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Digital commons governance in the era of AI: Blockchain, tokenization, and institutional design

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Abstract

AI's rapid concentration of data, models, and compute threatens the original promise of open digital commons. This paper argues that blockchain-enabled mechanisms—on-chain identity and provenance, token-engineered incentives, programmable licensing, and decentralized adjudication—can realign AI value creation with public-goods outcomes. We synthesize commons theory with contemporary AI realities (compute scaling, dataset governance, model enclosure) and evaluate practical design patterns: retroactive public-goods funding (RetroPGF) to reward ex-post impact, compute-to-data to protect sensitive corpora while enabling training, and decentralized marketplaces (compute, data, and model inference) to reduce platform lock-in. We analyze governance trade-offs (permissionless vs. curated registries; identity, reputation, and sybil resistance), licensing choices (RAIL, PolyForm), and dispute-resolution stacks (jurisdictional law, DAO wrappers, crypto-native courts). Case sketches—LAION and Books3 controversies, DAO legal frameworks, and decentralized compute networks—illustrate how incentives and policy interact in practice. We conclude with a pragmatic blueprint: pair minimal-trust primitives (attestations, provenance graphs, metering, slashing) with plural funding (grants + prizes + retroactive rewards), measured by transparent impact metrics. When carefully designed, blockchain governance can help shift AI from extractive platform models toward more resilient and auditable digital commons.

Keywords: digital commons, ai governance, blockchain, decentralized compute, data licensing, compute-to-data, token incentives; retroactive public-goods funding, dao legal wrappers, on-chain provenance, dispute resolution, model & dataset governance.

Introduction

This paper examines governance of digital commons in the AI era. AI increasingly depends on shared resources—datasets, open-source software, knowledge repositories, and collaborative communities—yet critical infrastructure such as large-scale compute, proprietary data, and foundation models is becoming concentrated among a few technology firms. This concentration raises concerns about the openness, sustainability, and resilience of digital commons.

Although information systems research has examined governance of digital platforms and innovation ecosystems, existing models are less suited to AI ecosystems characterized by globally distributed contributors and long-term value creation. Blockchain technologies offer alternative governance mechanisms, including programmable governance, tokenized incentives, and decentralized coordination.

We argue that governance failures in decentralized AI ecosystems arise from two institutional challenges: coordination and recognition. Coordination involves aligning incentives and actions among diverse

contributors, while recognition concerns the legitimacy and attribution of contributions. Without addressing both, digital commons struggle to scale, sustain participation, and maintain legitimacy.

To address these challenges, we propose a three-layer governance architecture for AI commons. The constitutional layer establishes mission, values, and legal legitimacy; the institutional layer governs decision-making and resource allocation; and the protocol layer implements governance through smart contracts, token incentives, and automated enforcement.

This study makes three contributions. First, it introduces a coordination–recognition framework for analyzing governance failures in AI-era digital commons. Second, it develops a three-layer governance stack integrating constitutional, institutional, and protocol governance. Third, it synthesizes blockchain governance experiments to derive design principles for sustaining AI commons. We further highlight two complementary approaches: nested governance structures that link local rulemaking with broader coordination and oversight (Ostrom, 2005), and quasi-legal governance systems that embed secondary rules into blockchain architectures to enhance adaptability, legitimacy, and enforceability (Bassan & Rabitti, 2024; Crepaldi, 2019; De Filippi & Wright, 2018; Hart, 2012; Tan et al., 2022). Together, these approaches combine institutional design with programmable coordination to strengthen governance of digital commons.

Defining the Digital Commons in the Age of AI

Digital commons are shared digital resources—such as software, datasets, algorithms, protocols, platforms, and digital identities—that are collaboratively created, publicly accessible, and governed through collective or distributed arrangements. Unlike traditional commons, digital commons are non-rivalrous, meaning one person’s use does not reduce availability to others. However, they remain susceptible to enclosure, under-provision, capture, and fragmentation, particularly as AI increasingly drives their value.

Core Elements of the Digital Commons

Digital commons are defined not only by openness but also by key institutional and technical characteristics. They involve collective production of resources such as open-source software and datasets, shared access through licenses that permit reuse and redistribution, and distributed infrastructure that reduces reliance on centralized platforms. They also depend on collective governance, where communities, foundations, or decentralized organizations coordinate development and access rights, sometimes through DAOs (Han et al., 2025). Examples include Wikipedia, Linux, Ethereum, Common Crawl, and community-trained AI models such as OpenAssistant.

Why the Digital Commons Matters More in the AI Era

Artificial intelligence increases both the value and vulnerability of digital commons. Core AI resources—data, models, code, and compute—are increasingly treated as proprietary assets despite relying heavily on open contributions. For example, large language models such as GPT-4 are trained partly on internet-scale datasets containing community-generated content (OpenAI, 2023). Open-source frameworks such as PyTorch and TensorFlow, along with scientific preprints and code repositories shared through platforms like arXiv and GitHub, continue to underpin AI development.

This dependence on commons-based inputs combined with privatized outputs creates a fundamental asymmetry. As firms restrict access to compute and models through APIs and legal protections, mutual benefit structures increasingly resemble winner-takes-all markets. This pattern echoes the enclosure of internet commons during Web2 (Scholz, 2016), where open protocols evolved into corporate platforms.

Without intervention, AI may become a mechanism for extracting value from public knowledge and infrastructure while reinforcing corporate dominance.

Governance Forms for the Digital Commons

Following institutional economics, commons governance can be understood through three primary modes (Benkler, 2006; Ostrom, 1990). Market governance allocates resources through prices and ownership, network governance relies on peer coordination and reputation, and hierarchical governance depends on centralized authority. Each has limitations: markets can exclude participants, networks often struggle to scale, and hierarchies risk bureaucracy and rent-seeking.

Blockchain introduces a fourth model—programmable governance—in which rules, rights, and incentives are embedded in code (De Filippi et al., 2024; Esposito et al., 2025). This enables mechanisms such as peer-to-peer funding, retroactive rewards, and decentralized licensing. However, the central challenge remains ensuring these systems support sustainable commons governance rather than financial speculation.

From Open Access to Institutional Design

Early internet discourse often assumed that openness alone would sustain healthy digital ecosystems. However, open systems frequently face collective-action problems: free riders can extract value without contributing (Benkler, 2009), maintainers may experience burnout or sponsor dependence (von Hippel et al., 2003), and corporations may appropriate open resources without reciprocity (Ayala et al., 2025).

As the economy becomes increasingly AI-centric, the challenge is not merely preserving openness but ensuring sustainable governance. This requires institutions that align incentives among contributors, users, and maintainers while preventing enclosure by dominant platforms. Blockchain coordination, token engineering, and programmable governance offer promising mechanisms, but they are not sufficient on their own. The remainder of this paper examines how these tools can support digital commons governance in the AI era.

The Political Economy of AI Infrastructure

Although AI appears as software, its capabilities depend on physical and institutional infrastructure, including large-scale compute, proprietary datasets, cloud platforms, and capital-intensive R&D (Sastry et al., 2024). As frontier models become larger and more costly, control over infrastructure increasingly shapes the political economy of AI. This shift has significant implications for the future of the digital commons.

Centralization of Compute

Modern AI systems, particularly foundation models such as GPT-4, Claude, and Gemini, require enormous computational resources. Training GPT-4 alone is estimated to have cost over \$100 million (OpenAI, 2023), illustrating the infrastructure demands of frontier AI. Consequently, advanced AI capabilities are concentrated among organizations with access to specialized hardware, large-scale compute clusters, and major cloud platforms.

Although open-source AI continues to grow, frontier development remains dominated by firms that control compute supply chains (Amodei & Hernandez, 2018). Access to high-performance compute acts as a gatekeeper, determining who can develop cutting-edge models and who is limited to adaptation and

deployment (Mueller, 2025). This reflects a broader pattern of digital enclosure, where shared infrastructure increasingly gives way to privately controlled platforms.

Data Enclosure and Legal Uncertainty

AI models are trained on vast datasets drawn from web scraping, proprietary corpora, and licensed sources. Early advances relied heavily on open datasets such as Wikipedia, ImageNet, and Common Crawl, whereas frontier models increasingly use restricted and commercially licensed data. This shift reflects a broader move from open datasets toward controlled data pipelines.

The trend raises important legal and ethical questions about the use of public data in AI systems. Debates focus on consent, community control over data access, and ownership of value derived from digital commons. Lawsuits involving organizations such as The New York Times (2024) and Getty Images (2025), as well as claims by artists against firms including OpenAI and Stability AI, highlight these tensions. Beyond legal concerns, the central issue is political economy: value generated from shared data resources is increasingly captured by major technology firms and AI laboratories rather than by the communities that created the underlying data.

Model Ownership and API Capture

Even when trained on public data, many AI models remain closed. Systems such as GPT-4 and Claude are accessible only through APIs and restrictive terms of service, creating a form of epistemic enclosure in which use is separated from understanding, replication, and governance (OpenAI, 2023).

APIs have become key chokepoints for value extraction in the AI ecosystem (Alexander, 2026). By controlling access to models, they limit modification, integration, independent evaluation, and external oversight while reinforcing platform lock-in. Moreover, some open-weight models, including LLaMA and Mistral, are released under licenses that restrict commercial use or redistribution. Consequently, models that appear open at the level of code or weights may remain closed in terms of governance and control (Epoch, 2024; Meta, 2023).

The Emergence of AI Gatekeepers

A small number of firms increasingly dominate the AI value chain (Voinea, 2025). Compute is concentrated among major chipmakers and cloud providers, model development among frontier labs such as OpenAI, Anthropic, Google DeepMind, and Meta, and distribution through platforms, repositories, and API marketplaces. Together, these layers concentrate control over AI infrastructure, models, and access.

This vertically integrated stack is reinforced by capital, partnerships, and APIs. Venture capital further concentrates resources in projects with strong growth and defensibility. The result is a quasi-feudal AI economy (Varoufakis, 2024), where developers remain dependent on upstream providers and community-driven AI risks becoming economically subordinate.

Implications for the Digital Commons

The AI infrastructure stack mirrors earlier waves of digital enclosure. Open web ecosystems evolved into platform-controlled “walled gardens” (Van Dijck et al., 2018), open-source software into cloud-based services controlled by providers (Cusumano et al., 2019), and open AI research into proprietary models delivered through APIs (Ahmed et al., 2023).

In each case, commons-based innovation was later enclosed through infrastructure control. Without governance over compute, data, and model access, AI commons risk the same fate. Sustaining them requires

institutional arrangements—not just open AI—that are enforceable, adaptable, and incentive-aligned. Blockchain governance, token engineering, and legal hybridity offer potential mechanisms.

Blockchain as a Governance Layer for the Digital Commons

As AI becomes more powerful and embedded in proprietary infrastructure, effective governance of digital commons grows increasingly important. Traditional mechanisms often struggle to govern decentralized ecosystems at scale. Blockchain offers an alternative institutional layer by embedding ownership, coordination, and governance into code (Esposito, 2025; Hunhevicz et al., 2024). Beyond its technical or financial role, blockchain can function as a programmable governance system for managing rules, incentives, and coordination across digital commons.

Blockchain as a Coordination Infrastructure

Blockchain is a distributed ledger maintained through network consensus, but its significance lies in the governance mechanisms it enables. These include smart contracts that automate rule enforcement (Christidis & Devetsikiotis, 2016), tokens that represent rights and incentives (Voshmgir, 2020), and DAOs that support collective decision-making through programmable governance (Buterin, 2014).

Together, these tools allow communities to coordinate participation, distribute rewards, and adapt governance without centralized authorities. Compared with traditional institutions, which often face legal and enforcement constraints, blockchain systems can support scalable and relatively low-friction coordination in digital commons.

Property Without the State?

Classic property rights theory emphasizes enforcement through courts or sovereign authority (North, 1990; Libecap, 1989). Blockchain challenges this model by enabling self-enforcing digital property, where ownership, transfer, and control are governed by protocol rules rather than legal adjudication. This reflects the idea of “code as law” (Lessig, 1999), particularly in digital environments.

In digital commons such as software, protocols, AI models, and datasets, blockchain tokens can represent access, usage, governance, or reputation rights. Unlike traditional licenses, these rights are programmable, fractional, and composable, enabling flexible value distribution and incentive structures suited to AI ecosystems with many contributors and long innovation cycles.

Blockchain Governance: Beyond Decentralization Hype

Not all blockchain governance systems are effective or truly decentralized. Common challenges include whale capture by large token holders (Messias et al., 2023), off-chain influence by investors or core developers (Weidener et al., 2025), and the absence of clear mechanisms for evolving governance rules (Santalo & Filatotchev, 2025).

Blockchain governance extends beyond simple token voting. Emerging mechanisms include quadratic voting and funding (Lalley & Weyl, 2018), conviction voting (Emmett, 2019), futarchy (Hanson, 2007), and multisignature governance (Beck et al., 2018; Lumineau et al., 2021). The key opportunity lies not in decentralization itself, but in designing governance systems that are modular, auditable, and adaptable over time.

Why Blockchain Is Not Enough—But Still Necessary

Blockchain is not a universal solution. Common challenges include voter apathy and stakeholder concentration in token-based governance (Beck et al., 2018; Feichtinger et al., 2023; Lumineau et al., 2021), legal uncertainty surrounding DAOs (Hassan & De Filippi, 2021), and governance distortions driven by token speculation (Cong et al., 2021).

Despite these limitations, blockchain enables global participation, programmable value flows, and decentralized digital property rights. In AI ecosystems, these capabilities can support programmable licensing, contributor compensation, transparent governance, and community-based funding for open-source development. Blockchain thus represents an emerging institutional layer for coordinating and sustaining digital commons at scale.

Tokenization and Programmable Incentives

Tokenization is more than converting assets into tradable tokens; it encodes rights, roles, and incentives into programmable units of value. In digital commons, particularly those supporting AI, tokenization can help coordinate contribution, ownership, and participation among distributed actors with minimal trust. When designed carefully, programmable incentives can support sustainable commons governance, though poorly designed systems risk reducing commons to speculative financial assets.

What Does Tokenization Do?

Blockchain tokens can encode ownership, access, reputation, governance, and revenue rights within digital ecosystems (Catalini & Gans, 2020; Cong et al., 2021; Beck et al., 2018; Lumineau et al., 2021; Chen et al., 2021; Hassan & De Filippi, 2021; Yermack, 2017). Through smart contracts, contributors can be rewarded for measurable work, creating self-reinforcing incentive systems for digital commons (Buterin et al., 2019).

Bitcoin illustrates this approach through quadratic funding, DAO governance, and reputation mechanisms that support public digital infrastructure (Buterin et al., 2019). Its model combines broad community participation with transparent on-chain funding and governance (Benkler, 2002; Buterin et al., 2019; Cong et al., 2021). Related initiatives, including Optimism's retroactive public goods funding, reward contributions after their value becomes evident through adoption (Li et al., 2024).

Incentive Design in AI Commons

Tokenized incentives are increasingly used to coordinate contributions in AI ecosystems. Examples include data cooperatives that reward data contributors, model DAOs that govern model development, open-source AI treasuries that fund shared infrastructure, and annotation protocols that compensate labeling and testing efforts (Catalini & Gans, 2020; Cong et al., 2021; Lumineau et al., 2021).

These approaches seek to replace extractive data practices with systems that reward ongoing participation in AI development. However, their effectiveness depends on governance mechanisms that prevent manipulation, ensure fair attribution, and balance financial rewards with intrinsic motivations (Deci & Ryan, 2013).

Financialization Risks

Poorly designed token systems can weaken digital commons through speculative trading, concentrated voting power, exploitative work-to-earn models, and incentives that prioritize token prices over long-term public value.

These risks are particularly relevant in AI ecosystems. Tokenized access may reinforce infrastructure inequalities, training rewards may favor quantity over quality or safety, and data bounties may encourage low-quality contributions. Consequently, tokenization requires careful institutional design, including clear objectives, feedback mechanisms, and governance structures that support long-term ecosystem value rather than short-term extraction.

Design Principles for Commons-Aligned Tokenization

To support AI-era digital commons, token systems should emphasize reciprocity, transparency, plural governance, delayed rewards, and interoperability. Rewards should favor contributors over speculators, governance and value flows should be auditable, participation should be broadly distributed, compensation should recognize long-term contributions, and systems should operate across ecosystems. When guided by these principles, tokenization can strengthen the sustainability of digital commons by complementing community governance with programmable coordination.

Coordination and Recognition Challenges in Decentralized AI

Despite the promise of blockchain and open-source AI, most decentralized AI ecosystems struggle to scale and endure. Two persistent challenges—coordination and recognition—undermine their legitimacy, adoption, and sustainability.

Coordination: The Problem of Fragmentation

Coordination is the ability of developers, researchers, funders, and users to align their goals and actions. In decentralized environments, achieving such alignment is particularly difficult:

Protocol Fragmentation

Decentralized AI projects such as Bittensor, Ocean Protocol, Fetch.ai, Gensyn, and SingularityNET experiment with different incentives, governance models, and technical architectures. While this diversity fosters innovation, it also fragments the ecosystem by duplicating infrastructure, competing for talent and resources, and limiting coordination around shared standards and interoperability (Catalini & Gans, 2020; Cong et al., 2021; Klinger et al., 2023; Lumineau et al., 2021; Yoo et al., 2010).

Governance Incompatibility

Each protocol typically employs its own governance mechanisms, including token voting, DAO councils, multisignature controls, and community processes. Limited interoperability creates coordination challenges: cross-ecosystem upgrades are difficult, reputation rarely transfers across networks, and contributors must learn multiple governance systems to participate effectively.

Misaligned Incentives

AI commons initiatives are often funded through tokens or grants, but tokenization can create coordination problems. Common issues include short-term selling incentives, misalignment between investors and contributors, and bureaucratic governance structures that discourage participation. Without alignment among stakeholders, ecosystems risk stagnation rather than long-term development.

Recognition: The Problem of Legitimacy

Recognition refers to whether claims—of ownership, contribution, governance authority—are acknowledged and enforceable within broader institutional systems. While blockchain provides internal enforcement through smart contracts, this doesn't always translate to real-world legitimacy.

Legal Recognition of Digital Property

Token ownership does not necessarily confer enforceable legal rights. Questions remain about the legal status of tokens, the authority of DAO decisions, and liability when AI systems cause harm. As a result, token-based governance may offer limited recourse in cases of disputes or governance failures. Efforts such as LexDAO and Wyoming DAO LLC seek to bridge decentralized governance and existing legal systems, but substantial legal uncertainty remains (Yermack, 2017).

Social Recognition of Commons Contributions

Recognition is essential to digital commons governance, yet token systems often reward easily measured activities while overlooking contributions such as safety, documentation, and coordination. Reputational signals are also frequently confined to individual ecosystems. In AI communities, where contributions take diverse forms, simple metrics often fail to reflect real impact. Without stronger recognition mechanisms, contributors may disengage, weakening participation and long-term sustainability (Benkler, 2009).

Forking and the Problem of Identity

Blockchains and DAOs can be forked, creating competing versions of the same project. While forks may encourage experimentation, they also create governance uncertainty regarding legitimacy, control of shared assets, and ownership of community identity and reputation. In AI commons, where datasets and models are collectively developed, forks can fragment communities and generate competing claims over governance and performance, undermining trust in shared infrastructure (Lumineau et al., 2021).

Recognition and Coordination Are Interlinked

Coordination and recognition are mutually reinforcing challenges. Without recognition, contributors have little incentive to coordinate; without coordination, projects struggle to gain legitimacy. Even technically strong AI commons may face limited adoption if they lack legal standing or credible governance. The result is a governance limbo in which projects are too decentralized to coordinate effectively yet insufficiently recognized to achieve broad acceptance.

Toward Institutional Solutions

Addressing these challenges requires institutional as well as technical innovation (Congleton, 2007). Potential solutions include nested governance structures (Ostrom, 2005), legal wrappers that connect decentralized organizations to existing legal systems (Beck et al., 2018), portable reputation protocols (Hassan & De Filippi, 2021), and decentralized dispute-resolution mechanisms (Zhuk, 2023). Together, these institutions can provide the legitimacy, accountability, and coordination needed for scalable AI commons.

The Enclosure of AI: Compute, Data, and Models

AI's early advances were built on open research, datasets, and software. As commercial stakes rise, however, control over compute, data, and models is increasingly concentrated among a few firms. This enclosure mirrors historical commons enclosures and threatens the participatory foundations of AI ecosystems.

The Return of the Walled Garden

The internet evolved from open protocols to platform-dominated ecosystems controlled by a few firms. A similar shift is occurring in AI, where public data becomes proprietary models, open tools depend on platform APIs, and foundation models are distributed through restrictive gateways. This emerging “walled garden” favors rent extraction and gatekeeping over public value creation, while the scale and opacity of AI systems make enclosure harder to detect or challenge (Klinger et al., 2023; Plantin et al., 2018; Van Dijck, 2013).

Compute as a Bottleneck

The growth of frontier AI models has fueled a computational arms race, requiring massive investments in compute, energy, and infrastructure. This has strengthened ties between AI labs and cloud providers while concentrating access to advanced compute among well-funded actors. Although decentralized compute networks such as Gensyn and Akash seek to expand access, they remain limited relative to centralized providers. As long as large-scale compute remains effectively pay-to-play, AI development will primarily reflect the priorities of capital-rich organizations rather than broader public interests (Bommasani et al., 2021; Kenney & Zysman, 2016).

Data Lock-In and Licensing Wars

Data has become a core resource in AI development, yet access is increasingly restricted through licensing changes, API paywalls, dataset removals, and legal disputes. Meanwhile, commons-based datasets such as LAION-5B, Mozilla Common Voice, and OpenStreetMap remain vital to open AI research but face underfunding, quality challenges, and legal uncertainty. Without stronger governance and incentives, these shared resources risk degradation, commercial extraction, or closure (Benkler, 2009; Klinger et al., 2023).

The Shadow of Closed Models

Frontier AI systems such as GPT-4, Claude, and Gemini possess powerful capabilities but operate within highly opaque infrastructures. Their architectures, training data, and model weights are largely inaccessible, while API-based access limits independent auditing and modification. This lack of transparency hinders evaluation of risks, biases, and capabilities, creating challenges for accountability and innovation. From a digital commons perspective, such opacity represents not only enclosure but also epistemic expropriation, whereby collective knowledge is transformed into privately controlled intelligence systems (Bommasani et al., 2021; Klinger et al., 2023).

Intellectual Property as a Weapon

AI enclosure is often reinforced through intellectual property regimes that protect model architectures, datasets, and AI-generated outputs. Yet contributors to commons-based resources—such as dataset creators, open-source developers, and annotators—typically receive little compensation or recognition. This creates a one-way flow of value from shared knowledge infrastructures to capital-intensive firms, risking a growing imbalance between private appropriation and collective knowledge production (Burrell & Fourcade, 2021).

Fighting Enclosure with Institutional Innovation

Countering AI enclosure requires institutions that protect and expand digital commons. Potential mechanisms include data trusts, open-model licensing, tokenized contributor incentives, and policies supporting open AI in publicly funded sectors. While blockchain and Web3 can facilitate decentralized coordination, their effectiveness depends on governance structures aligned with public-interest goals. Sustaining AI commons is therefore an institutional and political challenge as much as a technical one (Dulong de Rosnay & Stalder, 2020; Hardjono et al., 2019).

Beyond Defensive Commons: Regenerative AI Ecosystems

The goal is not only to preserve AI commons but to expand them through sustainable ecosystems that fairly reward contributors, maintain shared infrastructure, and align innovation with public benefit. Achieving this requires new institutional forms—such as digital cooperatives, tokenized collaboration networks, and reputation-based coordination systems—and a shift from extractive monetization toward collective stewardship of shared knowledge resources (Dulong de Rosnay & Stalder, 2020; Hardjono et al., 2019).

Institutional Innovation: From Open Source to Token-Engineered Commons

The open-source movement has long exemplified digital commons, but its limitations are increasingly evident in the AI era. Foundational tools such as PyTorch, Hugging Face, and TensorFlow generate substantial value while often relying on limited maintenance resources. The challenge is not participation but sustainable institutional support. Tokenization and programmable governance offer a potential solution by creating incentive-aligned, actively maintained, and transparently governed ecosystems—what we term token-engineered commons.

The Crisis of Open Source in AI

Open-source AI projects face persistent sustainability challenges (Eiras et al., 2024). Contributors are often unpaid, maintainers carry ongoing support burdens, and large firms frequently benefit from open resources without proportional reinvestment. As AI becomes critical infrastructure, the central challenge is how to fund, govern, and sustain these systems while preserving openness and resisting enclosure or decline.

What Are Token-Engineered Commons?

A token-engineered commons is a digital infrastructure that uses blockchain tokens to coordinate contributions, governance, and value distribution (Freni et al., 2022). Contributors can be rewarded through tokens, governance can occur through DAOs, and value flows and rules can be automated via smart contracts. By combining incentives, collaboration, and programmable governance, these systems support shared ecosystems in which tokens may represent not only financial value but also reputation, governance rights, contribution, or future access.

Tools for Building Commons-Based AI Institutions

Token-engineered commons are supported by governance platforms such as Aragon, Gnosis Safe, and DAOstack, which enable treasury management and collective decision-making. Other mechanisms—including quadratic funding, bonding curves, and reputation systems—help coordinate funding and reward contributions.

New licensing and legal frameworks further support these ecosystems. Responsible licensing models seek to balance openness with safeguards, while DAO legal wrappers provide limited liability and legal recognition, helping connect decentralized governance with existing institutions.

Commons-Based Alternatives to Traditional Institutions

Traditional institutions for research, funding, licensing, and governance are increasingly being reimaged through Web3-native structures. Research DAOs coordinate scientific collaboration, community funding mechanisms support innovation, smart licensing enables programmable intellectual property management, and DAO governance can facilitate standards development and protocol evolution. Similarly, membership-based DAOs mirror cooperative ownership and governance models through tokenized participation and decision-making. Table 1 summarizes how token-engineered systems can replicate and extend traditional institutional functions.

Table 1. Token-Engineered Systems For Traditional Institutional Functions

Traditional Institution	Web3 Commons Equivalent
University lab	Research DAO (e.g., VitaDAO, Molecule)
Venture capital fund	Quadratic grants + retro funding
Licensing office	Smart licensing + tokenized royalties
Standards body	DAO-driven governance with modular upgrades
Cooperative	Token-weighted, membership-based DAO

Case Studies: Gitcoin, SingularityNET, Ocean Protocol

Real-world implementations illustrate how blockchain and tokenization can govern AI-era digital commons through programmable coordination, open access, and incentive alignment. Cases such as Gitcoin, SingularityNET, and Ocean Protocol demonstrate how blockchain mechanisms address coordination and recognition challenges in funding, AI service markets, and data governance across the AI infrastructure stack.

Gitcoin: Coordinating Open-Source Funding at Scale

Gitcoin is a leading platform for funding digital public goods through blockchain-based mechanisms such as quadratic funding and DAO governance. Originally focused on Ethereum open-source development, it now supports a broader range of digital commons, including AI-related tools, protocols, and infrastructure. Its retroactive funding model rewards projects after they demonstrate ecosystem value, making it particularly relevant for AI commons. Gitcoin demonstrates how programmable funding can align incentives and increase transparency, but it also faces challenges, including sybil attacks, evolving governance structures, and continued reliance on external funding sources.

SingularityNET: Decentralized AI as a Service

SingularityNET is an early decentralized marketplace for AI services, enabling developers to offer AI tools through a token-based ecosystem governed by a DAO. It aims to move AI infrastructure away from proprietary APIs toward an open, permissionless network and promotes AI as a shared resource rather than a purely corporate asset. At the same time, SingularityNET highlights the challenges of decentralized AI. Adoption remains limited relative to centralized platforms, while interoperability, performance, and token-economy volatility continue to constrain growth. As such, it reflects the broader tension between open AI infrastructure and practical scalability.

Ocean Protocol: Data as a Public Good

Ocean Protocol is a decentralized platform for tokenizing and exchanging data. Using datatokens and the OCEAN token, it enables controlled access to datasets and APIs while supporting governance and ecosystem funding. Its compute-to-data approach allows AI models to train on private data without exposing the underlying datasets, addressing data access, privacy, and monetization challenges. Ocean demonstrates how tokenized governance can support decentralized data ownership, privacy, and data-sharing incentives. However, adoption remains constrained by onboarding challenges, limited liquidity, and regulatory uncertainty, underscoring the need for complementary legal and institutional frameworks.

Governance Architectures for AI Commons

Institutional Foundations for Digital Commons Governance

AI-related digital commons require governance systems that coordinate distributed contributors while protecting shared resources. Unlike hierarchical organizations, they depend on decentralized participation, creating challenges in decision-making, recognition, funding, and resistance to capture. Commons research shows that sustainable governance requires clear rules, transparent processes, and mechanisms for oversight and conflict resolution. These principles are particularly important for AI infrastructure such as datasets, models, and open-source software. Blockchain provides new governance tools through smart contracts, tokens, and DAOs. However, sustainable AI commons require more than technical automation; they depend on integrating legal legitimacy, institutional coordination, and programmable enforcement.

Quasi-Legal Governance: Bridging Code and Law

Blockchain governance often operates in a legal grey zone. While smart contracts can enforce rules digitally, questions remain regarding legal recognition, jurisdiction, asset ownership, contractual authority, and liability. To address these gaps, many projects are adopting quasi-legal governance that combines blockchain-based coordination with recognized legal structures. Approaches include DAO legal wrappers, dual licensing frameworks, and decentralized dispute-resolution systems. The goal is not full integration into traditional law but interoperability, allowing digital commons to engage with legal and institutional systems while preserving decentralized governance principles.

Programmable Governance: Institutions in Code

Traditional institutions rely on human-mediated governance, whereas blockchain enables programmable institutions in which rules, value flows, and governance processes are encoded in software. Smart contracts can automate enforcement, increase transparency, and support verifiable decision-making while complementing, rather than replacing, human judgment. In AI commons, programmable governance can automate contributor rewards, adapt governance rights based on participation or reputation, and enable stakeholders to vote on system upgrades and policy changes. The goal is to balance adaptability with accountability while reducing risks of centralized control and opaque decision-making.

A Three-Layer Framework

Sustainable AI-era digital commons require governance across three institutional layers. The constitutional layer establishes mission, values, legal legitimacy, and external accountability through mechanisms such as governance charters, legal wrappers, and dispute-resolution frameworks. The institutional layer governs funding, upgrades, and community decision-making through mechanisms such as voting systems, reputation models, and resource-allocation processes. The protocol layer enforces these rules through smart contracts, staking, token-gating, and other automated mechanisms. Together, these layers integrate legal legitimacy, collective governance, and technical enforcement, creating digital commons that are accountable, adaptable, and resilient. Figure 1 illustrates the three-layer governance stack.

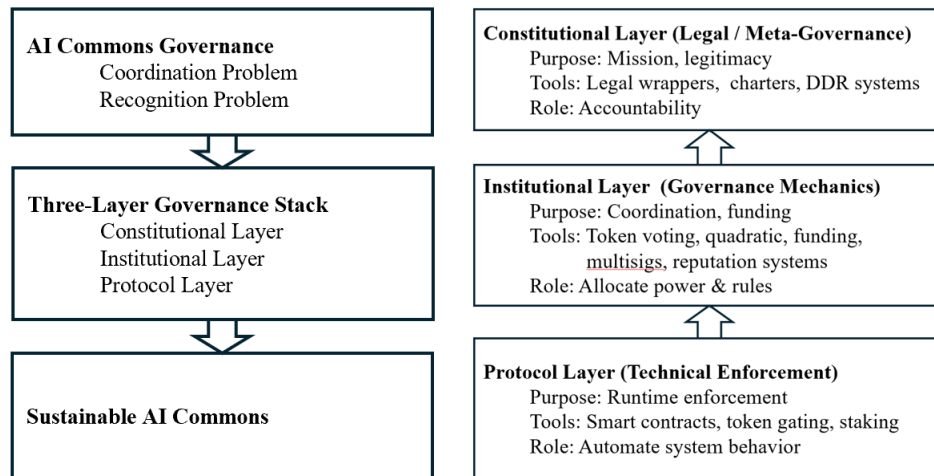


Figure 1. The Three-Layer Governance Stack.

Governance Is the New Infrastructure

In the AI era, governance is core infrastructure. It shapes participation, decision-making, and the distribution of risks and rewards across digital commons. Without effective governance, commons face coordination failures or capture by centralized platforms. Governance architectures that combine programmable rules, nested institutions, and quasi-legal frameworks can support scalable, transparent, and accountable ecosystems. Such structures provide a foundation for AI development that remains aligned with public-interest goals.

Risks, Tradeoffs, and Governance Capture

Although blockchain- and AI-enabled digital commons offer significant promise, they also face important risks and failure modes. As with the internet's evolution toward platform monopolies and surveillance capitalism, decentralized technologies can produce new forms of control, exploitation, or dysfunction. This section examines these threats and how governance can mitigate them.

Governance Capture: New Boss, Same as the Old Boss

Governance capture is a persistent risk in decentralized systems, occurring when a small group gains disproportionate influence through token ownership, founding-team control, investor pressure, or social influence. As a result, many Web3 projects risk reproducing traditional power hierarchies despite claims of decentralization.

In AI ecosystems, capture could shape model development, data governance, and resource allocation in ways that favor powerful stakeholders over broader community interests. Mitigating these risks requires safeguards such as reputation-based voting, contributor protections, progressive decentralization, and strong transparency mechanisms that distribute influence and strengthen accountability.

Tokenomics Pitfalls and Incentive Misalignment

Token-based systems often suffer from misaligned incentives, including pump-and-dump behavior, exploitative work-to-earn models, treasury volatility, and the undervaluation of essential but less visible contributions. Poorly designed incentives can turn collaborative ecosystems into extractive markets, leading to burnout, declining quality, and greater centralization.

To address these risks, governance systems can employ delayed or retroactive rewards, reputation-based influence, and decision-making safeguards such as quorum requirements, cooldown periods, and staged voting processes that encourage long-term participation and discourage opportunistic behavior.

Sybil Attacks and Identity Games

Decentralized governance systems are vulnerable to sybil attacks, in which a single actor uses multiple identities to manipulate votes, rewards, or influence. This is especially challenging in AI commons, where valuable contributions are often difficult to measure. Proposed solutions include proof-of-personhood systems, reputation-based governance, and layered identity models. However, each involves trade-offs among privacy, decentralization, and accountability, making identity governance a persistent challenge.

Regulatory and Legal Gray Zones

As digital commons become more important, they face growing regulatory challenges involving securities law, data privacy, intellectual property, and liability for AI outputs. These issues are particularly complex in decentralized ecosystems spanning multiple jurisdictions. Addressing them requires governance mechanisms that interact with legal systems through tools such as DAO legal wrappers, licensing frameworks, and privacy-preserving data governance. However, regulatory uncertainty remains a major barrier to participation and investment.

Fragmentation and Fork Wars

Forking allows digital commons to split into competing versions, enabling innovation but also creating risks of community fragmentation, legitimacy disputes, and resource division. These challenges often arise when governance processes are unclear or conflicts remain unresolved. Mitigation strategies include formal exit procedures, shared contribution and reputation records, and gradual forking mechanisms that test alternatives before a full split occurs.

The Risk of Commons Failure: Decay or Capture

The greatest threat to digital commons is commons failure: the gradual decline of shared infrastructure through underfunding, poor maintenance, governance breakdowns, or private capture. Datasets, models, and other shared resources may become unsustainable, inaccessible, or ineffective over time. Common causes include neglect, contributor burnout, hostile capture, and mission drift. Thus, the modern tragedy of the commons is not only overuse but also abandonment and under-provisioning of critical digital infrastructure.

Designing for Resilience

Resilient digital commons require governance based on pluralism, transparency, modularity, composability, and human oversight. These principles help distribute power, strengthen accountability, enable adaptation, and maintain interoperability while ensuring that ethical judgment complements automated processes. Resilience is therefore not a fixed condition but an ongoing process of institutional learning, social negotiation, and technological adaptation.

Conclusion and Research Agenda

As AI becomes embedded across society, control over AI infrastructure is increasingly consequential. The current trajectory favors enclosure, concentrating control over compute, data, and models despite their reliance on public resources and collective contributions. An alternative lies in digital commons, blockchain governance, and tokenized incentives that support more open, participatory, and public-interest-oriented AI

systems. Realizing this vision requires deliberate institutional design, technical innovation, and cultural commitment.

Key Insights

Digital commons are essential infrastructure for AI, supporting shared datasets, open-source models, and collaborative innovation. Ensuring their sustainability is critical to keeping AI development accessible, transparent, and aligned with societal interests. Blockchain introduces programmable governance mechanisms that coordinate participation, incentives, and decision-making. Initiatives such as Gitcoin, Ocean Protocol, and SingularityNET illustrate both the potential and challenges of decentralized funding, data governance, and AI service networks. To succeed, AI commons require governance systems that combine institutional design, legal legitimacy, and programmable enforcement.

Although risks such as concentration, speculation, and coordination failures remain, resilient AI commons can be built through intentional governance structures that distribute authority, sustain participation, and support long-term public value.

A Research Agenda for AI Commons

Although no definitive blueprint exists for governing AI-era digital commons, an interdisciplinary research agenda can guide their development. As AI increasingly relies on shared datasets, models, and infrastructure, new institutional frameworks are needed to coordinate distributed communities while protecting public interests.

Key research areas include institutional design, incentive engineering, law, data governance, and large-scale coordination. Important questions concern how to combine legal recognition with programmable governance, design incentives that sustain public goods, integrate decentralized systems with existing legal institutions, and govern shared data and models responsibly.

Researchers must also explore governance architectures that support coordination across AI ecosystems, promote inclusion and accountability, and clarify the roles of governments, NGOs, and public institutions in sustaining equitable and resilient AI commons.

Discussion

AI stands at a crossroads between centralized, platform-controlled ecosystems and commons-based models grounded in openness, transparency, and shared governance. The tools for the latter already exist, but realizing their potential requires action from developers, researchers, governments, and communities. Rather than treating AI solely as a proprietary asset, it should be stewarded as a shared societal resource. Digital commons offer one of the most promising foundations for achieving that goal.

References

- Ahmed, N., Wahed, M., & Thompson, N. C. (2023). The growing influence of industry in AI research. *Science*, 379(6635), 884-886.
- Alexander, L. E. E. (2026). The Efficiency Shock in AI Governance: Open-Weight Models, Regulatory Fragmentation, and the Emerging Limits of Chokepoint Control. *Journal of Algorithmic Governance & Policy*, 1(1), 107-119.

- Amodei, D., & Hernandez, D. (2018, May 16). *AI and compute*. OpenAI. <https://openai.com/index/ai-and-compute/>
- Aragon Court. (2023). *Dispute resolution protocol docs (legacy)*. <https://legacy-docs.aragon.org/products/aragon-court/aragon-court>
- Ardila, R., Branson, M., Davis, K., Kohler, M., Meyer, J., Henretty, M., ... & Weber, G. (2020, May). Common voice: A massively-multilingual speech corpus. In *Proceedings of the twelfth language resources and evaluation conference* (pp. 4218-4222).
- Ayala, J., Ngo, S., & Garcia, J. (2025, May). A deep dive into how open-source project maintainers review and resolve bug bounty reports. In *2025 IEEE Symposium on Security and Privacy (SP)* (pp. 522-538). IEEE.
- Bassan, F., & Rabitti, M. (2024). From smart legal contracts to contracts on blockchain: An empirical investigation. *Computer Law & Security Review*, 55, 106035.
- Beck, R., Müller-Bloch, C., & King, J. L. (2018). Governance in the blockchain economy: A framework and research agenda. *Journal of the association for information systems*, 19(10), 1.
- Benkler, Y. (2009). Coase's Penguin, or, Linux and the Nature of the Firm"(2002). *Yale LJ*, 112, 369.
- Benkler, Y. (2006). *The wealth of networks: How social production transforms markets and freedom*. Yale University Press.
- BigScience. (2022). *The BigScience RAIL license (Responsible AI Licenses)*. <https://bigscience.huggingface.co/blog/the-bigscience-rail-license>
- Bittensor team. (2022). *Bittensor whitepaper: Incentivizing intelligence*. Bittensor. <https://bittensor.com/whitepaper>
- Bommasani, R., Hudson, D. A., Adeli, E., Altman, R., Arora, S., von Arx, S., ... Liang, P. (2021). On the opportunities and risks of foundation models. *arXiv*. <https://arxiv.org/abs/2108.07258>
- Books3 dataset background (183k pirated books used in model training). Authors Guild explainer.
- Burrell, J., & Fourcade, M. (2021). The society of algorithms. *Annual review of sociology*, 47(1), 213-237.
- Buterin, V. (2014). DAOs, DACs, DAs and more: An incomplete terminology guide. *Ethereum Blog*, 6, 2014.

- Buterin, V., Hitzig, Z., & Weyl, E. G. (2019). Liberal radicalism: A flexible design for philanthropic matching funds. *Management Science*, 65(11), 5171–5187.
<https://doi.org/10.1287/mnsc.2018.3260>
- Buterin, V. (2024, January 30). *The promise and challenges of crypto + AI applications*. Vitalik's blog.
<https://vitalik.eth.limo/general/2024/01/30/cryptoai.html>
- Catalini, C., & Gans, J. S. (2020). Some simple economics of the blockchain. *Communications of the ACM*, 63(7), 80-90.
- Chen, Y., Richter, J. I., & Patel, P. C. (2021). Decentralized governance of digital platforms. *Journal of Management*, 47(5), 1305-1337.
- Christidis, K., & Devetsikiotis, M. (2016). Blockchains and smart contracts for the internet of things. *IEEE access*, 4, 2292-2303.
- Cong, L. W., Li, Y., & Wang, N. (2021). Tokenomics: Dynamic adoption and valuation. *The Review of Financial Studies*, 34(3), 1105-1155.
- Congleton, R. D. (2007). Elinor Ostrom, *Understanding institutional diversity*. *Public Choice*, 132(3–4), 509–511. <https://doi.org/10.1007/s11127-007-9157-x>
- Crepaldi, M. (2019, June). Why blockchains need the law: Secondary rules as the missing piece of blockchain governance. In *Proceedings of the Seventeenth International Conference on Artificial Intelligence and Law* (pp. 189-193)
- Cusumano, M. A., Gawer, A., & Yoffie, D. B. (2019). *The business of platforms: Strategy in the age of digital competition, innovation, and power* (Vol. 320, pp. 1-5). New York: Harper Business.
- De Filippi, P., Mannan, M., & Reijers, W. (2024). Blockchain technology and the rule of code: Regulation via governance. *Geo. Wash. L. Rev.*, 92, 1229.
- De Filippi, P., & Wright, A. (2018). *Blockchain and the law: The rule of code*. Harvard University Press.
- Deci, E. L., & Ryan, R. M. (2013). *Intrinsic motivation and self-determination in human behavior*. Springer Science & Business Media.
- Dulong de Rosnay, M., & Stalder, F. (2020). Digital commons. *Internet Policy Review*, 9(4).
<https://doi.org/10.14763/2020.4.1530>
- Eiras, F., Petrov, A., Vidgen, B., Schroeder, C., Pizzati, F., Elkins, K., ... & Foerster, J. (2024). Risks and

- opportunities of open-source generative ai. *arXiv preprint arXiv:2405.08597*.
- Emmett, J. (2019). Conviction voting: A novel continuous decision making alternative to governance. *Commons Stack*.
- Epoch AI. (2024). *How far behind are open models?* <https://epoch.ai/blog/open-models-report>
- Esposito, M., Tse, T., & Goh, D. (2025). Decentralizing governance: exploring the dynamics and challenges of digital commons and DAOs. *Frontiers in Blockchain*, 8, 1538227.
- Feichtinger, R., Fritsch, R., Vonlanthen, Y., & Wattenhofer, R. (2023, May). The hidden shortcomings of (d) aos—an empirical study of on-chain governance. In *International Conference on Financial Cryptography and Data Security* (pp. 165-185). Cham: Springer Nature Switzerland.
- Freni, P., Ferro, E., & Moncada, R. (2022). Tokenomics and blockchain tokens: A design-oriented morphological framework. *Blockchain: Research and Applications*, 3(1), 100069. <https://doi.org/10.1016/j.bcr.2022.100069>
- Getty Images. (2025, November 4). *Getty Images issues statement on ruling in Stability AI UK litigation*. *Getty Images Newsroom*. <https://newsroom.gettyimages.com/en/getty-images/getty-images-issues-statement-on-ruling-in-stability-ai-uk-litigation>
- Getty Images (US), Inc. v. Stability AI, Inc., No. 1:23-cv-00135 (D. Del. filed Feb. 3, 2023).
- Han, J., Lee, J., & Li, T. (2025). A review of DAO governance: Recent literature and emerging trends. *Journal of Corporate Finance*, 91, 102734.
- Hardjono, T., Pentland, A., & Shrier, D. (2019). Toward a design for collective data governance. *Communications of the ACM*, 62(6), 46–54. <https://doi.org/10.1145/3320791>
- Hart, H. L. A. (2012). *The concept of law*. OUP Oxford.
- Hanson, R. (2007). Shall we vote on values, but bet on beliefs? *Social Choice and Welfare*, 14, 135–157. (Original work published 2000). <https://hanson.gmu.edu/futarchy2007.pdf>
- Hassan, S., & De Filippi, P. (2021). Decentralized autonomous organization. *Internet Policy Review*, 10(2). <https://doi.org/10.14763/2021.2.1556>.
- Hippel, E. V., & Krogh, G. V. (2003). Open source software and the “private-collective” innovation model: Issues for organization science. *Organization science*, 14(2), 209-223.
- Hunhevicz, J. J., Hall, D. M., Brasey, P. A., Bonanomi, M. M., & Fischer, M. (2024). Decentralized

- project delivery on the crypto commons: Conceptualization, governance mechanisms, and future research directions. *Project Leadership and Society*, 5, 100132.
- Kenney, M., & Zysman, J. (2016). The rise of the platform economy. *Issues in Science and Technology*, 32(3), 61–69.
- Klinger, J., Mateos-Garcia, J., & Stathoulopoulos, K. (2018). *Deep learning, deep change? Mapping the development of the artificial intelligence general purpose technology*. arXiv. <https://arxiv.org/abs/1808.06355>
- Klinger, J., Mateos-Garcia, J., & Stathoulopoulos, K. (2023). Deep learning, foundation models, and the changing structure of AI innovation. *Research Policy*, 52(1). <https://doi.org/10.1016/j.respol.2022.104693>
- LAION-5B dataset controversies and child-safety reports (2023–2024 press coverage). The Guardian; Wired.
- Lailey, S. P., & Weyl, E. G. (2018, May). Quadratic voting: How mechanism design can radicalize democracy. In *AEA Papers and Proceedings* (Vol. 108, pp. 33-37). 2014 Broadway, Suite 305, Nashville, TN 37203: American Economic Association.
- Lessig, L. (2009). *Code: And other laws of cyberspace*. ReadHowYouWant. com.
- Li, J., Cheng, Y., Huang, W., Zhang, M., Fan, J., Deng, X., ... & Zhang, J. (2024). Decentralized Funding of Public Goods in Blockchain System: Leveraging Expert Advice. *IEEE Transactions on Cloud Computing*, 12(2), 725-736.
- Libecap, G. D. (2003). Contracting for property rights. *Property rights: Cooperation, conflict, and law*.
- Lumineau, F., Wang, W., & Schilke, O. (2021). Blockchain governance—A new way of organizing collaborations?. *Organization science*, 32(2), 500-521.
- Messias, J., Pahari, V., Chandrasekaran, B., Gummadi, K. P., & Loiseau, P. (2023). Understanding blockchain governance: Analyzing decentralized voting to amend defi smart contracts. *arXiv preprint arXiv:2305.17655*.
- Meta AI. (2023). *LLaMA: Open and efficient foundation language models*. arXiv. <https://arxiv.org/abs/2302.13971>
- Mueller, M. L. (2025). It's just distributed computing: Rethinking AI governance. *Telecommunications Policy*, 49(3), 102917.

- North, D. C. (1990). *Institutions, institutional change and economic performance*. Cambridge university press.
- Nouns DAO. (2023–2025). *Governance docs and protocol references*. <https://docs.nouns.wtf/>
- Ocean Protocol Foundation. (2020). *Ocean Protocol: Tech whitepaper v4 (including Compute-to-Data)*.
<https://oceanprotocol.com/tech-whitepaper.pdf>
- Ocean Protocol Docs. (2024). *Compute-to-Data overview*.
<https://docs.oceanprotocol.com/developers/compute-to-data/>
- OpenAI. (2023). *GPT-4 technical report*. arXiv. <https://doi.org/10.48550/arXiv.2303.08774>
- Ostrom, E. (1990). *Governing the commons: The evolution of institutions for collective action*. Cambridge university press.
- Ostrom, E. (2005). *Understanding institutional diversity*. Princeton University Press.
- Optimism Collective. (2021–2024). *Retroactive Public Goods Funding (RetroPGF) program docs*.
<https://community.optimism.io/citizens-house/how-retro-funding-works>
- Plantin, J.-C., Lagoze, C., Edwards, P. N., & Sandvig, C. (2018). Infrastructure studies meet platform studies in the age of Google and Facebook. *New Media & Society*, 20(1), 293–310.
<https://doi.org/10.1177/1461444816661553>
- PolyForm Project. (2020–2025). *PolyForm licenses (Noncommercial, Perimeter, Shield, etc.)*.
<https://polyformproject.org/licenses/>
- Santalo, J., & Filatotchev, I. (2025). Strategic governance of blockchain platforms: From centralized to open source control systems. *Long Range Planning*, 58(4), 102539.
- Sastry, G., Heim, L., Belfield, H., Anderljung, M., Brundage, M., Hazell, J., ... & Coyle, D. (2024). Computing power and the governance of artificial intelligence. *arXiv preprint arXiv:2402.08797*.
- Scholz, T. (2016). Platform cooperativism. *Challenging the corporate sharing economy*. New York, NY: Rosa Luxemburg Foundation, 435.
- Laion-5B: An open large-scale dataset for training next generation image-text models. *Advances in neural information processing systems*, 35, 25278-25294.
- Tan, E., Mahula, S., & Cromptvoets, J. (2022). Blockchain governance in the public sector: A conceptual

- framework for public management. *Government Information Quarterly*, 39(1), 101625.
- The New York Times Co. v. Microsoft Corp. & OpenAI, No. 1:23-cv-11195 (S.D.N.Y. filed Dec. 27, 2023).
- Van Dijck, J., Poell, T., & De Waal, M. (2018). *The platform society: Public values in a connective world*. Oxford university press.
- Van Dijck, T. (2013). Understanding social media logic. *Media and Communication*, 1(1), 2–14.
<https://doi.org/10.17645/mac.v1i1.70>
- Varoufakis, Y. (2024). *Technofeudalism: What killed capitalism*. Melville House.
- Voinea, D. V. (2025). Reconceptualizing gatekeeping in the age of artificial intelligence: A theoretical exploration of artificial intelligence-driven news curation and automated journalism. *Journalism and Media*, 6(2), 68.
- Voshmgir, S. (2020). *Token economy: How the Web3 reinvents the Internet* (2nd ed.). BlockchainHub Berlin.
- Weidener, L., Heurich, B., & Lukács, B. (2025, June). Bridging Social Capital and Financial Incentives: Navigating Liability and Regulatory Challenges in DAO Governance. In *European DAO Workshop* (pp. 97-113). Cham: Springer Nature Switzerland.
- Wyoming Legislature. (2021). *Decentralized Autonomous Organizations (DAO) Supplement*—SF0038 (codified at Wyo. Stat. § 17-31-101 et seq.). <https://www.wyoleg.gov/Legislation/2021/SF0038>
- Yermack, D. (2017). Corporate governance and blockchains. *Review of finance*, 21(1), 7-31.
- Zhuk, A. (2023). Applying blockchain to the modern legal system: Kleros as a decentralised dispute resolution system. *International Cybersecurity Law Review*, 4(3), 351-364