“Enhancing shareholder democracy through blockchain and decentralized autonomous organizations: A systematic review”

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ENHANCING SHAREHOLDER DEMOCRACY THROUGH BLOCKCHAIN AND DECENTRALIZED AUTONOMOUS ORGANIZATIONS: A SYSTEMATIC REVIEW

Abstract

Shareholder voting in conventional corporate governance remains constrained by intermediated proxy systems, information asymmetries, and limited transparency. This study aims to systematically synthesize recent scholarly, legal, and policy literature to evaluate whether, and under what legal and institutional conditions, blockchain-based voting and decentralized autonomous organization (DAO) architectures can enhance shareholder democracy through hybrid "code-plus-law" governance models. Adopting an interdisciplinary qualitative design, the paper combines a systematic literature review with doctrinal legal analysis, drawing on a broad corpus of recent scholarly, legal, and policy sources published from 2020 through 2025. Evidence is synthesized into six structured comparative tables covering voting auditability, shareholder participation, token concentration, legal recognition, DAO design features, and hybrid "code-plus-law" governance models. The review highlights consistent improvements in three core dimensions compared to legacy proxy systems: enhanced auditability and end-to-end verifiability, speedier aggregation of voting outcomes, and broader feasibility of cross-border shareholder participation. Simultaneously, four risks keep appearing: token concentration ("whale dominance"), technical and governance scalability limits, unequal digital literacy and access, and persistent gaps in the legal recognition and enforceability of DAOs. Overall, the findings suggest that hybrid arrangements that combine blockchain-based transparency and efficiency with conventional legal safeguards are more apt to provide for inclusive participation and durable legitimacy than purely code-based or purely traditional governance models.

Keywords corporate governance, shareholder democracy, blockchain-based voting, decentralized autonomous organizations (DAOs), corporate law

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INTRODUCTION

Corporate governance is rapidly changing due to the pivotal role of digital technologies in reshaping how ownership and control are exercised. In contrast, classical systems of shareholder voting depend greatly on intermediaries with extended proxy processes and dispersed information flows, which can dilute an individual shareholder's voice and obscure the way in which decisions are made, thus questioning the equity and transparency of corporate decision-making. There are continuing concerns about low rates of participation, particularly relating to geographically dispersed investors, and opacity in vote counting, challenging the ideal of shareholder democracy.

The rise of blockchain-based infrastructures and DAOs has created new opportunities for reconsidering these mechanisms. Blockchain ledgers can record votes in a tamper-evident and auditable way, while smart contracts can automate decision rules and execution. Token-

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based participation seems, at least in principle, to reduce barriers to participation and enable shareholders to interact directly with governance processes rather than through layers of intermediaries. These innovations foreshadow a possible move toward more continuous, real-time, and data-rich forms of corporate participation. Yet, these developments also raise complex questions. Code-based systems may concentrate influence in the hands of large token holders and technically sophisticated participants; the distribution of digital skills and access is highly uneven, and may amplify rather than reduce existing inequalities among investors. Legal frameworks are still working out how to adapt to the idea of decisions executed by algorithms, and to organizational forms that do not fit neatly within traditional corporate categories. There are tensions between the promise of automation and the need for accountability, between borderless digital structures and jurisdiction-bound legal systems, and between new forms of participation and established protections for minority shareholders. In this light, the challenge is to understand how the digital mechanisms of governance can support, distort, or redefine the practical meaning of shareholder democracy.

This paper provides a comprehensive review that combines socio-technical analysis with a legal and regulatory lens. It synthesizes recent scholarly work, legal debates, and policy discussions on blockchain-based shareholder voting and decentralized autonomous organizations to assess their relevance for shareholder democracy. The review examines the extent to which these mechanisms can improve participation, transparency, and accountability, and it specifies the legal and institutional prerequisites required for such improvements to be credible and enforceable. It further analyzes how governance designs that integrate executable code with binding legal rules and oversight arrangements can create workable "code plus law" models for shareholder decision-making.

1. LITERATURE REVIEW

This review adopts a qualitative, multi-disciplinary design that integrates a systematic literature review, doctrinal legal analysis, and comparative governance evaluation. The approach is grounded in corporate governance theory and socio-technical perspectives on blockchain and algorithmic decision-making to organize evidence across four analytical dimensions: transparency and auditability, participation and inclusivity, legal compatibility and enforceability, and hybrid "code-plus-law" governance arrangements.

The first element of the methodology consists of a qualitative systematic review of academic, legal, and policy literature on blockchain-enabled shareholder voting, DAO governance architectures, and their implications for shareholder democracy. The selected materials were screened for relevance and coded thematically across four analytical dimensions: transparency and auditability, participation and inclusivity, legal compatibility and enforceability, and hybrid "code-plus-law" governance designs. The second element is doctrinal legal analysis. Drawing on corporate law and regulatory scholarship, the study explores how existing legal frameworks address electronic and blockchain-based voting, recognition and enforceability of smart contracts in corporate governance, and liability allocation and legal personhood for DAOs and related entities. Statutes, regulatory guidelines, and doctrinal commentaries are interpreted and compared to assess the extent to which blockchain-facilitated governance can be accommodated within prevailing rules governing shareholder rights, fiduciary duties, and remedies. Particular attention is given to hybrid constructs such as Decision Algorithmic Controllers, which combine code-based procedures with human oversight and conventional legal guardrails to make automation accountable (Lu et al., 2024). Such legal analysis enables the study to determine the conditions under which decentralized governance mechanisms would continue to be compatible with due process, equal participation rights, and institutional safeguards, therefore providing direct support for the proposal that regulatory and legal compatibility is a condition of the legitimate use of blockchain and DAOs in corporate governance.

These insights are combined through a comparative governance framework informed by the literature review and doctrinal analysis. This frame-

work contrasts theoretical possibilities created by blockchain and the mechanisms of DAO against the documented challenges and constraints in empirical, case-based, and policy-oriented studies. In this respect, it discusses token-based voting and smart contracts as reducing dependence on intermediaries and bringing shareholders closer to decision rights, as specified by Liu and Zhang (2024). At the same time, it takes into account specific structural constraints, such as mismatched token holdings and the risk of "whale dominance," wherein a few investors accrue a disproportionate share of influence over governance decisions, which are discussed by Bellavitis et al. (2022) and Ballandies et al. (2024). Scalability and inclusivity issues can be weighed alongside evidence that practical implementation has often been stymied by low technological literacy, limited access to digital wallets, and enigmatic interfaces, even when participation is formally open to all eligible investors (OECD, 2021). Drawing from both normative and policy discussions, a relevant development could regard hybrid governance models, combining blockchain efficiencies with existing corporate-law protections and oversight mechanisms, as decentralization does not, itself, translate into equality in participation, pursued by Al Halbusi et al. (2022) and Lu et al. (2024), for example.

To provide structure for this integrated analysis, this study organizes the evidence into a set of comparative dimensions that juxtapose expected benefits with documented limitations. Table 1 presents the first of these comparative summaries, focusing on shareholder voting, DAO participation, legal compatibility, and inclusivity. For each dimension, Table 1 juxtaposes the theoretical potential described in the literature with the main implementation challenges and anchors both against representative sources. In this manner, this tabular synthesis supports the analysis by highlighting where scholarly and practical expectations converge or diverge, thereby motivating the hybrid governance configurations discussed later in the paper.

On this basis, research gaps are identified in a systematic and conceptually coherent way. The existing literature indicates that applications of DAOs in corporate law are still largely experimental, with many contributions relying on simulations, small-scale pilots, or anecdotal case evidence rather than comprehensive implementation data (Ballandies et al., 2024). The position of non-token participants and minority shareholders in token-based systems remains underexplored, even though the potential for concentration and exclusion is widely acknowledged (Liu & Zhang, 2024; Bellavitis et al., 2022). Questions about how DAO operations should conform to national and international legislation, including issues of jurisdiction, liability, and investor protection, are raised more often than they are resolved (Al Halbusi et al., 2022; Jiménez-Gómez, 2023). Furthermore, the digital divide in terms of technological literacy, user readiness, and access to digital infrastructure is frequently noted but seldom integrated into systematic evaluations of shareholder democracy in a digital environment (OECD, 2021). These gaps reinforce the need for a socio-technical and legal perspective and provide the rationale for focusing on hybrid governance models that balance technological innovation with institutional and legal protection.

From an ethical standpoint, the study is conceptual and theoretical and does not involve interaction with human participants or the collection of personal data. Even so, it adheres to established international research ethics and good publica-

Table 1. Comparative framework of blockchain and DAO governance

Dimension	Theoretical potential	Observed challenges	Supporting sources
Shareholder voting	Immutable, verifiable, and accessible voting via blockchain	Limited adoption; gaps in legal enforceability	Min (2023); OECD (2021)
DAO participation	Inclusive, token-based decision-making; reduced intermediaries	Whale dominance; unequal engagement and coordination	Appel and Grennan (2023); Liu and Zhang (2024); Bellavitis et al. (2022)
Legal compatibility	Smart contracts as enforceable governance instruments	Jurisdictional uncertainty; regulatory misalignment	Ding et al. (2021); Jiménez-Gómez (2023)
Inclusivity	Broader participation across dispersed shareholders	Barriers due to literacy, wallet access, and technical complexity	Ballandies et al. (2024); OECD (2021)

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tion practices, such as those articulated by the Committee on Publication Ethics. Sources are selected and interpreted with an emphasis on objectivity and relevance, references are provided transparently and consistently, and prior evidence is represented accurately. No confidential or personally identifiable information is used at any stage of the research.

Scholarships in corporate governance are preoccupied with the extent to which shareholders can exercise effective control over managers and hold them accountable for the use of corporate resources. In many markets, prevailing models are characterized by hierarchical boards, complex chains of intermediaries, and proxy mechanisms that dilute the voice of beneficial owners and entrench information asymmetries (Elayah, 2025; Sergakis, 2023; Thomadakis, 2024; Awad & Aldabousi, 2024). Running in parallel, developments in digital technologies and financial innovation have encouraged scholars to explore whether new infrastructures can rebalance these relationships through a reduction in frictions, enhancement of transparency, and broadening participation (Abdulquadri et al., 2021; Al Halbusi et al., 2022; Wynn et al., 2021; Idzi & Gomes, 2022; Kassen, 2023; Tamilmani et al., 2021).

Within this wider transformation, blockchain has been advanced as a governance tool whose technical attributes (immutability, decentralization, and verifiability) can resolve longstanding deficits in shareholder voting and information disclosure (Dierksmeier & Seele, 2019; Yadav, 2024). Distributed ledgers can reduce dependency on intermediaries and lower reconciliation costs, thereby reducing the opportunities for manipulation and agency loss in proxy processes (Denis & Blume, 2021; Min, 2023). Various empirical and design-oriented studies indicate that end-to-end cryptographic verification of votes can eliminate many of the delays and opacity of traditional systems (Bellavitis et al., 2023; Bhandari et al., 2025; Abdulquadri et al., 2021). Blockchain-based infrastructures also come across, in a range of contexts, as being related to wider trends in digital transformation, financial innovation, and e-government, reinforcing perceived potential as trust-enhancing rails for collective decision-making (Skrinjarić et al., 2021; Ogunmokun et al., 2021; Yusuf et al., 2025; Abdulquadri et al., 2021; Wynn et al., 2021). What has been termed the "intermediary voting dilemma", in which chains of custodians and proxy advisers can distort or dilute investor preferences, is particularly constraining shareholder democracy, and blockchain-enabled voting systems are put forward as a remedy, promising tamper-evident audit trails, direct verification of outcomes, and better alignment between the recorded vote and the intention of beneficial owners (Fisch & Schwartz, 2024; Thomadakis, 2024). Pilot implementations and experimental designs indicate that it might improve fairness, reduce administrative expenditures, and enable cross-border participation. However, they also show substantial challenges regarding technical integration, organizational readiness, and user trust in blockchain rails (Othman et al., 2023; Ndasi et al., 2022; Kim & Manoli, 2022). These findings echo the broader literature on technology acceptance and digital participation, which underscores the role of perceived usefulness, ease of use, and behavioral readiness in sustaining engagement (Tamilmani et al., 2021; Tomczyk et al., 2021; Müller et al., 2021; Aldabousi, 2022).

At the same time, cautionary perspectives emphasize that these technological affordances do not automatically translate into more equitable distributions of power. Policy and ethics-oriented analyses have underlined the ways in which token concentration and platform design may, in practice, re-centralize control by increasing the voice of resource-rich or technologically adept actors (Denis & Blume, 2021; Della Pietra, 2023; Lucchini et al., 2021; Sharma et al., 2024). Similarly, studies of digital markets and online communities reveal that participation becomes skewed and potentially vulnerable to coordinated influence without effective governance mechanisms (Lucchini et al., 2021; Ballandies et al., 2024). This implies, in summary, that at the corporate level, while blockchain can enhance auditability and dampen some frictions, participation gains remain dependent on distributional, design, and literacy factors affecting the effective use of voting rights.

DAOs extend the technological turn in governance by encoding decision rules directly in smart contracts, enabling token-based voting and automated execution (Appel & Grennan, 2023; Ding et al., 2021; Saurabh et al., 2024). According to Davidson

(2024), DAOs constitute a typological break with hierarchical control, where self-enforcing rules recorded on blockchain platforms replace layers of delegation. This architecture can, in principle, compress decision cycles, reduce dependence on intermediaries, and place stakeholders closer to substantive decision rights, offering a laboratory for the reimagination of shareholder participation.

Empirical evidence so far paints a mixed picture, however. Bellavitis et al. (2022, 2023) document coordination frictions, participation fatigue, and "whale dominance", whereby large token holders exert disproportionate influence that may subvert equity aims. Liu and Zhang (2024) show that liquid-democracy variants embedded in DAOs frequently fall short of expectations when digital literacy is uneven, and the perceived benefits of participation are low. Kovalchuk et al. (2025) and Hashemi-Khiabani and Polónia (2023) explore design interventions such as quadratic voting and more sophisticated decision algorithms to mitigate concentration and improve deliberative quality. Yet, they also note implementation complexity and uncertain scalability. From a broader socio-technical standpoint, Ballandies et al. (2024) and Sharma et al. (2024) treat DAOs as large-scale algorithmic organizations whose performance depends on emergent patterns of collective intelligence rather than on code alone.

Apart from corporate contexts, DAOs and related instruments have been explored in democratic innovation, civic technology, and public-sector experimentation (Halpin, 2024; Kassen, 2023; Wynn et al., 2021). These studies reveal both decentralized participation's promise and the fact that engagement is conditioned by motivation, identity, and trust. The same observations are made in the literature on corporate social responsibility, customer engagement, and digital communities (Kim & Manoli, 2022; Awad et al., 2025a; Saad et al., 2025; Shaheen et al., 2025; Ghonim & Awad, 2024; Mahmoud et al., 2025). The implication of this observation is that democratization is not an automatic result of the code. Actual performance depends on governance parameters, such as quorum thresholds, vote caps or decay functions, and delegation safeguards, socio-technical capability, and incentives to participate across heterogeneous groups of investors.

A central axis of debate revolves around the compatibility of blockchain voting and DAOs with existing legal infrastructures. While blockchain can increase transparency and traceability, its enforceability under corporate law remains uneven across jurisdictions (Jiménez-Gómez, 2023; Lafarre & Van der Elst, 2023, 2024; Thomadakis, 2024). Legal scholars argue that corporate and securities frameworks must adapt to accommodate blockchain governance, yet fragmented rules impede harmonization and predictability, particularly for cross-border enterprises (Panisi et al., 2024; Zhuk, 2025). Ding et al. (2021) and Hashemi-Khiabani and Polónia (2023) indicate that smart contracts (optimized for automated execution) are not necessarily congruent with deliberative legal processes, potentially creating accountability gaps when contingencies or disputes arise. Relatedly, whether DAOs can or should be recognized as legal persons continues to be contested, with significant implications for liability, venue, and regulatory oversight (Hassan & De Filippi, 2021; Lu et al., 2024; Saurabh et al., 2024).

A growing number of studies examine hybrid mechanisms to strike a balance between code and law. Lu et al. (2024) introduce decision-algorithmic controllers as a way to embed algorithmic procedures within legally cognizable guardrails to maintain fiduciary duties, minority protections, and avenues for redress. Work on digital governance and the transformation of the public sector thus far yields analogous results, underlining that the digital needs to be anchored in clear accountability structures and robust rule-of-law environments (Fleischer & Carstens, 2022; Idzi & Gomes, 2022; Wynn et al., 2021). Correspondingly, analyses of financial markets and dispute resolution also indicate that technological innovation needs to be met by legal clarity in order for its full advantages to be enjoyed (Skrinjarić et al., 2021; Aldabousi et al., 2025; Al-Sherman & Aldabousi, 2024; Obeidat et al., 2024; Aldabousi, 2025; Aldabousi et al., 2025).

Comparative evidence suggests that institutional context conditions both feasibility and outcomes. In Europe, Lafarre and Van der Elst (2023, 2024) analyze legal-tech pathways to reduce engagement frictions in listed companies, while studies in emerging markets have underlined infra-

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structure constraints, regulatory uncertainty, and weaker investor-protection baselines that inhibit diffusion. Contributions on e-government, digital transformation, and stakeholder engagement coming from interdisciplinary perspectives further underline that successful reform depends on aligning technological, organizational, and societal dimensions (Wynn et al., 2021; Idzi & Gomes, 2022; Abdulquadri et al., 2021; Bhandari et al., 2025; Fleischer & Carstens, 2022).

Despite the fast-growing interest, several gaps remain. First, robust empirical evidence on the widespread application of DAOs within corporate law is limited; most studies rely on simulations or small-N case analyses that constrain generalizability (Ballandies et al., 2024; Sharma et al., 2024; Saurabh et al., 2024). Second, issues of legal interoperability and cross-border regulatory harmonization have been underexplored, especially in cases when firms are listed in one jurisdiction, operate in another, and host token governance on globally accessible platforms (Zhuk, 2025; Panisi et al., 2024; Jiménez-Gómez, 2023). Third, the often-assumed trajectory from transparency to equitable participation is contested: token concentration and uneven technological literacy can undermine inclusivity (Denis & Blume, 2021; Liu & Zhang, 2024; Lucchini et al., 2021; Kovalchuk et al., 2025). Fourth, while conceptual proposals for hybrid models exist, there is little systematic assessment of designs that marry blockchain auditability with conventional protections, such as fiduciary duties, appraisal rights, and derivative actions, especially under realistic constraints of platform scalability and heterogeneous investor preferences.

Related literature on digital participation, corporate social responsibility, financial innovation, and knowledge management reinforces these concerns by demonstrating how technology-enabled transparency and interaction do not automatically produce equitable and/or effective outcomes (Abdulquadri et al., 2021; Awad et al., 2025a; Awad et al., 2025b; Ghonim & Awad, 2024; Ghonim et al., 2025; Mahmoud et al., 2025; Saad et al., 2025; Shaheen et al., 2025; Obeidat et al., 2024). Rather, such outcomes are mediated by trust, capability, identity, and the broader regulatory environment. This suggests that understanding blockchain-enabled shareholder democracy requires an integrated socio-technical and legal perspective.

In summary, prior scholarship indicates that blockchain-based voting can improve auditability and reduce intermediary frictions. At the same time, DAO-inspired governance expands the design space for more direct participation but introduces risks of concentration, coordination burdens, and unequal access. The reviewed literature also converges on the view that legal recognition, enforceability, and investor-protection safeguards are decisive for translating technical capabilities into credible shareholder democracy.

2. RESULTS AND DISCUSSION

The results are organized under four themes: blockchain voting and auditability, DAO governance and inclusivity, legal and institutional compatibility, and hybrid "code-plus-law" governance arrangements.

Table 2. Synthesized evidence on blockchain voting mechanisms and shareholder participation

Aspect	Result
Verification	Blockchain voting systems provide immutable records of votes that are verifiable by all shareholders.
Accessibility	Digital wallets enable direct allocation of voting rights to dispersed shareholders.
Reliability	Automated counting through smart contracts reduces the risk of fraud and error.
Speed	Aggregation of votes is significantly faster compared to traditional proxy voting.
Cross-border voting	Blockchain supports seamless participation across jurisdictions.

Overall, the synthesized evidence indicates that blockchain-based voting can strengthen transparency, end-to-end verifiability, and administrative efficiency in shareholder ballots through immutable records and automated tallying. At the same time, the reviewed sources consistently note that practical outcomes depend on organizational readiness, user trust, and the surrounding institutional context, meaning that participation and legitimacy gains are not automatic.

Table 3 reports the consolidated results regarding DAOs as mechanisms for participatory gov-

ernance and the inclusivity outcomes associated with token-based decision-making.

Table 3. DAO-based governance mechanisms and inclusivity outcomes: Generalized findings of the reviewed literature

Dimension	Result
Token-based voting	DAOs allow proportional influence tied to token ownership.
Delegation	Voting power can be delegated flexibly, enabling representation of minority shareholders.
Inclusivity	Participation is theoretically open, but practical challenges include unequal token distribution.
Scalability	Large-scale decision-making processes encounter technical and coordination barriers.
Engagement	Active participation is limited by technological literacy, interface complexity, and participation fatigue.

The generalized evidence suggests that DAOs expand the design space for programmable participation by encoding decision rules in smart contracts and enabling token-based voting and delegation. However, the same body of work repeatedly highlights concentration dynamics ("whale dominance"), coordination burdens, participation fatigue, and unequal digital access as constraints that can limit inclusive outcomes unless mitigated by governance design choices.

Table 4 presents the results of the legal and institutional compatibility assessment for blockchain-based voting and DAO governance.

Table 4. Legal and institutional compatibility of blockchain and DAOs

Legal dimension	Result
Enforceability	Smart contracts enable conditional enforcement but lack comprehensive recognition in corporate law.
Accountability	Assignment of responsibility within decentralized systems remains unclear.
Jurisdiction	Recognition of blockchain voting and DAOs varies significantly across countries.
Regulatory alignment	Shareholder rights frameworks encourage digital technologies but provide few DAO-specific provisions.
Risk management	Existing legal rules are not fully equipped to address fraud, failures, or disputes in DAO contexts.

The legal and institutional assessment shows partial accommodation of electronic and blockchain-enabled participation in some jurisdictions, but fragmented and uneven treatment of DAO legal status, liability allocation, and dispute resolution. Across the reviewed legal sources, clarity on enforceability, accountability, and investor protection emerges as a necessary condition for credible deployment of blockchain and DAO mechanisms in corporate governance.

Table 5 organizes the results concerning hybrid governance models that combine technological infrastructures with traditional legal safeguards.

Table 5. Hybrid governance models: Results of comparative analysis

Feature	Result
Efficiency	Blockchain provides automation and transparency, reducing transaction and reconciliation costs.
Legitimacy	Legal safeguards ensure enforceability, investor protection, and compliance with corporate law.
Inclusivity	Combining digital platforms with traditional protections can broaden access for dispersed shareholders.
Stability	Hybrid models mitigate the risks of token concentration and governance failures through legal oversight.
Flexibility	Alignment with multiple jurisdictions is more feasible when digital tools operate within recognized legal forms.

The comparative analysis indicates that hybrid governance configurations offer the most balanced profile by combining blockchain transparency and automation with conventional corporate-law safeguards such as fiduciary duties, minority protections, and avenues for redress. This synthesis points to a forward-looking research agenda on how specific hybrid design features (e.g., vote-cap mechanisms, audited smart-contract controls, and jurisdiction-aware compliance layers) affect participation, fairness, and enforceability across contexts.

Taken together, the generalizations indicate that blockchain and DAO mechanisms can enhance shareholder democracy primarily when technical design, socio-technical capacity, and legal safeguards are aligned. Future research should prioritize comparative, jurisdiction-sensitive evaluations and empirical evidence on participation outcomes, concentration mitigation, and enforceability under hybrid governance arrangements.

The study has investigated blockchain technology and decentralized autonomous organizations

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as instruments for improving shareholder democracy, with special emphasis on transparency, participation, legal enforceability, and inclusivity. The results show that blockchain-based voting systems will significantly improve the integrity and efficiency of shareholder voting, while DAOs extend the design space for participatory governance. At the same time, the examination of token concentration, digital divides, and unresolved legal questions demonstrates the bottlenecks to realizing the ideals of democratic corporate governance through technology alone.

Regarding blockchain-based voting, these findings align with previous studies that emphasize blockchain's auditability and tamper-evident capabilities to increase confidence in corporate vote tabulation (Zhuk, 2025; Kim & Manoli, 2022). The end-to-end verifiability of a blockchain, together with immutable records and automated tallying, reduces the space for errors and the chances of manipulation, in addition to streamlining voting process stages (from initiation and authentication to delegation and recording), in accordance with expectations voiced by Min (2023) and Ndhlovu and Maree (2022). Mobile-enabled platforms and digital wallets further expand opportunities for participation by enabling shareholder votes from dispersed locations at lower cost and with fewer intermediaries, reflecting evidence that such infrastructures can deepen engagement and reduce some of the barriers to participation (Othman et al., 2023). However, the findings also give weight to more sober interpretations, which suggest that technological rails alone cannot iron out asymmetries in governance. Questions of access, digital literacy, and trust remain salient, consistent with Denis and Blume's (2021) emphasis on the socio-economic conditions that determine who participates.

This study confirms their conceptual promise in the domain of DAOs as stakeholder-driven governance mechanisms that can effectively redistribute decision-making authority away from traditional hierarchies. This is in line with analyses that consider DAOs a disruptive organizational form, typified by rule-by-code and token-based participation (Davidson, 2024; Appel & Grennan, 2023). However, the synthesized evidence shows that pragmatic barriers are substantial. Low engagement, participation fatigue, token centralization, and coordination problems limit the inclusivity and effectiveness of many DAO implementations. These problems are in tune with the literature that "whale dominance," scalability constraints, and the complexity of interfaces undermine the ideal of broad-based digital participation (Liu & Zhang, 2024; Bhandari et al., 2025). In that sense, DAOs almost seem to instantiate a paradox: they give new channels for participation and visibility, but without careful design and supporting conditions, their power to decide may become at least as concentrated as traditional structures are.

The legal and institutional challenges then become a core determinant of what is possible in practice. Indeed, doctrinal analysis confirms these concerns that smart contracts or blockchain-based governance systems do not always neatly map onto deliberative legal processes in corporate law under particular assumptions about human decision-makers, board accountability, and set procedures for contesting decisions (Ding et al., 2021). What increases complications in its adoption is the regulatory heterogeneity across jurisdictions faced by entities operating or listing in several markets, which reinforces the characterization of DAOs as "borderless organizations" that encounter territorially bounded legal regimes (Hassan & De Filippi, 2021). Related tensions support the conclusion that regulatory and legal compatibility is not a secondary consideration but a central condition for legitimate implementation. After all, without clear rules on recognition, enforceability, liability, and investor protection, the democratic credentials of blockchain and DAO governance remain fragile.

One of the main contributions of this study is to articulate and support the argument for hybrid governance models. The findings suggest that arrangements that combine blockchain's transactional efficiency and transparency with traditional legal protections stand a better chance of overcoming the limitations inherent in either approach on their own. Hybrid models can leverage automated, verifiable record-keeping and faster decision cycles while maintaining mechanisms for oversight, minority protection, and dispute resolution. This conclusion is consistent with suggestions that digital infrastructures should be embedded within robust institutional frameworks rather than treated as substitutes for them, as highlighted in policy-oriented work such as OECD (2021). The comparative analysis here re-

inforces these arguments by showing how efficiency, inclusiveness, and legitimacy can be aligned in a more coherent way when code-based mechanisms operate within clearly defined legal guardrails.

These findings have theoretical and practical implications. Theoretically, this paper contributes to corporate governance scholarship by combining socio-technical and legal approaches to analyze shareholder democracy. It demonstrates that digital technologies should be analyzed not only as a means of reducing transaction costs but also as institutional arrangements that reshape accountability, participation, and power. Practically, these findings guide regulators, policymakers, and corporate actors who are considering deploying blockchain-based voting and DAO-inspired mechanisms. They indicate that reforms should focus on promoting transparent design, legal clarity, and safeguards against concentration and exclusion rather than adopting technological novelty per se.

At the same time, this study has several limitations. The analysis is mostly theoretical, based on secondary sources, and does not include original empirical data or large-sample quantitative tests. It is jurisdictionally selective and thus cannot capture the full range of global regulatory approaches. Moreover, key factors such as technology adoption, digital literacy, and organizational readiness are discussed only conceptually and through others' studies, rather than being directly measured. These limitations also provide avenues for further empirical research. Cross-jurisdictional case studies of companies adopting blockchain-based voting might be considered, along with quantitative assessments of participation and voting outcomes under hybrid models, and longitudinal studies that track how such systems perform as shareholder bases and regulatory expectations evolve. Education and capacity building for shareholders and other stakeholders, especially in markets with pronounced digital divides, will also be important areas for further study.

In sum, the general argument that can be distilled from the study is that, while blockchain and DAOs bear significant transformative potential for shareholder democracy, they cannot ensure democratically legitimate outcomes on their own. Their effects are mediated by legal frameworks, institutional quality, socio-technical conditions, and design choices. The most promising path forward lies in a symbiotic convergence of digital infrastructures and law, wherein technological innovation is used in a manner to reinforce, rather than supplant, institutional safeguards. It is under such hybrid arrangements that blockchain and DAO-inspired mechanisms could meaningfully contribute to more transparent, more participatory, and more accountable corporate governance.

CONCLUSION

This review paper aims to systematically synthesize recent scholarly, legal, and policy literature to evaluate whether, and under what legal and institutional conditions, blockchain-based voting and decentralized autonomous organization (DAO) architectures can enhance shareholder democracy through hybrid "code-plus-law" governance models.

The reviewed evidence indicates that blockchain-enabled voting can improve auditability, end-to-end verifiability, and the speed of vote aggregation while reducing reliance on intermediaries. DAO architectures broaden participatory design options through programmable rules and delegation, but persistent risks include token concentration, coordination burdens, and unequal digital access. Across jurisdictions, legal recognition, enforceability, liability allocation, and investor-protection safeguards remain uneven, constituting a central constraint on adoption.

Based on these results, hybrid "code-plus-law" governance arrangements that embed blockchain and DAO tools within established corporate-law safeguards appear most capable of delivering inclusive participation and durable legitimacy. Accordingly, practical implementation should prioritize enforceability, accountability, minority protection, and accessibility, alongside empirical evaluation of real-world participation outcomes.

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