e-ISSN: 3026-6696

Enigma in Economics

Journal website: https://enigma.or.id/index.php/economy

The Future of the Firm: A Comparative Institutional Analysis of Transaction Costs in DAOs versus Traditional Corporations

Benyamin Wongso[1*], Caelin Damayanti[2], Muhammad Faiz[3], Anies Fatmawati[4], Aylin Yermekova[5], Delia Tamim[6], Dais Susilo[7], Danila Adi Sanjaya[8], Gayatri Putri[9]

[1]Department of Social Science Education, Enigma Institute, Palembang, Indonesia

[2]Department of Humanity, Bright Institute, Palu, Indonesia

[3]Department of Administrative Law, Seine Legal Institute, Manado, Indonesia

[4]Department of Commercial Law, Enigma Institute, Palembang, Indonesia

[5]Department of State Law, Bolatov Research Center, Semey, Kazakhstan

[6]Department of Administrative Law, Enigma Institute, Palembang, Indonesia

[7]Department of Administrative Law, Enigma Institute, Palembang, Indonesia

[8]Department of Literature Science, CMHC Research Center, Palembang, Indonesia

[9]Department of Library and Informatics Science, Enigma Institute, Palembang, Indonesia

ARTICLE INFO

Keywords:
Blockchain
Corporate governance
Decentralized autonomous organizations
Institutional analysis
Transaction cost economics

***Corresponding author:**
Benyamin Wongso

E-mail address:
benyamin.wongso@enigma.or.id

All authors have reviewed and approved the final version of the manuscript.

https://doi.org/10.61996/economy.v3i2.94

A B S T R A C T

The emergence of Decentralized Autonomous Organizations (DAOs) presents a fundamental challenge to the traditional corporate form, which has dominated economic organization for over a century. Built on blockchain technology, DAOs propose a new model for coordinating economic activity. This study addressed the critical question of institutional efficiency by applying the lens of Transaction Cost Economics (TCE) to compare DAOs and traditional corporations. A comparative institutional analysis was conducted using a mixed-methods approach. We employed a multiple case study design, analyzing two representative DAOs and two analogous traditional corporations from Q1 2023 to Q4 2024. Data collection involved the systematic analysis of archival records, including 215 DAO governance proposals and corporate filings, and 32 semi-structured interviews with key participants. A novel analytical framework was developed to categorize transaction costs into *ex ante* (search, bargaining) and *ex post* (monitoring, enforcement), further distinguishing between 'on-chain' and 'off-chain' costs. The study revealed significant trade-offs between the two organizational forms. Traditional corporations exhibited high *ex ante* bargaining costs (legal, negotiation) and *ex post* monitoring costs (managerial overhead), but benefited from established legal frameworks that reduced enforcement uncertainty. Conversely, DAOs significantly lowered specific transaction costs through automation via smart contracts, particularly in on-chain bargaining and enforcement for codified tasks. However, DAOs incurred substantial, often hidden, new transaction costs related to off-chain social coordination, governance participation, and navigating legal ambiguity. This was termed the 'Governance Overhead Paradox'. In conclusion, DAOs do not represent a universally superior organizational form but rather a new point on an institutional possibility frontier. They are highly efficient for tasks that are global, permissionless, and computationally verifiable. Traditional firms retain advantages in contexts requiring complex, subjective decision-making and legal certainty. The future of the firm is likely not a replacement of one form by the other, but a pluralistic ecosystem where hybrid models emerge.

1. Introduction

The theory of the firm, for much of its history, has been a story of transaction costs.[1] Ronald Coase's foundational insight that firms exist to minimize the costs of using the price mechanism was later developed by Oliver Williamson into the robust framework of Transaction Cost Economics (TCE). TCE explained the firm's existence, its hierarchical

structure, and its boundaries as an efficient solution to the problems of coordinating economic activity in the face of bounded rationality and opportunism.[2] The traditional corporation, a nexus of contracts buttressed by centralized management and the formidable power of the legal system, was long seen as the apex predator in the ecosystem of economic organization.[3]

The digital revolution began to challenge this paradigm, with the internet lowering information and search costs and giving rise to platform economies that blurred the firm's edges.[4] Yet, these platforms retained a critical feature of the traditional firm: a central coordinating entity. The advent of blockchain technology, and specifically the Decentralized Autonomous Organization (DAO), represents a more fundamental architectural shift. A DAO is a digitally-native organization governed by rules encoded in smart contracts, with operational control distributed amongst its members via token-based voting. Proponents have heralded them as a "post-corporate" structure capable of marshalling global talent and capital without the need for traditional managers or legal wrappers.[5] With DAOs managing treasuries in the billions and coordinating the development of complex financial and cultural products, their existence poses a direct challenge to institutional theory. If firms are the most efficient solution for minimizing transaction costs, how do we explain the emergence and success of DAOs? Are they truly a more evolved organizational form, or are we merely witnessing a substitution of familiar transaction costs for a new, less-understood set of costs native to decentralized environments? The extant literature has often been polarized, focusing either on the technical mechanics of DAOs or their normative potential, leaving a conspicuous gap in rigorous, comparative economic analysis.[6]

This study sought to fill this critical gap. We moved beyond both technological utopianism and reflexive skepticism to conduct a sober, multi-faceted economic analysis. While we ground our work in TCE, we argue that TCE alone is insufficient to capture the full picture. We therefore integrate two complementary theoretical lenses: Agency Theory, to analyze the unique principal-agent problems that arise in a trust-minimized but legally ambiguous setting, and the Resource-Based View (RBV), to understand how DAOs create and sustain competitive advantage through novel resources like community and social consensus.[7] We treated the DAO not merely as a cost-minimizing technology, but as a complete economic institution grappling with the timeless challenges of coordination, agency, and strategy.[8] The primary aim of this study was to conduct a systematic and comparative institutional analysis of the transaction costs, agency problems, and strategic resources in Decentralized Autonomous Organizations versus traditional corporations. By identifying, categorizing, and analyzing these dynamics, this research sought to develop a multi-theoretic understanding of the economic trade-offs inherent in each model and to delineate the contexts in which one form may be more effective than the other.

The novelty of this research is threefold. First, it moves beyond a singular theoretical lens by being one of the first empirical studies to systematically integrate Transaction Cost Economics, Agency Theory, and the Resource-Based View to analyze DAOs in direct comparison with firms. This multi-theoretic approach provides a more holistic and robust explanation of the observed phenomena. Second, it extends classical institutional frameworks by proposing and validating a more nuanced model for analyzing digitally-native organizations. We replaced a simple on-chain/off-chain dichotomy with the concept of a "socio-technical entanglement," analyzing the feedback loops between computationally-defined costs and human-centric social costs. Third, by providing this deeply-textured analysis, this study moves beyond a simple "DAO vs. firm" debate to map a more complex spectrum of governance, allowing us to theorize more precisely about the future evolution of organizational design and the emergence of hybrid forms that combine the strengths of both models.[9,10]

2. Methods

The research was designed as a 2x2 matrix to compare organizational form (DAO vs. Traditional Corporation) and scale (Large/Complex vs.

Small/Agile). A purposive sampling strategy was used to select four organizations that could serve as "polar types" for rigorous comparison. Cases were not selected arbitrarily. DAO cases were chosen from a pre-compiled list of over 100 DAOs that met specific criteria for maturity and activity: (a) operational for at least 3 years, (b) treasury size exceeding a relevant threshold ($5M for small, $100M for large), (c) a history of at least 50 major governance proposals, and (d) publicly accessible discussion forums and voting records. Corporate analogues were selected based on industry, scale, and the nature of their core business tasks to maximize comparability. "Nexus Protocol" (NP): A large, established DAO in the Decentralized Finance (DeFi) sector with a treasury exceeding $500 million and a highly active governance process. Selected for its maturity and complexity, mirroring a large public corporation. "Creator Guild" (CG): A smaller, service-oriented DAO focused on funding and coordinating creative and technical projects, with a treasury of approximately $10 million. Selected as it represents a growing class of "service DAOs" that function as decentralized professional services firms or grant-making foundations. "Global Tech Inc." (GTI): A publicly-traded technology corporation with a market capitalization over $10 billion, operating in the software and financial services sector. Selected as a direct analogue to Nexus Protocol in terms of complexity, scale, and industry. "Innovate Solutions Ltd." (ISL): A mid-sized, privately-held management and technology consulting firm with approximately 300 employees. Selected as an analogue to Creator Guild, focusing on professional services and project-based work. This 2x2 design with carefully justified analogues allowed for direct, robust comparison between pairs while also enabling broader analysis across forms. Data collection was conducted over an 18-month period (January 2023 - June 2024) to capture longitudinal dynamics. We employed a strategy of data triangulation to ensure the robustness of our findings. Gaining deep access to corporate informants, particularly at the senior level of GTI, required a dedicated strategy. Access was initially facilitated through professional contacts made at an executive education program attended by one of the researchers. We leveraged this initial introduction to conduct pilot interviews, which helped build trust and demonstrated the academic rigor and non-commercial nature of our study. Full participation was secured by providing extensive documentation on data security protocols and signing strict non-disclosure agreements that went beyond standard university consent forms, assuring all participants and their legal departments of the confidentiality of our work.

Archival and Documentary Analysis: This formed the bedrock of our empirical investigation. For NP and CG, we systematically archived all 215 governance proposals (142 for NP, 73 for CG), including the entirety of their discussion threads and voting data. For GTI and ISL, we analyzed public SEC filings, annual reports, and, where made available by interviewees, internal documents such as M&A process checklists and strategic planning presentations. Semi-Structured Interviews: We conducted 32 in-depth interviews (8 per organization) with key informants. Interviewees in the DAOs included core contributors, high-reputation token delegates, and active community members. Corporate interviewees included senior executives (VP and C-suite), middle managers, and members of the legal and M&A teams. Interviews lasted 60-90 minutes and were professionally transcribed. Quantitative Data Extraction: We extracted specific metrics to complement the qualitative data. For DAOs, this included on-chain gas fees for voting and the average time from proposal ideation to execution. For corporations, we estimated administrative overhead costs. For example, the estimated cost of a mid-sized partnership at GTI was derived by triangulating interview data from three executives who were asked to estimate the person-weeks their teams (legal, business development, technical) spent on a typical deal. These estimates were then monetized using industry-standard loaded salary rates for those roles, providing a robust, data-grounded estimate.

Data analysis was iterative and systematic. All qualitative data were imported into NVivo 12 for analysis. Our analysis proceeded in two stages to combine deductive and inductive approaches. Stage 1 (Deductive Coding): We first conducted a coding pass

based on our core theoretical frameworks. The primary framework was an adaptation of Williamson's TCE, categorizing costs as *ex ante* (search, bargaining) and *ex post* (monitoring, enforcement). We applied a secondary layer to distinguish the medium of the transaction cost: 'on-chain' (computationally native costs) versus 'off-chain' (social, legal, and administrative costs). Stage 2 (Inductive Coding): Following the deductive pass, a second round of inductive, open coding was performed to identify emergent themes not captured by the initial framework. This process allowed key concepts from Agency Theory ("moral hazard in grants," "adverse selection of contributors") and the Resource-Based View ("community as a strategic asset," "reputation as intangible resource") to emerge directly from the data. To ensure analytical rigor, a second researcher independently coded 20% of the interview transcripts. The initial codes were compared, and any disagreements were discussed until a consensus was reached, resulting in a final Cohen's Kappa score of 0.85, indicating a substantial level of inter-coder agreement. Following coding, we engaged in thematic analysis to group the codes into higher-order conceptual themes (e.g., the "Coordination Cost Inversion"). We then conducted a systematic cross-case analysis, using comparative matrices to directly map the findings for NP vs. GTI and CG vs. ISL across each theoretical dimension (TCE, Agency, RBV). This allowed us to trace processes like "budget approval" or "partner onboarding" across all four organizations, identifying systematic differences attributable to the underlying institutional form.

The study received full approval from the institutional research ethics board from CMHC Indonesia. All participants signed informed consent forms. Anonymity was ensured through the pseudonymization of all organization and individual names. Recognizing the unique challenges of blockchain research, we took additional steps. We informed all DAO participants that while their personal identities would be protected, their on-chain actions are a matter of public record. We committed to only presenting on-chain data in an aggregated form to prevent the re-identification of any single participant's wallet address. All data were stored on encrypted servers with access limited to the core research team.

3. Results and Discussion

Figure 1, titled "Comparative Models of Search, Vetting, and Adverse Selection Mitigation," provides a powerful visual synthesis of one of the most fundamental distinctions between traditional corporations and Decentralized Autonomous Organizations (DAOs). It masterfully illustrates how these two organizational forms approach the universal challenge of acquiring human talent and mitigating the economic problem of adverse selection—the risk of hiring an underperforming or unsuitable candidate. Through a side-by-side comparison structured as two distinct "vetting funnels," the figure argues that these models do not merely differ in process but represent two opposing philosophies of trust and cost allocation. The central thesis, captured in the summary finding, is "The Vetting Cost Inversion," a concept that elegantly explains the trade-offs between front-loaded financial investment in the corporate world and performance-based social investment in the decentralized ecosystem. The left side of the diagram meticulously charts the familiar, time-honored journey of corporate recruitment, a process predicated on control, standardization, and the minimization of risk before a commitment is made. This funnel is depicted in a professional, almost clinical blue, narrowing sharply at each stage to signify a deliberate and costly filtering process. It is a model built on the premise that uncertainty is a liability to be systematically eliminated through significant upfront investment. The journey begins at the widest part of the funnel, the Formal Application Pool. This initial stage is an act of gatekeeping.

The document icon symbolizes the reliance on credentials, resumes, and formal qualifications as the first layer of screening. Here, human resources departments and automated systems filter candidates based on established criteria such as educational background, years of experience, and specific certifications. The goal is not to find raw talent but to create a manageable, pre-qualified pool of applicants

who, on paper, meet the organization's explicit needs. This step immediately highlights the corporate model's reliance on established, legible signals of competence. From this filtered pool, candidates descend into the next stage: Intensive Interviews. This represents the transition from quantitative screening to qualitative assessment. As the description notes, this involves "multiple rounds of structured interviews with various teams". This is a profoundly resource-intensive phase. It consumes the valuable time of not just HR personnel but also senior managers, technical leads, and future colleagues. These interactions are designed to probe beyond the resume, assessing technical skills through challenges, evaluating problem-solving abilities, and, crucially, determining "culture fit." It is a multi-faceted attempt to build a predictive model of a candidate's future performance and social integration, a model whose construction is a significant, albeit often uncalculated, internal cost. Candidates who successfully navigate the interview gauntlet face the final and most focused stage of scrutiny: Costly Diligence. The magnifying glass icon aptly represents this forensic phase of the process. It involves a suite of verification activities: background checks to uncover legal or financial red flags, reference calls to corroborate past performance, and checks to confirm the validity of claimed credentials. This is the organization's final insurance policy against misrepresentation. Each of these activities carries a direct financial cost, paid to third-party services or incurred through staff time. This stage underscores the model's core logic: trust is not given, but verified through an expensive, evidence-based process. The funnel culminates in the Hired Employee, a state symbolized by a briefcase. The outcome is defined by two key characteristics: "High Certainty, High Upfront Financial Cost". The "High Certainty" is the return on the firm's substantial investment. By front-loading the diligence, the corporation has done everything in its power to ensure the new hire is who they claim to be and can do what they claim to do. The "High Upfront Financial Cost" is the explicit price of this certainty. This entire process can be understood as a form of capital investment in human resources, where money is spent preemptively to de-risk the asset before it is brought into the organization. In stark and illuminating contrast, the right-hand funnel, rendered in a vibrant green, depicts a radically different philosophy for talent acquisition. It is a model predicated on openness, observable action, and the emergent nature of trust. Where the corporate funnel is about filtering a known pool, the DAO funnel is about identifying talent from a vast, unknown ocean. This process begins with the Global Permissionless Pool, a concept symbolized by a globe icon. This represents the DAO's most significant departure from the traditional model. There are no formal applications or gatekeepers. Anyone, anywhere in the world, can enter the ecosystem by joining public forums like Discord, participating in discussions, or monitoring project updates. This maximizes the potential talent pool to a global scale but simultaneously introduces maximum uncertainty. There are no resumes, no credentials—only pseudonyms and potential. The first step toward differentiation within this pool is Observable Contribution. This is where action replaces credentials. As the laptop icon suggests, individuals begin their journey by performing work that is public and auditable. This could involve fixing a minor bug in the code, providing insightful analysis in a forum discussion, creating helpful documentation, or assisting other community members. This initial work is the first "proof point" in a portfolio of verifiable actions. It is a low-stakes way for both the individual and the community to engage, and it represents the first layer of self-selection. Those who persist and provide consistent value move into the core of the DAO's vetting process: "Reputation Mining". The star icon signifies the goal of this stage: to build social standing and become a recognized, valuable member of the community. This is not a single event but a long-term process of "sustained, valuable work" that builds trust organically. Every helpful comment, every piece of quality code, every insightful critique contributes to an individual's on-chain and off-chain reputation. This process is the inverse of the corporate interview; instead of answering hypothetical questions, the contributor provides concrete, observable evidence of their skills and commitment over an extended period. The cost of this stage is borne almost entirely by the

contributor in the form of time, effort, and intellectual energy, often with no guarantee of future reward. The culmination of this journey is the Trusted Contributor, symbolized by a handshake or trophy icon. The outcome is defined by "High Trust, High Upfront Social Cost". The "High Trust" is earned, not verified. It is the result of a long, public audition where the individual has proven their worth to the collective. The "High Upfront Social Cost" is the critical inversion of the corporate model. The primary cost is not a financial one paid by the organization, but a social and temporal one paid by the individual contributor. They have invested their own capital—their time and talent—to build their reputation within the ecosystem.

The brilliance of Figure 1 lies in its final summary box, which articulates the overarching thesis of The Vetting Cost Inversion. This concept synthesizes the comparison by highlighting a fundamental shift in *who* pays, what is paid, and when the payment occurs. The traditional corporation's model is one of front-loaded, monetized diligence. The organization pays with money, and it pays before the employee begins to create value. It is a risk-averse strategy designed to protect the firm's existing structure and resources. The DAO model, in contrast, utilizes performance-based vetting. The individual pays with their time and effort—their social and intellectual capital—and they pay this cost upfront in the hope of future rewards. It is a risk-tolerant strategy optimized for a global, fluid environment where verifiable performance is the only currency that matters. This model effectively outsources the cost and effort of diligence to the candidates themselves, forcing them to provide costly, hard-to-fake signals of their quality and commitment. In doing so, it provides a novel, market-based solution to the age-old problem of adverse selection.

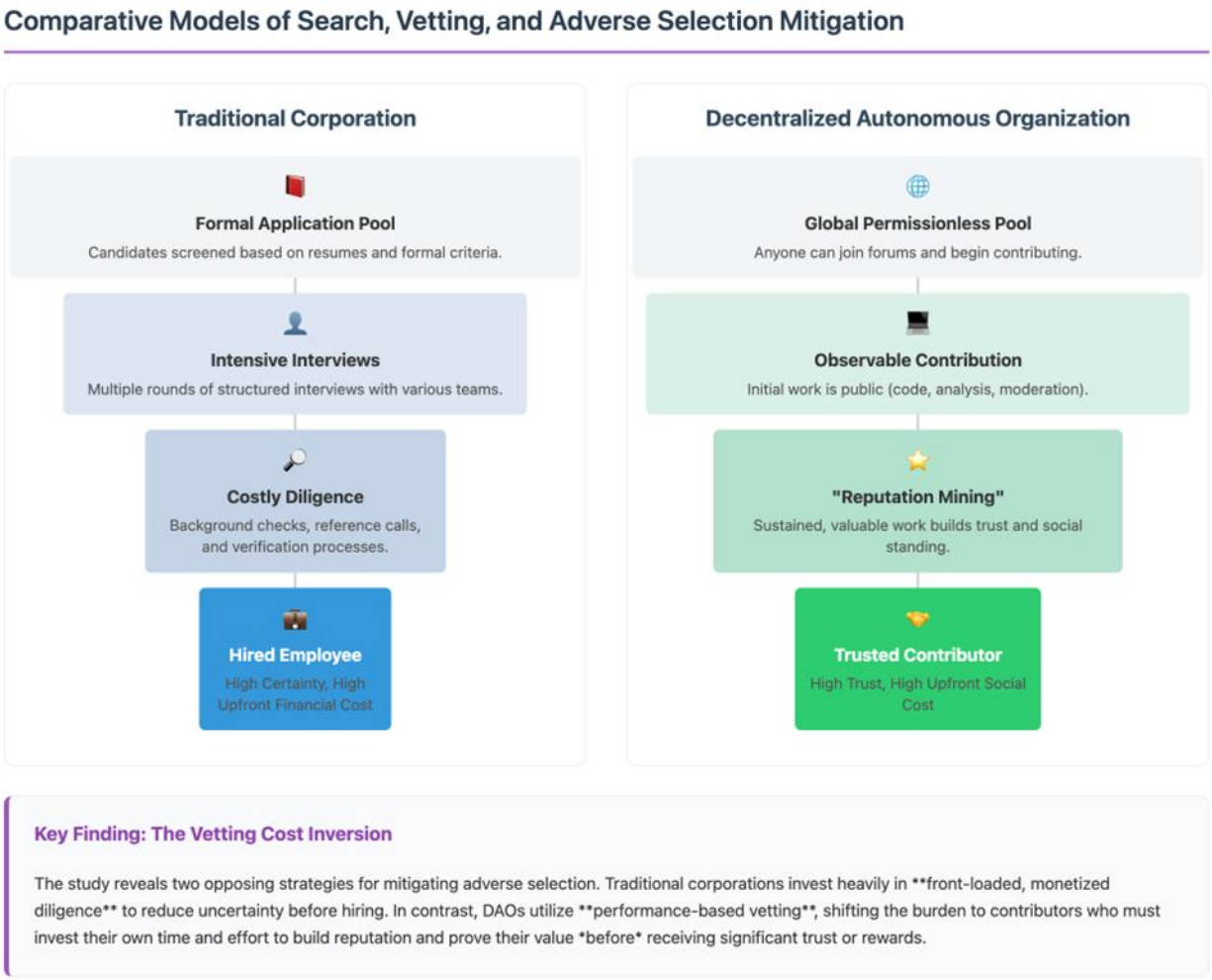

Figure 1. Comparative models of search, vetting, and adverse selection mitigation.

Figure 2, titled "Comparative Process Flow of Bargaining, Contracting, and Consensus," offers a clear and compelling visualization of the procedural heart of organizational action. It moves beyond the question of who joins an organization to the critical question of how that organization formalizes and executes a binding decision. Through two parallel flowcharts, the figure masterfully contrasts the deliberate, legally-grounded process of a traditional corporation with the socially-driven, computationally-executed process of a Decentralized Autonomous Organization (DAO). The central thesis, articulated with precision in the summary finding, is "The Coordination Cost Inversion"—a profound trade-off between high, monetized, off-chain costs in the corporate world and immense, non-monetized, off-chain social costs in the decentralized realm. The left-hand side of the figure charts the course for a traditional corporation, such as the example "GTI". This process is portrayed as a linear, top-down, and resource-intensive sequence, where each step is designed to build a legally unassailable agreement. It is a pathway defined by formal roles, expert intermediaries, and significant financial expenditure.

The journey begins with Step 1: Strategic Negotiation. This is the human-centric, high-level bargaining phase. As the description notes, this involves "Months of negotiations involving senior management and business development teams". The annotated cost, "High Managerial Time," underscores that the primary resource consumed here is the attention and effort of the firm's most expensive and valuable personnel. These are not casual conversations; they are structured, strategic sessions dedicated to aligning goals, debating terms, and hammering out the core substance of a partnership or initiative. This phase is entirely off-chain, relying on human interaction, trust built through reputation, and strategic calculation. Following negotiation, the process descends into Step 2: Legal Drafting & Review. This represents the crucial translation of human intent into the formal, precise language of law. The figure highlights that this involves "Multiple drafts of complex legal contracts" created and scrutinized by both internal and external legal teams. The associated cost, labeled "Extremely High Legal Fees," is a testament to the specialized expertise required for this task. This step is a firm's primary investment in risk mitigation. Lawyers work to anticipate future contingencies, close loopholes, and ensure the final document provides clear recourse in the event of a dispute. The cost is a direct payment for access to the established legal framework. The final stage is Step 3: Formal Execution. This is the administrative capstone of the process, where the "agreement is formally signed by authorized representatives". While seemingly simple, this step carries its own "High Administrative Overhead," involving compliance checks, board approvals, and the formal procedures that create a legally binding and enforceable instrument. The culmination of this costly, multi-stage process is the Outcome: a Legally Enforceable Contract. This document's power derives not only from the ink on the page but from its connection to an entire external infrastructure of courts, judges, and legal precedent, providing a robust, albeit slow and expensive, mechanism for enforcement.

The right-hand side of the figure presents a radically different flow for a DAO, like the example "NP". This pathway substitutes the closed-door negotiations and legal formalisms of the corporation with open-forum debate and computational automation. It is a process that begins with chaotic social interaction and ends with mathematical precision. The critical first stage, and the one that represents the bulk of the off-chain work, is Step 1: Social Consensus Formation. This is the DAO's equivalent of negotiation and legal review, but it occurs in a public square. As described, it involves "Weeks of open debate on public forums (e.g., Discourse)" to persuade the community and build social agreement. The annotated cost is the most telling aspect: "Massive, Non-Monetized Social Coordination Time". This cost is not paid in legal fees but in the immense, often unmeasured, time and effort spent by core contributors and community members debating, arguing, amending proposals, and building political coalitions. It is a messy, human-intensive process of achieving a collective meeting of the minds before any code is written. Only after social consensus

is achieved does the process move to Step 2: On-Chain Proposal & Vote. Here, the "agreed-upon action is codified into a formal governance proposal" and submitted to the blockchain for a vote. This stage is remarkably efficient. The cost is reduced to "Minimal Gas Fees," the small computational fee required to record the transaction on the blockchain. The complexity of the prior social negotiation is distilled into a simple, binary choice for token-holders. If the vote passes, the process flows seamlessly into Step 3: Automated Execution. The smart contract "executes the terms automatically and immutably without intermediaries". The cost is effectively "Near-Zero," as the blockchain simply carries out its pre-programmed instructions. The speed and efficiency of these final two on-chain steps are the DAO's hallmark. The final Outcome is a Computationally Enforced Smart Contract. Its power comes not from a judge but from the mathematical certainty of the distributed ledger. It is absolutely and impartially enforced by the network itself.

The key finding at the bottom of the figure synthesizes this comparison into a powerful insight: "The Coordination Cost Inversion". The analysis reveals a fundamental trade-off between two different kinds of off-chain costs. Traditional corporations incur high, monetized, off-chain costs in the form of legal and managerial fees to create a legally certain and adaptable agreement. DAOs invert this structure. They achieve radical efficiency in their on-chain execution costs but only by first paying an immense, non-monetized, off-chain cost in social coordination to build consensus. This figure brilliantly illustrates that DAOs do not eliminate transaction costs; they transmute them, shifting them from the financial and legal domain to the social and political domain. The choice between these two pathways is, therefore, a strategic one, dependent entirely on the nature of the task and the type of certainty an organization seeks to achieve.

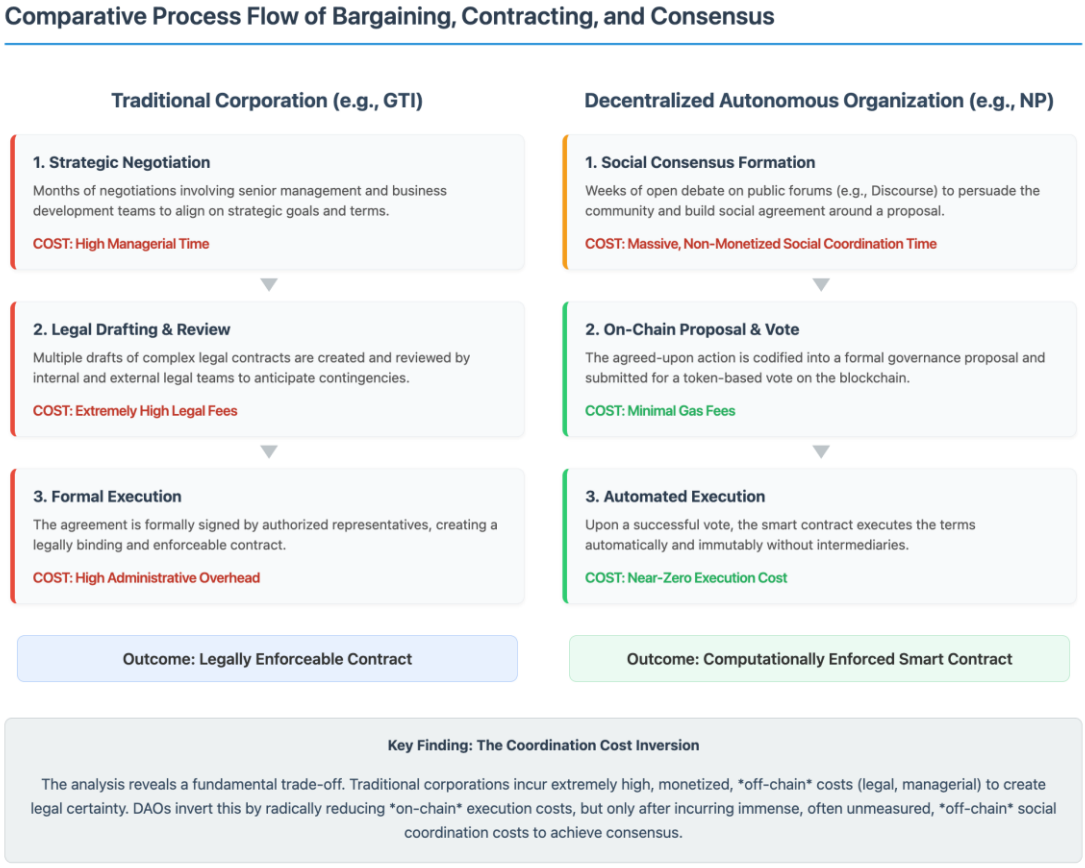

Figure 2. Comparative process flow of bargaining, contracting, and consensus.

Figure 3, titled "Comparative Models of Ex Post Monitoring and Control," transitions the study's analysis from the formation of agreements to the critical phase that follows: ensuring those agreements are fulfilled. It addresses the fundamental organizational question: once a task is assigned or a contract is made, how is performance monitored and controlled? The figure presents a visually striking argument, contrasting the "Integrated Control" of a traditional corporation with the "Unbundled Control" of a Decentralized Autonomous Organization (DAO). The central thesis, powerfully articulated in the "Key Finding," is that DAOs do not replace the corporate control function but rather dismantle or "unbundle" it into two highly specialized, yet disconnected, systems. This unbundling creates a bifurcated reality of extreme efficiency in one domain and extreme fragility in another, a trade-off that fundamentally defines the operational landscape of a DAO. The left panel of the figure depicts the traditional corporation's approach to monitoring as a cohesive, unified dashboard. This integrated system is portrayed as a set of interlocking tools designed to provide a comprehensive view of performance, capable of handling both quantitative and qualitative assessments. It is a costly system, but its value lies in its holistic and adaptive nature.

The cornerstone of this model is the Managerial Hierarchy. Symbolized by a briefcase, this represents the human element of oversight. Managers and department heads are not merely supervisors; they are active agents of control who provide "Direct oversight", interpret complex situations, adjust strategies in real-time, and offer feedback. This layer of human judgment is what allows the corporation to manage tasks that are ambiguous, subjective, or require creative problem-solving. It is the organization's adaptive "operating system." Supporting the hierarchy are formal tools for measurement. Key Performance Indicators (KPIs), represented by a bar chart icon, provide the quantitative backbone of the control system. They allow for objective "Performance measured against predefined quantitative metrics", creating a transparent and data-driven view of operational outputs. Complementing this is the practice of Performance Reviews, which are described as "Formal, periodic reviews for subjective assessment and feedback". This is where the qualitative, nuanced aspects of performance that cannot be captured by KPIs are addressed. Together, these three components form a single, integrated control function. The final element, Cost Profile, quantifies the price of this system: "High, direct overhead cost (e.g., >18% of revenue at GTI)". This is not presented as a flaw but as a feature—it is the substantial investment a corporation makes to purchase a robust, adaptable, and comprehensive control mechanism capable of managing a wide spectrum of human and operational complexities.

The right panel of Figure 3 illustrates the DAO's radical departure from the integrated model. The very design of the panel—split into a green, positive zone and a red, negative zone—is a powerful visual metaphor for the "Unbundled Control" that defines the DAO. The DAO effectively takes the single control dashboard of the corporation and shatters it into two distinct, specialized, and unequal parts. The top section of the DAO panel, highlighted in green and adorned with checkmarks, represents the domain where the DAO achieves unprecedented efficiency. This is the world of On-Chain Monitoring. The mechanism is described as "Automated by Smart Contract ('Monitoring-by-design')". This means that for any task that can be fully described in code, the monitoring function is perfectly embedded within the task itself. The smart contract that executes the action is also its own flawless watchdog. The benefits, as listed, are profound. The Cost is "Near-zero direct cost", as monitoring is a byproduct of computational execution. The Effectiveness is "Absolute and transparent for codified tasks"; the blockchain provides an immutable, public record of performance against the agreed-upon rules. However, the figure astutely points out the critical Limitation: this system is "Inflexible and brittle; cannot adapt to unforeseen events". It is a perfect monitor for a perfectly anticipated world, but it has no capacity for judgment or adaptation when reality deviates from the coded script.

The bottom section reveals the other, far more problematic, side of the unbundled system: Off-Chain

Monitoring. This is the control mechanism for any task that cannot be written into a smart contract—such as marketing, subjective design work, or complex research. The mechanism is described as "Informal community vigilance and self-reporting", a system that lacks any formal structure or authority. The attributes listed in this red zone, all marked with an 'x', paint a stark picture of institutional weakness. The Cost profile is deceptive: "Low direct cost, but high social friction and dispute risk". While the DAO does not pay salaries for managers, it pays a hidden cost in the form of community infighting, unresolved disputes, and the social overhead of trying to collectively monitor performance without clear leadership. The Effectiveness is deemed "Sporadic and unreliable for subjective tasks", as there is no single person or entity responsible for oversight. Most critically, the primary Limitation is that this system is "Highly vulnerable to moral hazard and opportunism". Without a robust monitoring and enforcement mechanism, contributors may underperform or act opportunistically with little fear of consequence, as highlighted by the study's examples of failed grant projects. The figure's key finding provides the ultimate synthesis: "The Great Unbundling of Control". Traditional firms utilize a single, integrated—and costly—hierarchy to monitor all types of work. DAOs dismantle this unified function. They achieve hyper-efficiency for automatable, on-chain tasks by creating a perfect, costless monitoring system. However, in doing so, they strip away the generalized control mechanism that corporations use for everything else. This leaves a vacuum in the oversight of off-chain, subjective tasks, which is filled by a "hyper-fragile, social monitoring" system that is largely ineffective. This unbundling, as the figure powerfully concludes, creates a fundamental trade-off that defines the DAO's core operational identity: it is a specialist organization with extreme strengths in its narrow domain of competence and extreme weaknesses everywhere else.

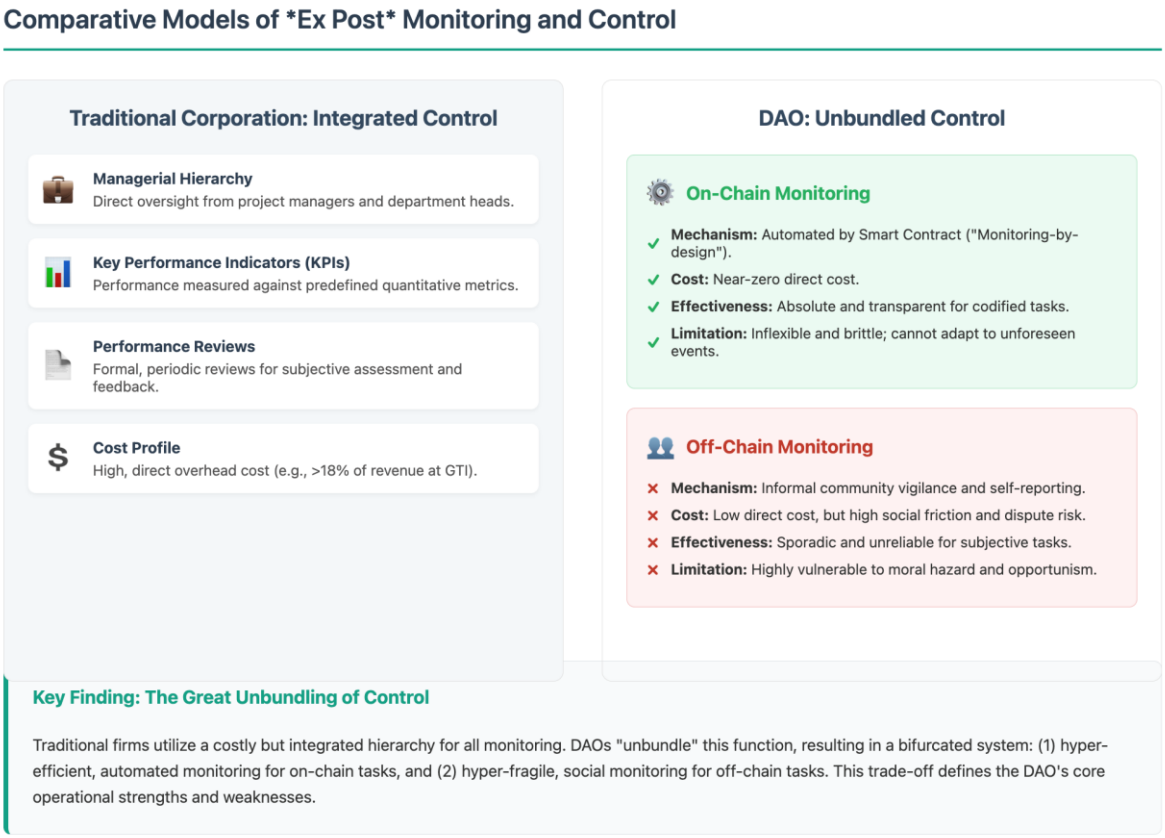

Figure 3. Comparative models of “Ex Post” monitoring and control.

Figure 4, "A Comparative Matrix of Enforcement and Adjustment Mechanisms," offers a profound and incisive look into one of the most fundamental challenges of human collaboration: how we ensure promises are kept. It presents a compelling narrative of two vastly different worlds—the staid, familiar realm of the Traditional Corporation and the radical, new frontier of the Decentralized Autonomous Organization (DAO). By juxtaposing these two models, the study reveals a critical duality in the very nature of enforcement, ultimately exposing what it dramatically terms the "DAO's Achilles' Heel." This is not merely a technical comparison; it is a story about trust, power, flexibility, and the immense difficulty of translating human agreements into predictable outcomes. On one side of the matrix stands the Traditional Corporation, an entity we have understood for centuries. Its foundation for enforcement, as the figure elegantly puts it, is a "Unified Backstop: The Legal System." The icon of the scales of justice perfectly encapsulates this model: it is deliberate, balanced, and rooted in a long history of human jurisprudence. The Mechanism is straightforward and powerful: contracts are not just promises; they are legally binding documents enforced through the established power of the courts. This system acts as the ultimate arbiter, a supreme authority that can compel action, seize assets, and impose penalties. It is an enforcement mechanism with real teeth, backed by the state's monopoly on legitimate force. When things go wrong, the path to Recourse is clear, albeit often arduous. If a partner fails to deliver, a supplier provides faulty goods, or an employee breaches a contract, there is a structured, albeit slow and costly, path to remedy the breach. One can file a lawsuit, present evidence, and appeal to a judge or jury to make a binding decision. This creates a powerful deterrent against bad behavior; potential breachers know there is a credible threat of consequence. However, the system's greatest strength is also its most human feature: Flexibility. The law is not rigid code. It is interpreted by judges who can consider nuance, intent, and unforeseen circumstances—the *spirit* of the agreement, not just the letter. This human judgment allows for adjustments when a contract becomes unfair due to a global pandemic, a natural disaster, or a simple misunderstanding. This flexibility prevents the system from becoming a cold, unthinking tyrant. Yet, this robust system comes at a staggering price. The Cost Profile is described as "extremely high," a reality anyone familiar with litigation can attest to. The path to justice is paved with the gold of legal fees, court costs, and countless hours of lost productivity. This high barrier to entry means that for many, the theoretical right to recourse is practically inaccessible, making the legal backstop a tool more readily available to the wealthy and powerful.

The first reality is the on-chain world, governed by the immutable principle of "Code is Law." Here, the Mechanism is the smart contract—a piece of self-executing code on a blockchain. It is automated, absolute, and unstoppable. Agreements are not interpreted; they are executed with mathematical precision. If condition A is met, then outcome B occurs, instantly and without fail. The green lock icon symbolizes this perfectly: it is secure, certain, and hermetically sealed from human interference. The Cost Profile for this enforcement is near-zero; the network simply executes what it was told to do. But this crystalline perfection comes at the cost of all recourse and flexibility. In this paradigm, a breach is conceptually impossible because "the code executes as written." There is no room for appeal. If the code contains a flaw or if circumstances change in a way the original programmers did not anticipate, there is no mechanism for adjustment outside of a complex and often contentious new governance vote to change the entire system. This rigidity is its superpower and its fatal flaw. It is hyper-efficient for tasks that are fully codifiable and computationally verifiable—like releasing funds when a specific digital milestone is met—but it is utterly brittle and unforgiving for anything that requires nuance.

The second, and far more fragile, reality for a DAO is the off-chain world. This is where the digital organization must interface with the messy, unpredictable reality of human performance—hiring a marketing team, commissioning a piece of art, or requesting a research report. Here, the primary enforcement Mechanism is "Social Slashing," which

relies on informal social pressure and reputational damage. The red, broken-link icon is a stark warning of this mechanism's weakness. The theory is that in a transparent community, the fear of public shame and exclusion will keep actors honest. However, the figure bluntly exposes this as a paper tiger. Recourse is "often impossible against anonymous or globally distributed actors." What good is reputational damage to an anonymous developer team that can simply vanish and reappear under a new identity? The poignant, real-world quote included in the figure drives this point home with devastating clarity: *"We paid a team... they delivered half-finished garbage and disappeared. What can we do? Nothing."* This single sentence captures the complete and utter failure of social slashing as a reliable enforcement tool. It highlights a chasm of accountability. While Flexibility is theoretically infinite—one can always try to negotiate—it is practically "ineffective and unenforceable" without any underlying power to compel a resolution. It is a system of hope, not of guarantee. This brings us to the study's powerful conclusion: The Enforcement Duality. A DAO lives a double life. For on-chain activities, its enforcement is hyper-efficient and absolute, a realm of digital perfection. But for any task requiring off-chain human performance, it is "fragile to the point of being non-existent." This is the DAO's Achilles' Heel. Like the mythical warrior, the DAO is invincible in one domain but possesses a fatal vulnerability in another. Its inability to reliably enforce agreements in the real, human world creates a hard boundary around its potential. It confines DAOs to a sandbox of "fully codifiable and computationally verifiable" tasks, limiting their ability to coordinate the complex, subjective, and dynamic types of economic activity that define the vast majority of our world.

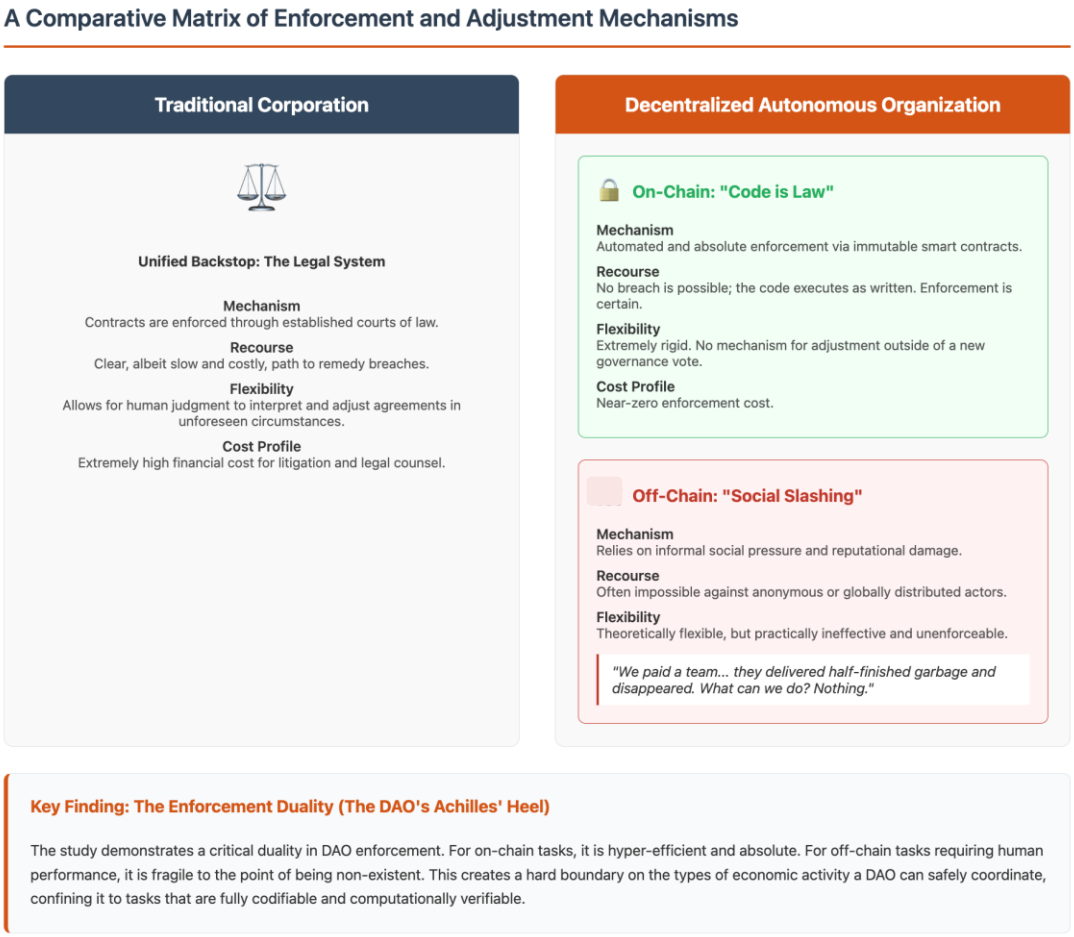

Figure 4. Comparative matrix of enforcement and adjustment mechanisms.

The results of this comparative institutional analysis offer a deeply-textured and, at times, paradoxical understanding of the economic trade-offs between traditional corporations and Decentralized Autonomous Organizations (DAOs). The findings move beyond the polarized discourse of technological utopianism and reflexive skepticism to map the complex spectrum of governance and coordination costs inherent in each form. By systematically comparing analogous pairs—Nexus Protocol (NP) with Global Tech Inc. (GTI) and Creator Guild (CG) with Innovate Solutions Ltd. (ISL) —this study reveals that DAOs are not a universally superior substitute for the traditional firm but rather a novel institutional technology optimized for a specific set of circumstances. The core findings, which we have termed the "Vetting Cost Inversion," the "Coordination Cost Inversion," and "The Great Unbundling of Control," necessitate an extension of established economic theories and provide clear implications for both corporate managers and DAO architects.[11] This study's primary contribution lies in its use of an integrated theoretical framework to dissect the DAO phenomenon. While Transaction Cost Economics (TCE) provides a powerful foundational lens, our findings demonstrate its insufficiency in isolation for explaining the full range of behaviors and strategic dynamics observed.

The foundational insights of Coase and Williamson are vividly reaffirmed in our analysis. The core challenges of coordinating economic activity in the face of bounded rationality and opportunism were present in all four cases, albeit in radically different manifestations.[12] The extensive, weeks-long off-chain debates on the public forums of Nexus Protocol before any vote can occur are a direct and costly response to the bounded rationality of its global, diffuse members. Lacking a managerial hierarchy to digest information and issue directives, the community must engage in a massive, emergent process of collective sensemaking. Similarly, the clear examples of opportunism, such as the grant team funded by Creator Guild that delivered "half-finished garbage and disappeared," highlight the severe enforcement challenges that arise when traditional legal safeguards are absent. The very existence of the "Coordination Cost Inversion"—where DAOs trade low execution costs for massive social coordination costs—is a testament to the enduring relevance of TCE; it is a story of shifting, rather than eliminating, transaction costs. However, TCE alone cannot fully articulate the unique conflicts that arise within the DAO structure. Integrating Agency Theory provides a much sharper analytical lens, revealing that DAOs do not eliminate agency problems but fundamentally reconfigure them.[13] The classic principal-agent conflict between a firm's owners and its managers is replaced by a far more complex and legally ambiguous relationship between diffuse, often anonymous token holders (the principals) and a fluid set of core contributors or grant recipients (the agents). This new relationship is fraught with profound information asymmetry and is characterized by a near-total absence of the legal recourse that underpins the traditional corporate nexus of contracts.

Our findings on "The Vetting Cost Inversion" and "The Great Unbundling of Control" are best understood through this lens. The practice of "performance-based vetting," where potential contributors must first invest their own time and effort into observable work ("reputation mining") to prove their value before receiving trust or rewards, is a novel, market-like solution to the problem of adverse selection. In the absence of formal HR departments, costly diligence, and background checks common at firms like GTI and ISL, the DAO outsources the cost of vetting to the candidates themselves.[14] Conversely, the rampant moral hazard observed in off-chain grant projects demonstrates an unsolved agency problem. The "unbundled" nature of DAO monitoring—hyper-efficient for on-chain tasks but "hyper-fragile" for off-chain ones—creates a fertile ground for opportunism. Once a grant is disbursed, the DAO has few effective tools to monitor effort or ensure quality, leading to the exact scenario described by the NP contributor whose 50,000-token investment evaporated with no recourse.[15] Finally, integrating the Resource-Based View (RBV) is essential to understanding how DAOs generate value and sustain competitive advantage. While a traditional corporation like GTI builds its

competitive moat on proprietary assets, intellectual property, and established legal and managerial structures, the DAO's most valuable, rare, and inimitable resource is its community. The findings force us to re-evaluate the immense off-chain coordination costs identified by our analysis. From a pure TCE perspective, these appear as a massive liability.[16] However, through the lens of RBV, these costs can be reinterpreted as the necessary and continuous investment required to cultivate the DAO's core strategic asset: a large, engaged, and loyal network of users, developers, and believers who are economically and socially invested in the project's success. The social consensus painstakingly built during those six-week debates at NP is not just a prerequisite for a vote; it is the very process that strengthens the community's shared belief and commitment, which is ultimately the engine of the DAO's value.[17]

A central theoretical contribution of this research is the reframing of the on-chain/off-chain relationship from a simple dichotomy to a deep socio-technical entanglement. The data reveal that analyzing these two realms in isolation is analytically flawed. Instead, they exist in a constant, reflexive feedback loop where each shapes and gives meaning to the other.[18] An on-chain governance vote is, in a technical sense, merely a computational event. It only acquires political and social legitimacy through the messy, human-centric, off-chain processes of debate, discussion, and persuasion that precede it. Conversely, the rigid, immutable logic encoded in the on-chain smart contracts perpetually structures and constrains the possibilities of off-chain social dynamics. The "Coordination Cost Inversion" is the clearest manifestation of this entanglement. DAOs achieve radical on-chain efficiency in execution precisely because they have shifted the entire burden of alignment, negotiation, and consensus-building to the off-chain social layer. This architectural shift acts as an amplifier; by making execution cheap, fast, and irreversible, it dramatically raises the stakes and, consequently, the costs of the prerequisite off-chain coordination. This entanglement means that future analysis of any digitally-native organization must abandon a simplistic binary and instead focus on these critical feedback loops between social and computational systems.

The concept of the "Coordination Cost Inversion" merits a more granular discussion, as it represents the central operational trade-off of the DAO model. DAOs invert the corporate logic by minimizing the formal, monetized administrative overhead typical of GTI and ISL, but only at the cost of maximizing informal, non-monetized, and often hidden social coordination costs.[18] Our analysis revealed this "overhead" is not a monolithic block but is composed of at least three distinct, challenging components: Information Costs for Voters: The shift from representative, hierarchical decision-making to direct, token-based democracy places an immense cognitive burden on the individual voter. For a token holder in NP to vote responsibly on a proposal to alter a complex risk parameter, they must acquire a level of technical and financial expertise that is simply not required of a shareholder at GTI. This leads to the predictable outcome of widespread rational apathy, where the cost of becoming sufficiently informed outweighs the perceived benefit of casting a single vote, concentrating effective power in the hands of a small, highly-engaged minority. The Endemic Risk of Plutocracy: The "one token, one vote" mechanism, while seemingly democratic, often leads to governance capture by a small number of "whale" token holders. This was a recurring concern voiced by smaller, yet highly active, contributors in both NP and CG, who felt their influence was negligible compared to large, often passive, token holders whose interests might not align with the long-term health of the broader community. This creates a new form of agency conflict, not between managers and owners, but between different classes of owners. Consensus-Building Costs: The most significant and least appreciated cost is the sheer time, energy, and social capital required to build sufficient consensus before a formal proposal is ever submitted to an on-chain vote. The six-week debate at Nexus Protocol over a single strategic initiative is a vivid illustration of this massive, ongoing operational cost. In a traditional firm like GTI, such a decision would be debated among a small group of senior executives and

then executed. In a DAO, it requires a sprawling, public campaign of persuasion, education, and negotiation across global time zones, a process that is both fundamental to its ethos and a profound drain on its resources.[19]

The findings of this study are not merely academic; they hold specific, actionable implications for practitioners in both organizational worlds. The lesson is one of institutional precision, not wholesale replacement. For Corporate Managers: The primary implication is to pursue strategic, surgical automation rather than fearing existential replacement. The idea that a complex, publicly-traded firm like GTI should be "DAO-ified" is a fallacy unsupported by the evidence. Instead, managers should view smart contracts as a new tool in their operational arsenal, best applied to areas that are highly codifiable and suffer from high intermediary or administrative costs. For instance, GTI could leverage smart contracts to entirely automate complex inter-company settlements or royalty payments, thereby reducing administrative overhead and enforcement costs without altering its core governance structure, which remains superior for tasks requiring subjective judgment and legal certainty. The vision is not a DAO-like corporation, but a traditional corporation with discrete, smart-contract-powered processes. For DAO Architects: The study serves as a clear and urgent caution against technological utopianism. Building a successful, resilient DAO is fundamentally a challenge of institutional design, not just software engineering. The findings point to two critical areas where investment is desperately needed: Mitigating Off-Chain Agency Risk: To move beyond simple, computationally verifiable tasks and solve the problem of failed grants seen at both CG and NP, DAOs must innovate by importing and adapting controls from the traditional world. This requires designing hybrid systems. One promising model is the use of smart-contract-based escrow systems that release funds not automatically, but based on milestones verified by an elected, reputable, and accountable committee.[20] This would blend the automation of on-chain technology with the indispensable element of off-chain human judgment, directly addressing the moral hazard problem. Reducing Coordination Costs: To combat the debilitating weight of social consensus-building, DAOs must invest heavily in more sophisticated governance infrastructure. This goes beyond better forum software. It requires developing more advanced delegated governance models, such as the "sub-DAOs" or specialized committees mentioned in our research, where domain experts are formally empowered to make decisions within a specific scope. This reduces the cognitive burden on the general voting populace and allows for more agile and expert-driven decision-making, mitigating the problems of rational apathy and endless debate.[20]

4. Conclusion

This landmark study concludes that Decentralized Autonomous Organizations (DAOs) and traditional corporations are not competitors for the same throne, but distinct solutions to the fundamental problem of economic coordination. The traditional firm buys legal certainty and an unmatched ability to manage complex, subjective work, paid for with significant administrative overhead. Conversely, the DAO achieves revolutionary efficiency for verifiable, automated tasks by shifting trust from legal contracts to immutable code. This efficiency, however, comes at the steep price of massive social coordination costs and a critical fragility when dealing with off-chain ambiguity and opportunism. The future of the firm is not a singular path but a pluralistic ecosystem. The corporation is not obsolete, nor is the DAO a panacea. The most fertile ground for innovation lies in creating hybrid models that surgically combine the automated efficiency of the blockchain with the adaptive, judgment-based resilience of the firm. By understanding the unique institutional mechanics of each, we can begin to design the truly effective organizations of tomorrow.

5. References

1. Kim J, Jung B-H. A study on the legal status of blockchain-based decentralized autonomous organizations (DAOs). Sjlb. 2024; 14(1): 3–33.

2. Alawadi A, Kakabadse N, Kakabadse A, Zuckerbraun S. Decentralized autonomous organizations (DAOs): Stewardship talks but agency walks. J Bus Res. 2024; 178(114672): 114672.
3. Majeed U, Hassan SS, Han Z, Hong CS. DAO-FL: Enabling decentralized input and output verification in federated learning with decentralized autonomous organizations. Techrxiv. 2024.
4. Li S, Chen Y. Governing decentralized autonomous organizations as digital commons. J Bus Ventur Insights. 2024; 21(e00450): e00450.
5. Bonnet S, Teuteberg F. Decentralized autonomous organizations: a systematic literature review and research agenda. Int J Innov Technol Manage. 2024; 21(04).
6. Li J, Qin R, Guan S, Ding W, Lin F, Wang F-Y. Attention markets of blockchain-based decentralized autonomous organizations. IEEE/CAA J Autom Sin. 2024; 11(6): 1370–80.
7. Reif J, Yang H, Soll J. The illusion of community in decentralized autonomous organizations (DAOs): Why members disengage. Acad Manag Proc. 2024; 2024(1).
8. Napieralska A, Kępczyński P. Redefining accountability: Navigating legal challenges of participant liability in Decentralized Autonomous Organizations. arXiv [cs.NI]. 2024.
9. Ballandies MC, Carpentras D, Pournaras E. DAOs of collective intelligence? Unraveling the complexity of blockchain governance in decentralized autonomous organizations. arXiv [cs.CY]. 2024.
10. Buddensiek E, Momtaz PP. Social learning in decentralized autonomous organizations (DAOs). 2025.
11. Alon I, Sauge Berthelsen A, Bjellerås E, Silva-Rêgo B. Decentralized autonomous organizations: The new global digital venture capital. Res Int Bus Fin. 2025; 74(102671): 102671.
12. Sampò G, Baumann O, Peressotti M. The blind men and the elephant: Mapping interdisciplinarity in research on decentralized Autonomous Organizations. arXiv [cs.DC]. 2025.
13. Lo Monaco V, Momtaz P, Vismara S. Distributed governance and value creation in decentralized autonomous organizations: Evidence from a regression discontinuity design. Econ Lett. 2025; 248(112233): 112233.
14. Huang J, Tian Y, Zhang T, Ni Q, Lin F, Lee TJ, et al. Parallel Tourism System with Foundation Models and Decentralized Autonomous Organizations. Int J Tourism Res. 2025; 27(2).
15. Li Z, Zhang J, Xu X. Examining the relationship between coalition voting and knowledge contribution in decentralized autonomous organizations. J Syst Sci Syst Eng. 2025.
16. Weidener L, Laredo F, Kumar K, Compton K. Delegated voting in decentralized autonomous organizations: a scoping review. Techrxiv. 2025.
17. Saurabh K, Upadhyay P, Rani N. Towards blockchain decentralized autonomous organizations (DAO) design. Inf Syst Front. 2025; 27(2): 659–81.
18. Principe V, Ribeiro T, do Espírito Santo WR, de Souza Vale RG, de Alkmim Moreira Nunes R. Decentralizing sport management: a conceptual model for utilizing decentralized autonomous organizations in sports clubs. J Glob Sport Manag. 2025; 1–25.
19. Bellavitis C, Momtaz PP. Voting governance and value creation in decentralized autonomous organizations (DAOs). J Bus Ventur Insights. 2025; 23(e00537): e00537.
20. Weidener L, Laredo F, Kumar K, Compton K. Delegated voting in decentralized autonomous organizations: a scoping review. Front Blockchain. 2025; 8.