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CORPORATE GOVERNANCE AT THE EDGE OF THE MACHINE

"A computer can never be held accountable; therefore, a computer must never make a management decision."
- IBM slide deck, 1979

– Abstract –

The increasing incorporation of algorithms, artificial intelligence, and automated decision-making systems into corporate governance marks a structural transformation in the way corporate authority is exercised. Decision-making processes that were historically grounded in human judgment, deliberation, and fiduciary responsibility are now increasingly mediated by algorithmic systems that shape or determine outcomes in areas such as risk management, compliance, shareholder voting, and capital allocation. While these developments are frequently justified in terms of efficiency, accuracy, and predictive capacity, their implications for corporate law remain insufficiently theorized. This article examines the emergence of what it terms algorithmic corporate actors, i.e. non-human systems that perform governance-relevant functions with legally and economically significant consequences for corporations and their stakeholders. It argues that the rise of such systems generates a black box dilemma for corporate law. On the one hand, algorithmic governance enhances decision-making capacity and oversight. On the other hand, it obscures responsibility, complicates the application of directors' fiduciary duties, and weakens traditional mechanisms of accountability and participation. The article analyses how reliance on opaque algorithmic outputs challenges established doctrines concerning directors' duties of care and oversight, reshapes the exercise of shareholder rights through automated voting and decision-support systems, and strains the capacity of regulators to monitor compliance regimes governed by proprietary code. Drawing on comparative perspectives and regulatory developments, including emerging approaches to algorithmic transparency and auditability, the article evaluates whether existing legal frameworks are adequate or require adaptation. The central claim advanced is that algorithmic corporate governance cannot be understood as a purely technical evolution. It represents a shift in the locus of authority within the firm that compels a reconsideration of core principles of corporate law, including responsibility, transparency, and meaningful participation. The article concludes by outlining normative and institutional safeguards aimed at preserving accountability in corporate governance structures increasingly shaped by code.

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1. INTRODUCTION

In Southeast Europe, the distance between law and power is not theoretical. Constitutions promise one reality, informal networks deliver another and in corporate governance, statutes articulate authority while decisions quietly escape the structures designed to contain them. (Koevski, G., & Spasevski, D., 2022). This historical sensitivity to the gap between law on books and power in practice offers a useful vantage point from which to observe a transformation now unfolding far beyond the region (Davies, PL., & Hopt, KJ., 2013). Across global markets, corporate governance is undergoing a shift no less consequential than the emergence of the modern corporation itself. This is the quiet but steady elevation of algorithms, artificial intelligence, and automated systems from technical instruments to governing actors (Hilb, M., 2020).

In corporate law, a governing actor is any entity that influences decision making within the company, produces legally or economically significant consequences, and is relied upon by those who formally hold authority, such as directors, officers, and shareholders (William L., and O'Sullivan M., 2000). Traditionally, these actors are human and legally recognizable, including boards of directors, senior management, shareholders exercising voting rights, and supporting bodies such as committees, auditors, and advisors. By contrast, a technical instrument is merely a tool that assists human judgment without shaping the logic of the decision itself, such as calculators, spreadsheets, accounting software, or presentation tools, where the human decision maker retains full responsibility for weighing information and choosing an outcome (Frederick A., 2017).

Algorithms, artificial intelligence, and automated systems depart from this model. An algorithm consists of preprogrammed instructions that determine how decisions are reached step by step, effectively embedding judgment into code, while artificial intelligence replaces explicit rules following with pattern-based decision making derived from large datasets, producing outputs that even its designers may not be able to fully explain (Hilb, M., 2020). Automated systems go further by acting without real time human intervention once predefined conditions are met, for example by blocking transactions, executing smart contracts, or casting shareholder votes.

These systems cease to be mere tools and become governing actors when human decision makers defer to their outputs, when the systems structure which options are visible or acceptable, when their outputs directly generate corporate consequences, and when their reasoning cannot be meaningfully challenged or reconstructed (Lessig, L., 2009). In such cases, although decisions remain formally attributed to human actors, the substantive judgment is exercised by code, thereby disrupting the core assumptions of corporate law concerning responsibility, justification, and accountability. Take a company’s business strategy as an example:

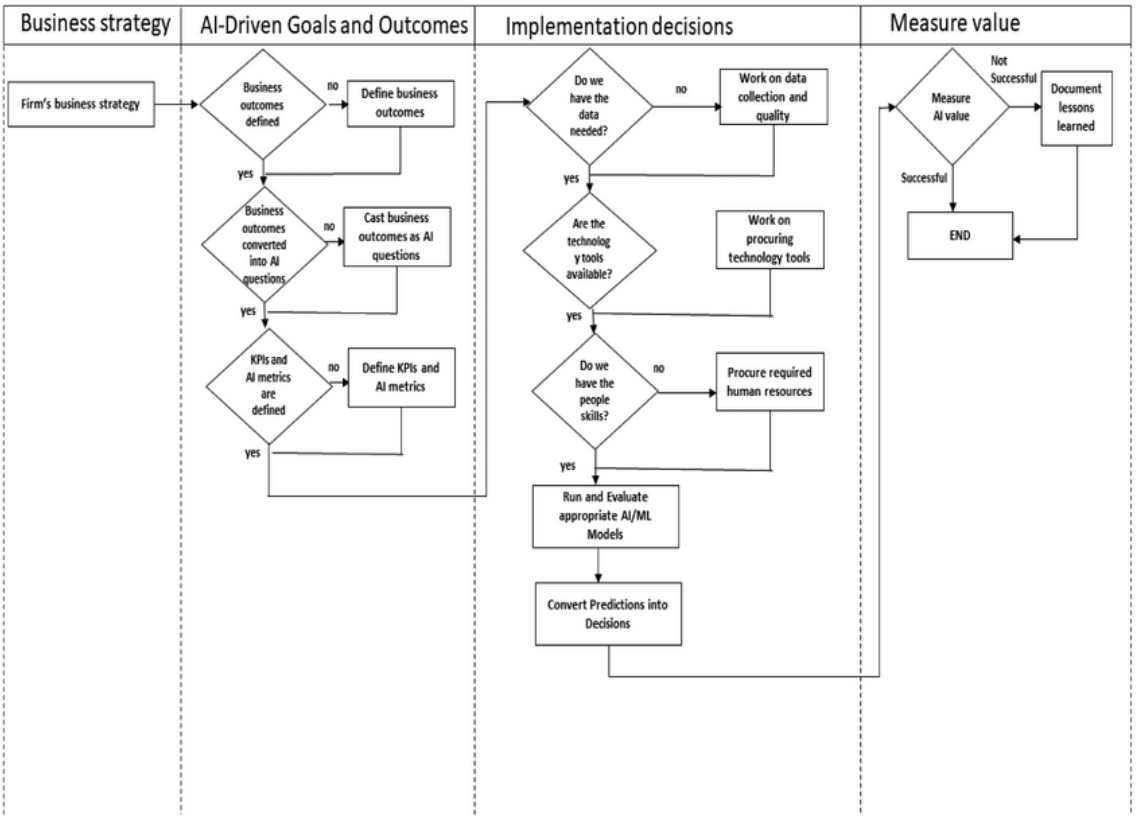

Figure 1: Business Strategy being Operationalized and Measuring its Success through AI

Boards still convene, minutes are still taken, and fiduciary duties remain codified in familiar language. Yet an increasing share of corporate decisions, from risk assessment and compliance monitoring to shareholder voting recommendations and capital allocation, are shaped, filtered, or effectively determined by algorithmic systems (Yeung, K., 2018). These systems are often far above assistants and are increasingly structuring human judgment. In doing so, they reconfigure the architecture of corporate authority in ways that corporate law has not yet fully conceptualized.

This development is often framed as a story of efficiency. Algorithms promise speed, consistency, and the ability to process vast quantities of data beyond human cognitive limits. Asset managers rely on integrated platforms such as BlackRock's Aladdin to guide investment decisions across trillions of dollars in assets (BlackRock, Inc., 2026). Major asset managers rely on integrated investment platforms that combine risk analytics, portfolio construction, and operational workflows into a single digital environment. BlackRock's Aladdin platform is one of the most widely used systems of this type as it processes vast amounts of financial data, supports portfolio decision-making, and provides risk and compliance tools to investment professionals across the globe. As of 2026, Aladdin was reported to manage or support investment decisions on over $21 trillion in assets, making it central to how many large asset managers evaluate risk, allocate capital, and respond to market conditions. This integration means that algorithmic outputs from such platforms can materially shape investment choices that have legal, economic, and governance implications for firms and their stakeholders.

Furthermore, proxy advisory firms deploy machine learning tools that influence the exercise of shareholder voting rights on a massive scale. Compliance and risk-management systems operate continuously, flagging irregularities in real time and, in some cases, triggering automatic responses. In an era defined by complexity and volatility, the appeal of automated governance is obvious. But beneath this narrative of optimization lies a deeper structural

transformation. Governance, traditionally understood as a human practice grounded in deliberation, responsibility, and accountability, is being partially delegated to systems that do not reason, explain, or justify themselves in legal terms (Lessig, L., 2009). Algorithms do not possess intent, conscience, or loyalty; they operate through statistical inference and optimization functions. Yet their outputs increasingly carry normative weight inside the firm. When a model flags a transaction as too risky, recommends a particular board decision, or determines how votes are cast, it effectively participates in corporate governance, regardless of whether the law formally recognizes it as an actor.

2. CONCEPTUAL FRAMEWORK ON ALGORITHMIC CORPORATE ACTORS AND THE BLACK BOX DILEMMA

This article refers to such systems as algorithmic corporate actors or non-human systems that perform decision-making or decision-shaping functions with legally or economically significant consequences for the corporation and its stakeholders. These include risk assessment, compliance monitoring, voting recommendations, automated execution and many others. The term is not meant to suggest legal personhood, nor to indulge in science fiction. Rather, it captures a practical reality that corporate law must confront, authority within the firm is no longer exercised exclusively by natural persons or even by identifiable corporate organs. It is increasingly mediated by code (Lessig, L., 2003).

The rise of algorithmic corporate actors generates what may be described as a black box dilemma for corporate law (Pasquale, F., 2015). On the one hand, these systems enhance decision-making capacity and promise more robust oversight. On the other hand, they obscure the allocation of responsibility. Directors remain subject to fiduciary duties of care and loyalty, yet they are often unable to fully explain or interrogate the logic of the systems on which they rely. Shareholders formally retain voting rights, but those rights are increasingly exercised through automated or semi-automated mechanisms that shape outcomes before any meaningful deliberation occurs. Regulators demand transparency and compliance, while confronting proprietary models that resist scrutiny and jurisdictions that struggle to keep pace.

The dilemma goes to the core of corporate law's normative foundations. Corporate governance has long rested on the premise that authority must be accountable to identifiable decision-makers who can be held responsible *ex post*. The delegation of governance functions to opaque systems challenges this premise. When outcomes are produced by machine learning models trained on historical data, responsibility becomes diffuse, probabilistic, and contested. The familiar legal vocabulary of intention, negligence, and judgment begins to strain.

This tension is particularly visible when viewed from legal systems outside the traditional centers of technological power. For smaller economies and transitional legal systems, including those in the Balkans, algorithmic governance arrives as an imported infrastructure, often developed elsewhere, embedded with assumptions about markets, risk, and rationality that may not align with local legal cultures or regulatory capacities. The asymmetry of power between those who design governance algorithms and those who are governed by them mirrors older patterns of legal transplantation, now accelerated by digital means.

Against this background, this article examines the implications of algorithmic corporate governance for corporate law. It asks three interrelated questions. First, how does the increasing reliance on algorithmic systems reshape the content and practical operation of directors' fiduciary duties? Second, what happens to shareholder rights and corporate participation of employees when governance processes are automated or mediated by code? Third, are existing regulatory and doctrinal tools sufficient to address these developments, or do they require adaptation?

The argument advanced is deliberately cautious. Algorithms are neither saviors nor

villains. Treating them as mere tools understates their governing role whilst treating them as autonomous agents overstates their legal status. The challenge for corporate law is to recognize algorithmic systems as sites of power without abandoning the human-centered foundations of accountability. This requires rethinking oversight, transparency, and participation, not to halt technological change, but to ensure that it remains compatible with the basic principles of corporate governance.

As code increasingly takes a seat at the corporate table, that old quote from the beginning of this text acquires a new, digital resonance. The question is no longer whether algorithms will influence corporate governance. They already do. The question is whether corporate law will remain capable of explaining, constraining, and legitimizing the authority they exercise.

This means that the integration of algorithmic systems into corporate governance marks a structural shift in the way authority is exercised within modern firms (Lessig, L, 2000). At its core, this transformation entails a reconfiguration of decision-making away from purely human deliberation toward processes in which computational systems play an active role in shaping, mediating, and in some instances executing governance outcomes.

The notion that code itself can function as a normative force traces back to foundational insights in the regulation of cyberspace. Lawrence Lessig's dictum that "code is law" illustrates how technical architectures can regulate behavior as effectively as statutes or judicial norms, shaping incentives and constraints without explicit legal articulation. Lessig's framework has been pivotal in legal theory on digital governance, foregrounding the regulatory force of computational design over social interaction and autonomy. The extension of this insight to corporate settings suggests that algorithmic systems, once considered ancillary tools, can become integral to governance regimes, embedding specific logics into the firm's decision-making fabric (Lessig, L., 2009).

Corporate governance scholarships have begun to recognize this phenomenon. Studies conceptualizing artificial governance explore scenarios in which machine learning and AI systems progressively structure board-level decision-making processes, raising questions of liability, business judgment, and accountability when governance outputs depart from human reasoning (Hilb, M., 2020). The governance of ethical and trustworthy AI systems also emphasizes the necessity of robust oversight and reflexivity in the deployment of AI, particularly when such systems exercise influence over strategic or risk-sensitive decisions (Agbese, M., Mohanani, R., Khan, A., & Abrahamsson, P., 2023).

Algorithmic corporate actors complicate established assumptions embedded in corporate law. Traditional fiduciary duties, including the duty of care to act with diligence and the duty of loyalty to promote the company's interests, presuppose that directors deliberate, weigh alternatives, and justify choices in light of normative standards such as good faith and sound judgment (De Lima, I. S., 2023). When governance outcomes are influenced or determined by non-transparent model outputs, these assumptions come under strain. Directors may rely on technical recommendations they lack the capacity to interrogate, creating a gap between legal accountability and practical control. This gap, which we term the black box dilemma, encapsulates the tension between enhanced decision-making capacity and obscured responsibility i.e. algorithmic systems promise analytical power, yet their internal logic and causal chains may be inaccessible to directors, shareholders, or regulators.

Hence, the black box dilemma is a material problem with regulatory resonance. Empirical evidence shows corporate disclosure practices are lagging behind the proliferating use of AI in strategic functions, prompting regulators such as the U.S. Securities and Exchange Commission (SEC) to increase enforcement actions against misleading disclosures of AI capabilities and to seek clearer transparency in corporate reporting of AI risks (SEC, 2024). Meanwhile, comprehensive regulatory frameworks such as the European Union's Artificial Intelligence Act (AI Act, 2024) lay down risk-based obligations for high-impact AI systems,

requiring human oversight, documentation, and governance measures for systems that affect safety, fundamental rights, or legal outcomes, albeit primarily targeted at developers and deployers rather than boards per se. These regulatory moves underscore the gravity of algorithmic influence on corporate practice and highlight the normative stakes involved in managing algorithmic governance.

Thus, algorithmic corporate actors and the black box dilemma form the conceptual core of this study as the former designates the locus of algorithmic agency within corporate governance processes, while the latter captures the epistemic and legal challenge of accounting for outcomes when the reasoning of those actors is blurred. Both concepts lay the groundwork for analyzing how traditional corporate law doctrines, regulatory regimes, and accountability mechanisms must adapt in response to the algorithmic turn in governance.

3. ALGORITHMIC GOVERNANCE AND DIRECTORS' DUTIES IN CORPORATE LAW

Algorithmic Governance and Directors' Duties in Corporate Law unfolds across five interrelated subparts that trace how code increasingly mediates, reshapes, and challenges the legal architecture of fiduciary responsibility. First, the analysis examines fiduciary duties in the age of algorithmic decision making, asking how duties of care, loyalty, and oversight operate when directors rely on computational systems rather than deliberative human judgment.

Second, it situates these developments within a comparative doctrinal perspective, highlighting how different corporate law systems respond, unevenly and often inadequately, to the delegation of governance functions to algorithmic tools.

Third, the discussion turns to regulatory imperatives, focusing on emerging disclosure, audit, and oversight obligations for artificial intelligence under securities law and technology regulation. Fourth, the section grounds theory in practice through a case study of automated risk models in financial institutions, illustrating how algorithmic governance operates in high stakes environments where errors are systemic rather than isolated. Finally, the analysis advances towards an accountability framework, arguing that existing fiduciary doctrines must be recalibrated to ensure that the rise of algorithmic governance strengthens, rather than dissolves, the foundations of responsibility at the core of corporate law.

3.1. Fiduciary Duties and the Rise of Algorithmic Decision-Making

At the heart of corporate law lies the fiduciary relationship between directors and the corporation's stakeholders. Directors are bound by duties of care and loyalty, entailing an obligation to act in good faith, with due diligence, and in the best interests of the company. Historically, fulfilling these duties has assumed that human directors exercise judgment through deliberation, risk assessment, and reasoned choice. When algorithmic systems enter the governance process, this assumption is disrupted. Algorithmic governance, the use of computational systems to generate, structure, or execute governance decisions, challenges the classical doctrinal foundations of fiduciary responsibility.

Directors' duties of care require that decisions be informed by adequate inquiry and rational analysis. In *Smith v Van Gorkom*, the Delaware Supreme Court emphasized that directors must make decisions on a "reasonably diligent" basis, with an informed understanding of the material facts relevant to a transaction. When a board relies on algorithmic outputs, the question arises whether such reliance satisfies the informed decision-making standard when directors may not fully understand the basis for algorithmic recommendations. Put differently, does reliance on an opaque model satisfy the duty of care, or does it merely displace human judgment with machine output without sufficient interrogation?

A doctrine that has emerged to address analogous problems is the business judgment rule, which protects directors' decisions absent gross negligence or self-interest (Delaware Business Judgment Rule Doctrine). The protection afforded by the business judgment rule is predicated on the notion that directors are better positioned than courts to make business decisions, provided they act in good faith and with sufficient information. However, when a director's decision is principally informed by a proprietary algorithm that cannot be reverse-engineered or explained to the board, the protective logic of the business judgment rule becomes strained. Courts may ask whether the director exercised independent deliberation or simply deferred to the "black box."

The non-transparency of many artificial intelligence systems compounds this problem. Deep learning models, trained on large datasets and optimized for predictive performance, often resist straightforward explanation. As a result, directors may be unable to articulate the reasoning behind model-based recommendations. In legal parlance, this raises questions analogous to those in informed consent doctrine in healthcare: can a fiduciary claim to have understood risks when the internal logic of the system is indeterminate even to its developers?

Zooming in on a specific national legislation, under the Law on Trade Companies of North Macedonia, the responsibility of directors is anchored in a unified statutory standard that closely approximates a fiduciary duty framework, even though the terminology of equity is not explicitly used. Members of the management body and supervisory board are required to act in the interest of the company and all shareholders and to perform their functions with the care of an orderly and conscientious trader (LTD of North Macedonia). This standard operates as both a duty of care and a loyalty-infused obligation of proper purpose. It is objective in nature and assessed against professional commercial prudence, not subjective good faith alone. The statute therefore establishes a conduct-based benchmark that is technologically neutral and adaptable to contemporary governance environments, including algorithmic decision-making.

Liability attaches where directors breach their obligations and fail to meet this standard of care. They are jointly and severally liable for damage caused to the company. The statute enumerates specific instances of misconduct, including unlawful distributions, inaccurate financial reporting, improper payments after insolvency, and misuse of company assets, but these grounds are illustrative rather than exhaustive. Importantly, supervisory board members may incur liability where they fail to exercise due diligence in approving or overseeing executive conduct. Claims may be pursued not only by the company but, under certain conditions, by shareholders and creditors. The structure is thus enforcement-oriented and does not tolerate passive or purely formal oversight.

The statute permits reliance on independent advisers and other competent persons; however, such reliance does not relieve directors of their obligation to act with the care of an orderly and conscientious trader. This provision is doctrinally decisive for algorithmic governance. Algorithmic systems, AI-based risk models, automated compliance tools, and data-driven decision-support systems would likely be treated analogously to external expert input or technical assistance. Their use may inform board deliberations, but ultimate responsibility remains with the natural persons holding office. The statutory framework contains no mechanism for delegating legal accountability to technological systems. Directors must therefore understand, supervise, and critically evaluate algorithmic outputs rather than treat them as autonomous decision-makers.

This allocation of responsibility becomes particularly salient in contexts involving financial reporting and insolvency risk. The law imposes structured reporting duties and immediate obligations in cases of significant loss or over-indebtedness. If algorithmic systems generate inaccurate financial data, miscalculate exposure, or delay detection of financial distress, directors cannot invoke technological opacity as a defense. Submission of untrue financial statements or failure to react appropriately to losses triggers liability irrespective of whether

the underlying error originated in automated processes. The statutory logic is clear and it highlights that technological mediation does not dilute personal accountability.

In the Macedonian context, therefore, algorithmic governance does not displace fiduciary responsibility, but it intensifies the standard of oversight expected from directors. The absence of a codified business judgment rules safe harbor comparable to certain common law jurisdictions means that the inquiry will focus directly on whether directors acted with the requisite professional diligence. Blind reliance on non-transparent models, failure to establish internal controls over automated systems, or insufficient technological literacy at board level could be characterized as a breach of the orderly and conscientious trader standard. Algorithmic tools remain instruments within the corporate decision-making architecture, but they do not alter the legal identity of the responsible actor. Under the LTD, only human office-holders bear fiduciary exposure, and the rise of algorithmic decision-making expands, rather than contracts, the domain of director oversight.

3.2. Comparative Doctrinal Developments

Different jurisdictions have begun to grapple with how algorithmic governance intersects with directors' duties. The United States, with its well-developed fiduciary frameworks, provides emerging but unsettled guidance. In the wake of automated trading strategies and big data models used by institutional investors, commentators have called for a reevaluation of the duty of oversight to account for algorithmic intermediaries (Salazar V, A. R., 2024). While Delaware courts have yet to decide a case squarely involving algorithmic governance at the board level, related litigation concerning reliance on technical models, such as risk models in financial institutions, suggests increased judicial scrutiny of directors' reliance on expert systems without meaningful understanding.

In the United Kingdom, the Corporate Governance Code emphasizes that the board should satisfy itself as to the "integrity of information, controls, and risk management processes." Recent guidance from the Financial Reporting Council underscores the need for boards to understand the sources and limitations of critical information, implicitly acknowledging that complex models require scrutiny similar to other professional judgements (FRC, 2024). This approach, while not yet doctrinally binding, signals heightened expectations around directors' comprehension of automated systems.

Civil law jurisdictions take a different course. Under German law, for example, directors are held liable for grossly negligent misconduct, and courts have emphasized that adequate monitoring and understanding of risk systems is integral to fulfilling supervisory duties (German Stock Corporation Act §93). The requirement to ensure that internal control systems are effective arguably extends to algorithmic controls, placing a burden on boards to ensure that any automated governance tool is subject to periodic review and explanation.

Coincidentally, these same countries take very different approaches, for example to the involvement of employees in corporate governance. Even though the benefits of worker involvement in corporate governance far outweigh the challenges, to the extent that some scholars consider employee participation in company management one of the most significant achievements of modern capitalism (Erik & von Thadde, 1999), certain legislations seem to be more reluctant to include workers in decision-making than automated AI.

Employees, as key stakeholders, have a vested interest in preventing asset misappropriation or value reduction by controlling shareholders, directors, or managers (Koevski & Spasevski, 2023). Some theorists even suggest that the exclusion of workers from decision-making could lead to unionization and radicalization of demands, ultimately resulting in greater costs for companies (Parkinson, 1997), albeit a better but seemingly unrealistic outcome for workers globally at the moment. However, the success of worker codetermination

depends on the adaptability of corporate culture, management structures, and the company's specific objectives (M. Colin, 1988). Several theoretical frameworks have emerged to explain worker participation in corporate governance.

The pluralist theory of worker participation, which emerged in the early 20th century, does not perceive employees as a distinct class with opposing interests to capitalists. Instead, it views them as a fluid, voluntary group whose composition is constantly evolving (Tsuk, 2003). Pluralists argue that multigroup representation, rather than class struggle, underpins modern governance, rejecting the notion that employees require special treatment.

The progressive or communitarian theory (also known as the neutral arbitrator model) posits that delegating authority to a board of directors to act as a neutral arbitrator in resource allocation fosters employee integration into corporate structures (M. O'Connor, 2000). This approach prioritizes long-term investment in human capital over short-term shareholder gains.

The fiduciary theory of employee participation suggests that, beyond contractual obligations, the relationship between directors and employees should be viewed through the lens of fiduciary duty (Koevski & Spasevski, 2023). This perspective implies that courts should protect employees as the weaker party in disputes, recognizing the trust inherent in long-term employer-employee relationships.

The human capital theory considers specialized employee skills as a form of investment that grants workers a stake in corporate decision-making (Roberts & van den Steen, 2003). This theory argues that companies frequently invest in employee development, and employees, in turn, invest in their own skills, creating a shared long-term interest.

Despite these theoretical developments, none have gained significant traction in the United States due to the dominance of the Anglo-American corporate governance model, in which directors and managers are accountable solely to shareholders (Piketty, 2020). Unlike the U.S., most European corporate governance models adopt a broader stakeholder approach, incorporating employee participation based on principles of social democracy. (O'Connor, 2000).

The continental European model of corporate governance emphasizes social dialogue and multi-stakeholder representation (Scholz & Sigurt, 2019). The European Works Council Directive mandates procedures for informing and consulting employees, though it does not prescribe specific governance structures. The proposed Fifth EU Directive (1972) initially sought to institutionalize employee participation through board representation or consultative councils but was withdrawn in 2001, illustrating the divergence between theoretical and practical applications of worker codetermination. Nonetheless, the EU continues to advance worker participation through corporate social responsibility frameworks, emphasizing fair labor standards, sustainability, and anti-corruption initiatives (V. Drpljanin, 2026).

Recent European regulatory efforts have also sought to strengthen employee participation. The European Trade Union Confederation, in its guidelines on Directive 2019/1151, advocates for stricter regulations on director disqualification and enhanced shareholder engagement in corporate governance. Additionally, EU Directive 2017/1132 codifies protections for employee rights during corporate restructurings, particularly in cross-border mergers, to prevent exploitation. The Non-Financial Reporting Directive further mandates large companies (with over 500 employees) to disclose non-financial data such as their social and environmental impacts, reinforcing corporate transparency and accountability. Nevertheless, some scholars also argue that codetermination may disadvantage minority shareholders, particularly in supervisory boards. When majority shareholders allocate board seats in collaboration with workers, they may limit representation for minority investors (V. Drpljanin, 2025). Additionally, critics contend that codetermination increases governance costs, deters external investment, and pressures firms to raise employee wages based on board-level financial disclosures (Davis & Hopt, 2013). Bottom line, this issue seems to be developing

much slower compared to the omnipresence of automated and semi-automated decision-making.

3.3. Regulatory Imperatives on AI Disclosure and Oversight

On the other hand, Regulatory regimes are evolving in tandem with legal doctrine. In the United States, the SEC has increasingly focused on how corporations disclose their use of artificial intelligence and algorithmic decision-making tools. In 2024, the SEC brought enforcement actions against investment advisers for making false or misleading claims about their use of artificial intelligence systems, underscoring the expectation that firms must be transparent about the role of such systems in advisory and governance processes. In addition, the SEC's 2025 AI disclosure proposals would require registrants to disclose material information about their use of algorithmic systems that materially affect financial performance, risk management, and investor decision making.

Internationally, the European Union's Artificial Intelligence Act introduces a risk-based framework for governing AI systems, classifying high-impact systems that affect legal rights, safety, or compliance as subject to stringent documentation and governance requirements. While the AI Act primarily targets developers and deployers rather than corporate boards specifically, its emphasis on documentation, human oversight, and traceability offers doctrinally relevant principles for corporate governance: boards may soon be expected to satisfy themselves that high-impact systems meet risk and oversight standards consonant with regulatory expectations. In effect, these regulatory frameworks place algorithmic governance squarely within the remit of directors' oversight duties.

3.4. Case Study on Automated Risk Models in Financial Institutions

Concrete examples illustrate the doctrinal and regulatory tensions at play. Consider a hypothetical but plausible scenario in which a bank's board adopts an automated risk assessment model to flag loan exposures. The system evaluates thousands of data points and outputs a risk classification that guides credit approval decisions. Over time, the board learns to defer to the model's assessments without technical interrogation, adopting the view that the system's track record obviates the need for further inquiry.

When a significant cluster of loans classified as "low risk" defaults in the face of an unforeseen market shock, regulators investigate whether the board breached its duty of care by failing to understand or challenge the model's underlying assumptions. The bank's risk officers claim they followed industry best practices in deploying the model, but the board cannot explain how the model weighed certain variables or whether it was responsive to macroeconomic changes. In litigation and regulatory review, the question becomes whether the board's reliance on an opaque system without adequate oversight constitutes gross negligence, particularly where the model's outputs were treated as determinative of the institution's risk tolerance.

This case study illustrates how algorithmic governance intersects with core fiduciary norms. It also underscores the limits of simply treating algorithmic systems as "expert tools" akin to actuarial tables. Unlike traditional forms of expertise, machine learning models can evolve, reweight variables, and respond to data in ways that are not *ex ante* articulated. Absent clear documentation and board-level understanding, directors may find themselves unable to justify decisions in a manner consistent with established fiduciary standards.

4. SHAREHOLDER RIGHTS AND PARTICIPATION UNDER ALGORITHMIC GOVERNANCE

The quote from the beginning of this article shows that as early as 1979, internal corporate materials at IBM articulated a concern that remains strikingly contemporary. This statement captured a foundational intuition of corporate governance that decision making authority must remain traceable to accountable human actors. While originally directed at managerial decision making, the same logic applies with equal force to shareholder participation. Shareholder rights, particularly voting and engagement, are premised on the idea that economic ownership translates into meaningful voice within corporate structures. Algorithmic governance complicates this translation by interposing automated systems between shareholders and corporate decision outcomes.

In modern capital markets, shareholder participation is increasingly mediated by algorithmic infrastructures. Institutional investors rely on automated proxy voting systems, data driven engagement tools, and algorithmic stewardship platforms to process thousands of resolutions across global portfolios. As a result, the exercise of shareholder rights is no longer predominantly an act of deliberation by identifiable individuals, but a function of computational systems optimized for scale, consistency, and efficiency.

One of the most consequential sites of algorithmic governance is proxy voting. Proxy advisory firms and institutional investors deploy algorithmic models to generate voting recommendations based on predefined governance criteria, historical voting patterns, and ESG metrics. In many cases, these recommendations are executed automatically or with minimal human review.

From a doctrinal perspective, this raises two interrelated issues. First, shareholder voting rights are formally exercised by shareholders, but substantively shaped by algorithms that determine how votes are cast. Second, accountability for voting decisions becomes diffuse. When a vote is cast pursuant to an automated policy, it is unclear whether responsibility lies with the beneficial owner, the asset manager, the proxy advisor, or the system itself.

Comparatively, jurisdictions diverge in how they approach this problem. In the United States, proxy voting is treated primarily as a matter of fiduciary obligation owed by asset managers to their clients, with disclosure obligations enforced by the Securities and Exchange Commission. In the European Union, recent regulatory initiatives emphasize transparency and stewardship but stop short of directly regulating algorithmic voting systems as such. In both systems, however, the law assumes that voting decisions are capable of explanation and justification. Algorithmic voting challenges this assumption by rendering the rationale for particular voting outcomes non-transparent or irreducible to human reasoning.

Corporate law traditionally conceives shareholder participation as a deliberative process, even if imperfect in practice. General meetings, information rights, and voting procedures are structured around the idea that shareholders can evaluate proposals, express dissent, and influence outcomes. Algorithmic mediation risks hollowing out this deliberative core.

When voting decisions are generated by automated systems, participation may persist formally while deliberation disappears substantively. Shareholders remain rights holders, but their agency is exercised through preconfigured computational logics that prioritize efficiency over contextual judgment. This produces what may be described as participation without deliberation, i.e. a system in which votes are cast, but no actor meaningfully engages with the underlying issues at stake.

This development raises normative concerns about legitimacy. If shareholder voice is central to the justification of corporate power, then governance structures that systematically replace human judgment with algorithmic execution risk undermining the democratic logic embedded in corporate law. The IBM dictum thus reappears in a new guise, if algorithms

cannot be held accountable, should they be permitted to exercise shareholder power at scale?

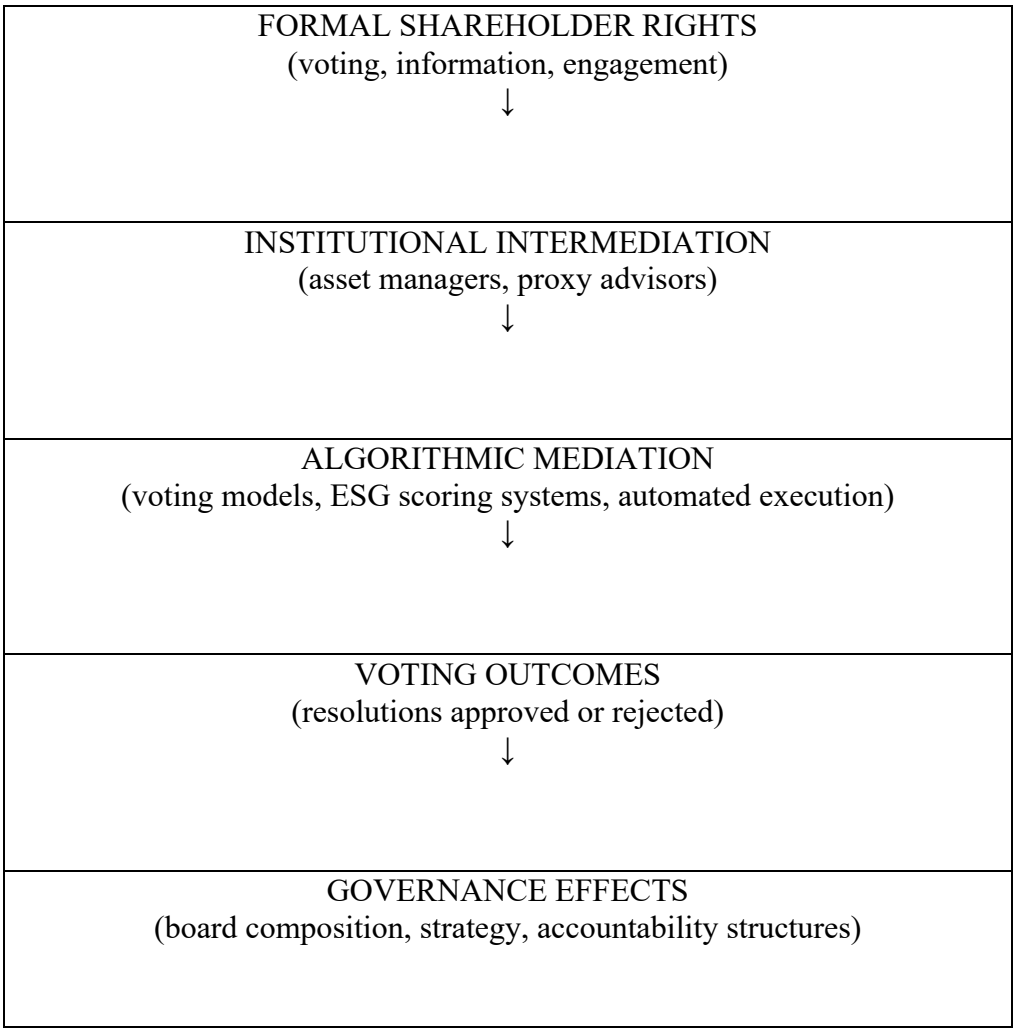

Figure 2: Shareholder Rights are Increasingly Exercised through Algorithmic Intermediaries

Regulators have begun to grapple with these challenges, albeit indirectly. Disclosure based approaches dominate. Asset managers are increasingly required to disclose their voting policies, use of proxy advisors, and engagement strategies. However, disclosure alone may be insufficient where algorithmic systems are proprietary, complex, and adaptive. Knowing that an algorithm was used does not explain how it shaped a particular voting outcome.

Doctrinally, courts have yet to confront the implications of algorithmic shareholder participation head on. Nevertheless, existing principles provide footholds. Fiduciary duties of loyalty and care owed by asset managers to beneficiaries could be interpreted to require meaningful oversight of automated voting systems. Similarly, corporate law's emphasis on informed decision making may justify heightened scrutiny of voting practices that rely on opaque algorithms without human review.

Doctrinal Assumption	**Traditional Model**	**Algorithmic Governance**
Shareholder agency	Individual or collective human judgment	Automated execution of pre-set policies
Accountability	Identifiable decision maker	Diffuse and opaque responsibility
Deliberation	Central to legitimacy	Often absent or minimal

Doctrinal Assumption	Traditional Model	Algorithmic Governance
Transparency	Decisions explainable	Outputs often non-explainable
Legal oversight	Ex post review possible	Review hindered by black box systems

Figure 3. Doctrinal Tensions in Algorithmic Shareholder Participation

Ergo, the rise of algorithmic governance does not eliminate shareholder rights, but it transforms their exercise. Participation becomes scalable, automated, and systematized, while accountability and deliberation recede.

5. REGULATORY DESIGN AND FUTURE SAFEGUARDS: WHY CODE IS WELCOMED WHERE WORKERS ARE EXCLUDED

One of the most striking features of contemporary regulatory debates on artificial intelligence and corporate governance is not merely what they include, but what they omit. Legislators and regulators are rapidly constructing complex frameworks to govern algorithmic systems in corporate decision making, while largely ignoring a governance mechanism whose benefits have been empirically and normatively established for decades: worker participation.

The result is a regulatory paradox. Corporate law and policy display a greater willingness to entrust decision making power to opaque, non-accountable technological systems than to extend meaningful participation rights to employees, despite the latter's proven capacity to enhance oversight, stability, and long-term value creation.

This imbalance is difficult to justify on efficiency or legitimacy grounds. The integration of artificial intelligence into governance structures is frequently defended on the basis of improved monitoring, risk detection, and decision quality. Yet the same arguments have long been advanced, and substantiated, in favor of worker involvement in corporate governance. Indeed, the benefits of employee participation are so well documented that some scholars regard it as one of the most significant achievements of modern capitalism for both workers and companies, rather than a concession to labour interests. The regulatory enthusiasm for algorithmic governance, coupled with continued resistance to worker participation, suggests that the issue is not functionality, but control.

Current regulatory approaches to algorithmic governance prioritize procedural safeguards. The European Union's Artificial Intelligence Act, for example, emphasizes risk classification, documentation, human oversight, and auditability. Similar themes appear in securities regulation, where disclosure and internal controls are positioned as the primary means of governing algorithmic systems. These mechanisms aim to ensure that AI systems are transparent, reliable, and subject to supervision.

What is conspicuously absent, however, is any systematic attempt to embed affected stakeholders into governance processes. Human oversight is defined narrowly as managerial or technical supervision, rather than participatory governance. Workers, despite being directly affected by algorithmic decisions relating to restructuring, performance evaluation, compliance enforcement, and risk management, remain largely external to the regulatory imagination.

This exclusion is normatively incoherent. Employees are uniquely positioned to detect misappropriation of assets, excessive risk taking, and long term value erosion by controlling shareholders, directors, or senior managers. Unlike algorithms, they possess contextual knowledge, experiential insight, and a direct stake in the sustainability of the enterprise. Treating algorithmic systems as acceptable governance intermediaries while excluding workers reflects a prioritization of capital friendly control over accountability grounded in lived corporate reality.

Corporate governance theory has long recognized that excluding workers from decision making is not neutral. Parkinson famously argued that systematic exclusion can generate counterproductive outcomes, including unionization, adversarial labour relations, and radicalization of demands, ultimately increasing costs for firms. While the prospect of widespread worker empowerment remains uneven and, in many jurisdictions, unrealistic in the short term, the structural insight remains valid i.e. governance systems that marginalize key stakeholders generate instability rather than efficiency.

Worker codetermination, where successfully implemented, operates as a governance safeguard rather than a constraint. Its effectiveness depends on corporate culture, management structures, and firm specific objectives, rather than on any single legal model. Importantly, worker participation introduces precisely the elements that algorithmic governance lacks: contestability, contextual judgment, and accountability rooted in social relations rather than code.

Several theoretical frameworks explain this dynamic. Stakeholder theory emphasizes the alignment of interests between employees and the long-term success of the firm. Agency based approaches highlight the role of workers in monitoring managerial opportunism. Institutional theories stress the embedding of firms within social and legal environments that cannot be reduced to data points. None of these frameworks are meaningfully engaged by current AI governance regimes, which focus instead on technical compliance and managerial oversight.

The current trajectory of regulatory design risks entrenching a governance hierarchy in which algorithms are trusted before workers. This is not merely ironic, but normatively troubling. Algorithms are introduced as neutral, efficient, and objective, despite mounting evidence of bias, fragility, and opacity. Workers, by contrast, are excluded on the grounds of presumed inefficiency or conflict, despite decades of evidence demonstrating their stabilizing role in corporate governance.

A more coherent regulatory approach would reverse this logic. Rather than treating algorithmic governance as an inevitable progression and worker participation as an optional supplement, legal frameworks should recognize worker involvement as a baseline safeguard against the very risks that algorithmic systems amplify. Algorithmic tools should be integrated into governance structures that are already pluralistic, participatory, and accountable, not used as substitutes for them.

Governance Mechanism	**Accountability**	**Contextual Judgment**	**Contestability**	**Risk of Capture**
Algorithmic systems	Low or diffuse	Limited or absent	Low	High
Managerial oversight	Moderate	Moderate	Limited	Moderate
Worker participation	High	High	High	Lower
Hybrid models	Variable	High	High	Lower

Figure 4: Comparison of Governance Safeguards

Therefore, the future of corporate governance should not be framed as a choice between human participation and technological innovation. The real challenge lies in designing hybrid governance models that integrate algorithmic tools within structures of shared authority. Such models would treat algorithms as instruments subject to collective oversight, rather than as autonomous governance actors.

In this sense, the 1979 IBM warning acquires renewed urgency. If a computer cannot be held accountable, then it should not exercise authority in isolation. Corporate law must resist the temptation to treat technological sophistication as a substitute for democratic legitimacy within the firm. Before granting code the power to govern, legal systems should ask a simpler

question: why are we willing to trust machines with authority that we still deny to the people who work inside the enterprise?

6. CONCLUDING OBSERVATIONS

This article has argued that algorithmic governance is not only a technological development within corporate decision making but a structural reallocation of power that unsettles the normative foundations of corporate law. Sections I-II demonstrated that algorithmic systems now operate as *de facto* corporate actors, shaping outcomes through opaque architectures that resist traditional attribution of responsibility. Section III showed how this shift strains directors' fiduciary duties, particularly duties of care, loyalty, and oversight, which presuppose human judgment, deliberation, and explainability. As algorithmic tools increasingly mediate risk assessment, compliance, and strategy, the legal fiction that directors "decide" becomes progressively detached from empirical reality.

Section IV extended this concern to shareholder rights, revealing how voting and engagement are filtered through institutional and algorithmic intermediaries, transforming formal participation into model driven governance with limited transparency or contestability. Section V then exposed a deeper regulatory paradox showing that policymakers are accelerating the deployment of artificial intelligence in corporate governance while leaving the most democratically grounded governance mechanism, worker participation, marginal or absent.

Taken together, these dynamics demand a normative intervention rather than further descriptive accommodation. Corporate law cannot continue to treat algorithms as neutral instruments without eroding its own legitimacy. If governance power is exercised through algorithmic systems, then accountability must attach to their design, deployment, and effects.

This implies reinterpreting fiduciary duties to include obligations of algorithmic literacy, explainability, and contestability; extending disclosure and oversight regimes beyond risk management rhetoric; and reembedding human stakeholders, particularly workers, into decision making processes before autonomy is ceded to machines.

To navigate these doctrinal and regulatory challenges, boards must adapt existing governance structures. Several principles emerge. Primarily, algorithmic literacy. Boards should ensure that at least some members possess sufficient understanding of algorithmic logic and limitations, either through training or independent expert advisors. Second, explainability and documentation. Boards should demand model documentation that outlines assumptions, training data sources, variables, and known limitations. Regulatory guidance from the EU AI Act and similar frameworks provides a starting point for such documentation. Third, independent audits. Just as auditors review financial controls, algorithmic systems should be subject to periodic independent review to assess bias, resilience, and alignment with corporate objectives. Fourth, human override. Governance structures should preserve human discretion in critical decisions, ensuring that algorithmic outputs inform but do not dictate outcomes.

Together, these principles offer a pathway for reconciling algorithmic governance with the doctrinal demands of fiduciary law and regulatory expectations. In doing so, they preserve the human core of accountability while recognizing that corporate governance in the digital age cannot ignore the structural influence of algorithmic systems. Thus, the choice is not between innovation and regulation, but between accountable governance and a drift toward automated authority without responsibility. Corporate law must therefore reclaim its normative core by insisting that no system, however efficient, governs without a traceable human answerability.

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