatie en laterale herintermediatie. Hoewel verticale disintermediatie zorgt voor een plattere organisatiestructuur met verhoogde efficiëntie, leidt het ook tot een hogere cognitieve belasting vanwege het grotere informatievolume. Aan de andere kant introduceert laterale herintermediatie nieuwe manieren van monitoren en prikkels voor het delen van informatie, maar dit gaat ten koste van rigiditeit en een strikte laterale opeenvolging van informatie (hoofdstuk 3).

Vanuit een *interorganisatorisch* perspectief, waarbij ik 128 blockchains analyseer, onthul ik een kritieke trade-off voor oprichters betreffende de keuze tussen hybride bestuursvormen boven op de algoritmische bestuurslaag, resulterend in een balans tussen gecentraliseerde en gedecentraliseerde controle. Specifiek, geven oprichters de voorkeur aan consortia als hybride vormen van administratieve controle als response op hoge coördinatiekosten en opportunisme (hoofdstuk 4).

In een ander onderzoek benadruk ik de "lead organisation paradox" die wordt waargenomen wanneer oprichters een blockchainnetwerk domineren voor snelle adoptie, wat leidt tot vervreemde concurrentie die niet wil deelnemen. Op basis van 66 interviews toont een diepgaande analyse van een prominente blockchain-case van ondernemingen de rol van deze paradox en het falen van de oprichters om te anticiperen op de effecten ervan en deze aan te pakken, wat uiteindelijk leidde tot een ineenstorting (hoofdstuk 5). Daarnaast onderzoek ik, op basis van 57 interviews over drie cases die stopten, doorgingen of stagneerden, de impact van initiële imprints van focale oprichters binnen blockchainnetwerken, die consequent bestuurlijke keuzes beïnvloeden en conflicten aanwakkeren tijdens aanpassingsprocessen (hoofdstuk 6).Voor de managementpraktijk geven interviews met 153 blockchain executives het belang aan van "het juiste bestuur" in intra- en interorganisatorische blockchaincontexten. Op basis van deze bevindingen stel ik vier generieke governancemodi voor: ‘chief’, ‘clan’, ‘custodian’ en ‘consortium’ om te voorzien in de behoefte aan coördinatie en controle in blockchainnetwerken, samen met vier strategische stappen: ‘connecting’, ‘isolating’, ‘loosening’, and ‘tightening’ om uitdagingen op het gebied van blockchaingovernance te navigeren (hoofdstuk 7).

Kortom, dit proefschrift levert een bijdrage aan de governance literatuur door digitale governance te definiëren als een aparte vorm van besturen en de belangrijkste governancemechanismen en -keuzes in het digitale tijdperk te schetsen. Bovendien vormt mijn werk een belangrijke bijdrage aan het veld van intra- en interorganisationeel bestuur en de opkomende blockchainliteratuur, met waardevolle inzichten voor zowel academici als practici die navigeren door de complexiteit van bestuur in het digitale tijdperk.

ABOUT THE AUTHOR

Curtis Meloy Goldsby (1992), born in New York City, obtained his MSc degree with distinction from the London School of Economics and Political Science in 2017. He started his journey toward Doctor of Philosophy in the Technology and Operations Management department of Rotterdam School of Management, Erasmus University, in September 2019, working together with his promoter, Prof. dr. Jan van den Ende, and his daily supervisors, dr. Helge Klapper and dr. Marvin Hanisch. Curtis studies how complex intra- and interorganizational networks are governed by forms of digital governance, including blockchains and platforms.

In his PhD pursuit, Curtis has presented his research at esteemed international conferences, such as the *Academy of Management Annual Meeting* (in 2021, 2022, and 2023), *Strategic Management Society* (in 2021 and 2022), *European Academy of Management* (in 2022), and *Strategy Science* (in 2023). His work has earned him best paper awards from the first two conferences mentioned. Curtis has published in outlets such as the *California Management Review* and the *Journal of Business Research*. His other articles are currently under review in top management journals.

During his PhD, Curtis held several consulting positions at the technology company IBM, where he combined his research interest for digital governance with cross-sector engagements for DAX 30 clients. At the time of completing his PhD, Curtis led the automotive consulting team for IBM Enterprise Strategy in Germany.

PORTFOLIO

Education

2019-2024	PhD in Management *Rotterdam School of Management, Erasmus University*, The Netherlands Dissertation title: Demystifying Digital Governance: Exploring the Mechanisms and Trade-offs of Blockchains for Organizations
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2012-2015	BA in International Business *Cologne Business School*, Germany

Research & Teaching Interests

blockchains, blockchain governance, corporate governance, digital governance, digital platforms, interorganizational governance, intraorganizational governance, metaverse, platform governance

Publications

Hanisch, M., Goldsby, C.M., Theodosiadis, V. (2023). With peer-to-peer transactions, will the metaverse render the platform business model obsolete? ***LSE Business Review***.

Goldsby, C.M., Hanisch, M. (2023). Agency in the Algorithmic Age: The Mechanisms and Structures of Blockchain-Based Organizing. ***Journal of Business Research,*** *168*, doi:10.1016/j.jbusres.2023.114195.

Hanisch, M., Goldsby, C.M., Fabian, N.E., Oehmichen, J. (2023). Digital Governance: A Conceptual Framework and Research Agenda. ***Journal of Business Research***, *162*, doi:10.1016/j.jbusres.2023.113777.

Goldsby, C.M., Hanisch, M. (2022). The Boon and Bane of Blockchain: Getting the Governance Right. ***California Management Review***, 64(3):141-168.

Awards & Recognition

2023	Nominations for **Best Paper Prize** and **Best PhD Paper** for “The Hidden Hand of Imprinting: Unraveling Governance Challenges in Interorganizational Blockchain Networks” *Strategic Management Society*
2023	**Distinguished Paper Award** from the AOM Strategic Management Division (STR) for “The Hidden Influences of Blockchain Governance: A Study of Organizational Imprinting” *Academy of Management*
2021	**Best Paper Award** for “Platforms, Blockchains, and Hybrids: Digital Governance of Interorganizational Networks” *Strategic Management Society*

Conference Presentations & Working Papers

The Hidden Influences of Blockchain Governance: A Study of Organizational Imprinting
Presented at:

- 83rd Annual Meeting of the *Academy of Management* (AOM), 2023, Boston, Massachusetts, USA, doi:10.5465/AMPROC.2023.211bp
- 43rd Annual Conference of the *Strategic Management Society*, 2023, (SMS), Toronto, Canada
- *Strategy Science* Conference, 2023, Munich, Germany

Digital Governance: A Conceptual Framework and Research Agenda
Presented at:

- Digital Knowledge Engineering for Strategy Development, 2022, Groningen, The Netherlands
- Published in *Journal of Business Research*

Agency in the Algorithmic Age: The Mechanisms and Structures of Blockchain-Based Organizing
Presented at:

- *European Academy of Management* (EURAM), 2022, Winterthur, Switzerland
- Published in *Journal of Business Research*

Walking a Tightrope: Balancing Centralization and Decentralization in Enterprise Blockchain Networks
Presented at:

- 82nd Annual Meeting of the *Academy of Management* (AOM), 2022, Seattle, Washington, USA, doi:10.5465/AMBPP.2022.13285abstract
- 42nd Annual Conference of the *Strategic Management Society* (SMS), 2022, London, UK
- *Strategic Management Society* (SMS) Special Conference, 2022, Milan, Italy

Conference Presentations & Working Papers – continued

Platforms, Blockchains, and Hybrids: Digital Governance of Interorganizational Networks

Presented at:

- 81st Annual Meeting of the *Academy of Management* (AOM), 2021, Virtual, doi:10.5465/AMBPP.2021.10541abstract
- 41st Annual Conference of the *Strategic Management Society* (SMS), 2021, Virtual

Professional Service

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Dissertations

1. Duijm, P., *On the Cyclical Nature of Finance: The role and impact of financial institutions,* Supervisors: Prof. D. Schoenmaker & Prof. W.B. Wagner

2. Maas, S.A., *In the Moment of Giving: Essays on contemporary forms of private and corporate philanthropy,* Supervisors: Prof. L.C.P.M. Meijs & Prof. J.P. Cornelissen

3. Langenbusch, C., *A lot to lose. Organizational identity and emotions in institutional contexts*, Supervisors: Prof. J.P. Cornelissen & Prof. G. Jacobs

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6. Heeren, J.W.J., *Management Innovation in the Military, Practice Adaptation Processes and Innovation Performance Consequences: Solving the Paradox between Institutional Pressure, Rational Motivation and Implementation Misfit*, Promotors: Prof. H.W. Volberda & Prof. V.J.A van de Vrande, Co-supervisor: Dr. E.J. de Waard

7. Caballero Santin, J.A., *Stunted Innovation: How large incumbent Companies Fail in the Era of Supply Chain Digitization*, Supervisor: Prof. ir. J.C.M. van den Ende, Co-supervisor: Dr. M. Stevens

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11. Jakobs, K., *ICT Standardisation Management*: *A multidimensional perspective on company participation in standardization committees*, Supervisors: Prof.dr.ir. H.J. de Vries & Prof. K. Blind

Amid digital transformation, organizations are adopting innovative governance forms to complement or automate existing structures. This dissertation highlights the role of digital governance in facilitating digital exchange relationships within and among organizations. First, a typology of *digital governance* is introduced, comprising *analog, augmented,* and *automated* governance forms, each with distinct control, coordination, incentive, and trust mechanisms. Second, the dissertation explores blockchain technology as a key opportunity to implement digital governance within and among organizations, allowing trustless exchanges between actors, independence from costly intermediaries, and rule-based automation to reach consensus.

Within organizations, blockchains create direct information channels between principals and agents, impacting organizational structures in two ways. Vertical disintermediation streamlines structures, resulting in increased cognitive load due to growing information. By contrast, lateral reintermediation introduces new monitoring and incentive mechanisms but sacrifices flexibility for strict lateral sequencing.

Among organizations, founders face three pertinent blockchain governance trade-offs: (1) selecting the ideal combination of analog and automated governance mechanisms; (2) maintaining the delicate balance between exerting tight control versus driving network adoption, and; (3) weighing the inherent trade-off between rigidity and dynamism that can arise from deeply engrained founder imprints.

Overall, this research contributes to governance literature by defining digital governance as a distinct form, elucidating key mechanisms and trade-offs related to blockchains, and adding valuable insights for both academics and practitioners grappling with digital governance complexities. More broadly, this dissertation contributes to the discussion about digital transformation by shifting the focus from organizational processes and business models to digital governance.

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This PhD thesis is a result of ERIM's Part-Time PhD Programme in Business and Management. Over the course of 5 years, part-time PhD candidates conduct research against the highest academic standards on topics with real-world application value, undergo training under the supervision of distinguished academic experts, and participate in international conferences – thereby creating a significant contribution to EUR's mission to make a positive societal impact.

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