

AI DISCLOSURE QUALITY AND FIRM VALUATION: A SERIAL MEDIATION FRAMEWORK OF CORPORATE GOVERNANCE AND INFORMATION ASYMMETRY

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Abstract

The rapid integration of artificial intelligence into corporate operations has intensified the challenge investor's face in distinguishing between firms with genuine AI capabilities and those engaging in symbolic AI narratives. This paper develops a conceptual framework examining whether and how artificial intelligence (AI) disclosure quality translates into capital market benefits in the context of an emerging economy. Drawing on Signaling Theory and the voluntary disclosure literature, we propose a serial mediation model wherein corporate governance capability enhances firm valuation through the sequential pathway of AI disclosure quality and information asymmetry. We argue that high-quality AI disclosures characterized by specificity, balance, forward-looking orientation, verifiability, and readability credibly communicate firms' substantive AI capabilities and reduce information asymmetry. The framework introduces algorithmic opacity as a distinct manifestation of information asymmetry arising from the inherent characteristics of AI systems: black-box algorithms, proprietary training data, and unpredictable model behavior. We contend that traditional governance mechanisms, designed primarily for standardized financial reporting, are insufficient to address this technologically rooted information gap. Instead, disclosure quality serves as the critical mechanism through which governance becomes economically visible to capital markets. The framework, if supported empirically, would offer guidance for corporate boards, investors, and regulators in Pakistan's evolving AI governance landscape, particularly in light of the National AI Policy 2025 and the Securities and Exchange Commission of Pakistan's emerging IT governance disclosure requirements. We outline a comprehensive research agenda for empirical testing of the proposed framework using archival data from the Pakistan Stock Exchange, including detailed methodological guidance for constructing AI disclosure quality and corporate governance capability indices. To our knowledge, this is among the first conceptual frameworks integrating corporate governance, AI disclosure quality, information asymmetry, and firm valuation in an emerging market context. The framework contributes to the literature by proposing a serial mediation model

linking governance, AI disclosure quality, information asymmetry, and firm valuation; conceptualizing algorithmic opacity as a new manifestation of information asymmetry; introducing a multidimensional AI disclosure quality construct tailored to emerging markets; and extending signaling theory to AI-related voluntary disclosure in an institutional context characterized by high information asymmetry and limited analyst coverage.

INTRODUCTION

As firms increasingly deploy artificial intelligence in strategic decision-making, investors face growing difficulty distinguishing substantive AI capability from symbolic AI narratives. A critical challenge in assessing AI's impact is that firms do not uniformly disclose AI investments, making it difficult to differentiate between genuine AI-investing firms and those who merely claim to be investing in it (Barrios et al., 2025). Information asymmetry the inherent difficulty in understanding, verifying, and valuing AI systems lowers the cost of exaggerating AI capabilities relative to genuine research and development, spurring widespread "AI-washing." This paper addresses this challenge by developing a conceptual framework that explains how governance translates into credible AI communication and, ultimately, capital market value.

Emerging evidence on AI disclosure practices suggests that quality and substantiation matter more than mere presence. Barrios et al. (2025) find that firms whose disclosed AI activity is closely aligned with their actual investment in AI-related human capital realize greater operational efficiency gains and stronger long-run stock returns than firms disclosing AI activity without matching substantive investment. Separately, research on corporate AI governance practices finds that certification, transparency, and AI patent filings are associated with measurable improvements in firm performance (Xia et al., 2025). Together, these findings motivate a central premise of this paper: that the capital market benefit of AI-related communication depends on its credibility and substance, not its volume.

Pakistan presents a uniquely compelling context for examining this phenomenon. On July 30, 2025, the federal cabinet approved the National Artificial Intelligence (AI) Policy 2025, aimed at

creating a comprehensive AI ecosystem in Pakistan (Government of Pakistan, 2025). The policy envisions responsible and ethical use of AI to address local challenges and ensure inclusive national growth and prosperity. The policy is built on six strategic pillars: AI Innovation Ecosystem, Awareness & Readiness, Secure AI Environment, Transformation & Evolution, AI Infrastructure, and International Partnerships. Simultaneously, the Securities and Exchange Commission of Pakistan (SECP) has been actively updating corporate governance rules for listed companies, focusing on board accountability, diversity, sustainability disclosures, and IT governance (SECP, 2025). PSX-listed companies are now required to include a Board responsibility statement on IT systems, controls, and AI strategy, including compliance with legal and regulatory requirements regarding data privacy and cybersecurity (Pakistan Stock Exchange, 2025).

Despite this regulatory momentum, the empirical evidence linking AI disclosure to firm financial outcomes in emerging markets remains nascent. This paper addresses this gap by developing a conceptual framework that can be empirically tested in future research. Our framework shifts the focus from AI governance to AI disclosure quality as the primary mechanism through which firms create capital market value in an emerging economy context. Specifically, we propose that corporate governance capability influences firm valuation through the serial mediation of AI disclosure quality and information asymmetry a pathway we term the "actions → words → markets" logic.

Literature Review and Theoretical Framework

Our theoretical framework is grounded in three complementary perspectives: signaling Theory (Spence, 1973), the voluntary disclosure literature (Verrecchia, 1983; Healy & Palepu, 2001), and

information asymmetry theory (Akerlof, 1970; Myers & Majluf, 1984). These theories have particular relevance in the Pakistani context, where financial reporting quality is often suboptimal and information asymmetry between managers and investors is pronounced. The integration of these three theories provides a coherent foundation for understanding how governance, disclosure, and information asymmetry jointly shape capital market outcomes.

Signaling Theory suggests that firms can credibly communicate their quality to outside stakeholders through costly, observable signals (Spence, 1973). In the context of AI, high-quality disclosures serve as signals of substantive AI capabilities and responsible stewardship. For signals to be credible, they must be costly to imitate a condition that, in principle, distinguishes substantive AI investment from symbolic AI-washing. Consistent with this logic, Barrios et al. (2025) find that firms whose AI disclosures are backed by matching investment in AI-related talent realize greater long-run benefits than firms whose disclosures are not similarly substantiated. The signaling framework thus provides the theoretical basis for why disclosure quality, rather than mere presence, matters for capital market outcomes.

The voluntary disclosure literature provides a comprehensive framework for understanding managers' reporting and disclosure decisions. Managers who anticipate capital market transactions have incentives to provide voluntary disclosure to reduce information asymmetry, thereby reducing the firm's cost of external financing (Verrecchia, 1983; Healy & Palepu, 2001). Research suggests that companies should prioritize enhancing the quality of information they disclose to investors over the volume, as the quality of financial information impacts the cost of equity capital, whereas the volume does not (Botosan, 1997; Botosan & Plumlee, 2002). This insight directly informs our focus on disclosure quality as the key mechanism through which governance creates value.

The information asymmetry literature posits that when managers possess superior information about firm prospects relative to outside investors, capital is misallocated and firm value is

diminished (Akerlof, 1970; Myers & Majluf, 1984). Information asymmetry increases the cost of capital as investors demand higher returns to compensate for uncertainty; increased, credible disclosure is, in turn, associated with greater market liquidity and a lower cost of capital (Diamond & Verrecchia, 1991). In the AI context, the challenge is particularly acute: managers possess private knowledge about AI model quality, training data integrity, algorithmic bias, and regulatory exposure information that is technically complex and difficult for outside investors to verify. This asymmetry is not merely a consequence of managerial opportunism; it is an inherent feature of the technology itself.

Algorithmic Opacity: A Proposed Extension

We propose that a distinct form of information asymmetry arises from the inherent characteristics of AI systems, which we term algorithmic opacity. Algorithmic opacity refers to the inability of external stakeholders to accurately evaluate AI systems because of their technical complexity, proprietary data inputs, and probabilistic behavior. We conceptualize algorithmic opacity as a specific manifestation of information asymmetry rather than a separate theoretical construct. Unlike traditional information asymmetry, which stems primarily from managerial discretion in financial reporting or strategic communication, algorithmic opacity has three distinguishing features.

First, black-box algorithms create technical opacity: the internal decision-making processes of many AI systems are difficult to interpret, even for their developers, making it hard for outside investors to assess model quality, bias, or reliability. This opacity is not a consequence of deliberate obfuscation but rather an inherent property of complex AI architectures. Second, proprietary training data creates data opacity: firms invest in proprietary datasets that are not observable to outsiders, so investors cannot verify the quality, completeness, or representativeness of the data underlying a firm's AI systems. Third, probabilistic model outputs create behavioral opacity: AI systems can produce context-dependent, non-deterministic outputs, and

phenomena such as model drift or unexpected model behavior are difficult for outsiders to predict or audit.

We argue that traditional governance mechanisms designed primarily for financial reporting that follows standardized accounting principles are not well equipped to address this technologically rooted information gap on their own. This motivates our focus on disclosure quality, rather than governance alone, as the mechanism most directly responsible for narrowing algorithmic opacity in the eyes of outside investors. The three dimensions of algorithmic opacity technical, data, and behavioral together constitute a form of information asymmetry that is distinct from traditional managerial opportunism and requires specific disclosure responses.

AI Disclosure Quality: Construct Development

The quality of corporate disclosures has long been recognized as a critical determinant of information asymmetry and capital market outcomes. Research on "bloated disclosure" shows that it is associated with adverse capital market consequences, such as

lower price efficiency and higher information asymmetry (Li, 2008). Low disclosure quality is associated with lower liquidity and higher cost of capital. This suggests that disclosure quality not merely disclosure presence is what matters for market outcomes. Recent empirical work on AI disclosure specifically reinforces this point. Barrios et al. (2025) show that capital markets reward AI disclosures substantiated by real investment in AI capabilities, rather than disclosure volume alone, underscoring that disclosure quality and credibility not mere presence drive capital market benefits in the AI context specifically.

We conceptualize AI disclosure quality as a multidimensional construct comprising five dimensions grounded in regulatory guidance from the SECP and PSX disclosure requirements, as well as the broader disclosure quality literature. These dimensions satisfy three criteria: they are (1) grounded in disclosure theory, (2) reflected in emerging AI disclosure guidance, and (3) objectively measurable using textual analysis. Table 1 presents the five dimensions with definitions and examples.

Table 1. Dimensions of AI Disclosure Quality

Dimension	Definition	Example
Specificity	Use of concrete, technical AI terminology	"hallucination," "bias," "training data," "model drift"
Balance	Proportionate discussion of both AI risks and opportunities	Addressing both bias concerns and efficiency gains
Forward-looking Orientation	Discussion of future AI implications	Expected investments, risks, opportunities
Verifiability	Inclusion of quantitative or measurable claims	Percentages, dollar amounts, specific dates
Readability	Clarity and accessibility of AI-related text	Short sentences, familiar words, clear structure

The first dimension is specificity, which refers to the use of concrete, technical AI terminology such as "hallucination," "bias," "training data," and "model drift." Specific disclosures are more informative and decision-useful, and PSX requires disclosure of advancement in digital transformation, specifically how organizations have leveraged AI to improve transparency and

governance (Pakistan Stock Exchange, 2025). Specificity serves as a costly signal because it requires firms to have genuine AI knowledge and substantively engage with AI issues. The second dimension is balance, which captures the proportionate discussion of both AI risks and opportunities. Balanced disclosures are more credible than one-sided promotional narratives, as

they signal that management has comprehensively considered AI's implications. This dimension is informed by regulatory concerns over AI-washing and one-sided claims, particularly in contexts where firms may have incentives to overstate AI benefits while downplaying risks. The third dimension is forward-looking orientation, which involves discussion of future AI implications, including expected investments, risks, and opportunities. PSX requires forward-looking statements in narrative and quantitative form, including projections about known trends and uncertainties (Pakistan Stock Exchange, 2025). Forward-looking disclosures signal management's confidence in their AI strategy and their ability to anticipate and manage future AI-related developments. The fourth dimension is verifiability, which refers to the inclusion of quantitative or measurable claims such as percentages, dollar amounts, or specific dates. Verifiable claims are more credible and enable investor validation, supporting the SECP's focus on evidence-based disclosure. Verifiability serves as a powerful signal because it exposes firms to potential scrutiny and penalties for inaccurate claims. The fifth dimension is readability, which captures the clarity and accessibility of AI-related text. Readable disclosures are more readily processed by market participants, narrowing the information gap between managers and investors (Li, 2008). In the Pakistani context, where investor sophistication varies considerably, readability is particularly important for ensuring that AI disclosures are accessible to a broad range of market participants.

Corporate Governance and AI Governance

Corporate governance encompasses the frameworks, policies, and practices that organizations establish to ensure effective oversight and accountability. In Pakistan, the SECP has strengthened its corporate governance framework with specific requirements for board composition, audit committees, and risk management (SECP, 2025). PSX-listed companies are now required to include a Board responsibility statement on IT systems, controls, and AI strategy, with the Board remaining committed to strong

governance, transparency, and the ethical use of technology (Pakistan Stock Exchange, 2025). As AI oversight becomes a more explicit governance expectation for listed firms, the question of how governance capability translates into credible AI-related communication becomes increasingly salient a gap this framework is intended to address. We conceptualize corporate governance capability as a composite index comprising five observable components grounded in SECP regulations and PSX disclosure requirements. These components are selected because they are consistently disclosed by PSX-listed firms and have theoretical grounding in the governance literature as determinants of disclosure quality and firm performance. The first component is board independence, measured as the proportion of independent directors on the board. Independent directors bring objectivity and enhance monitoring of management, reducing the likelihood of managerial opportunism in AI disclosures. The second component is audit committee quality, measured as the proportion of financial experts on the audit committee. Financial expertise enhances oversight of financial reporting and disclosure quality, including AI-related communications. The third component is board size, which captures the total number of directors on the board. Larger boards may bring more diverse expertise but can also face coordination challenges; the relationship between board size and governance quality is well-established in the corporate governance literature. The fourth component is institutional ownership, measured as the proportion of shares held by institutional investors. Institutional investors demand better governance and disclosure practices, creating pressure for more rigorous AI oversight and communication. The fifth component is board expertise, measured as the proportion of directors with advanced degrees in business, finance, accounting, economics, or STEM fields. Directors with advanced degrees bring greater analytical capacity and domain knowledge, enhancing the board's ability to oversee AI-related matters.

Information Asymmetry and Capital Market Outcomes

Information asymmetry between managers and outside investors has profound implications for capital markets. When information asymmetry is high, investors demand higher returns to compensate for uncertainty, increasing the firm's cost of equity capital. Earnings forecast dispersion the standard deviation of analyst EPS estimates is a widely used proxy for information asymmetry, with greater dispersion indicating greater disagreement and uncertainty about firm prospects. Similarly, bid-ask spreads reflect the cost of trading against informed investors, with wider spreads indicating greater information asymmetry. Research in Pakistan has examined the impact of information risk on the cost of equity, finding that dimensions of information risk increase the cost of equity (Amanullah & Lyu, 2022). Classic disclosure theory holds that increased, credible disclosure is associated with greater market liquidity and a lower cost of capital, because it reduces the adverse-selection risk faced by uninformed traders (Diamond & Verrecchia, 1991). A lower cost of capital, in turn, gives firms greater capacity to raise capital for investment. Corporate governance is also documented to negatively and significantly affect the cost of capital in the Pakistani context. In the AI context, we argue that the reduction of algorithmic opacity through high-quality disclosure plays a particularly

important role in reducing information asymmetry, given the technical complexity and inherent opacity of AI systems.

Conceptual Framework and Hypotheses

The Serial Mediation Model

Our conceptual framework proposes a serial mediation model wherein corporate governance capability enhances firm valuation through the sequential pathway of AI disclosure quality and information asymmetry. The full pathway is:

Corporate Governance Capability → AI Disclosure Quality → Information Asymmetry → Firm Valuation / Cost of Capital

This "actions → words → markets" logic posits that internal governance actions must be translated into credible external communication to generate market benefits. Governance creates the conditions for high-quality disclosure; high-quality disclosure reduces information asymmetry; reduced information asymmetry lowers the cost of capital and enhances valuation. This framework builds on emerging evidence that credible AI disclosure and responsible AI governance practices are each associated with improved firm-level outcomes (Barrios et al., 2025; Xia et al., 2025), and proposes a specific causal ordering through disclosure quality and information asymmetry that has not, to our knowledge, been jointly modelled in prior work.

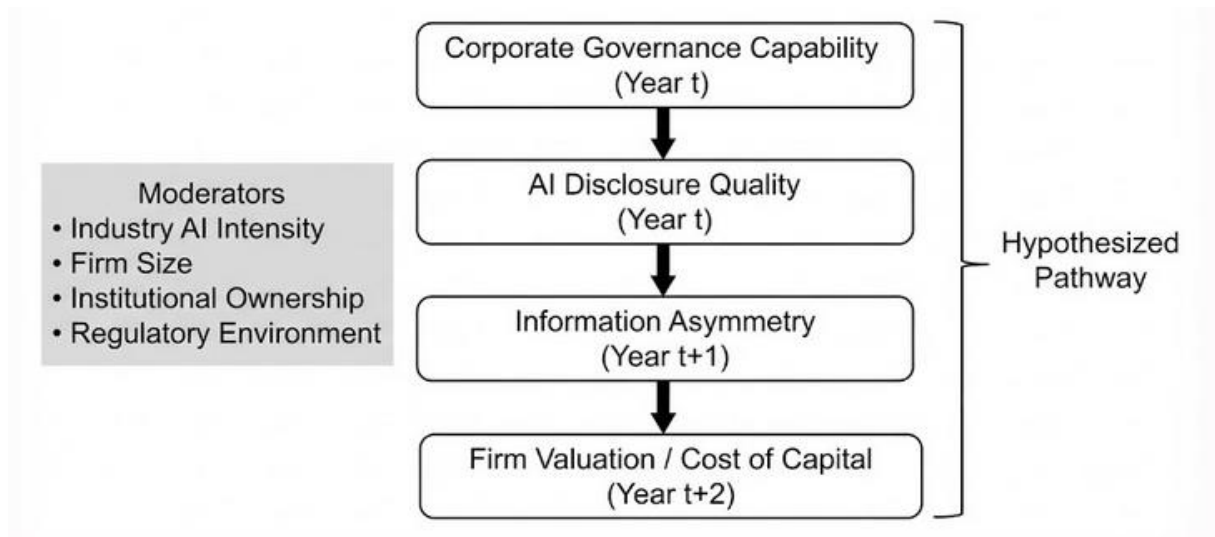


Figure 1 Conceptual Framework: Serial Mediation Model

Why Serial Mediation?

The serial mediation model is theoretically necessary for several reasons. First, corporate governance is an internal organizational characteristic that markets cannot directly observe. Investors do not see board meetings, audit committee deliberations, or institutional investor engagement. They only observe the outputs of governance including financial reports, disclosures, and strategic communications. Therefore, governance cannot affect market outcomes without an intermediate communication mechanism. This is the "actions → words" logic.

Second, disclosure quality, while observable, does not directly create value. Disclosure quality affects market outcomes only if it changes investors' beliefs about the firm. High-quality disclosures reduce uncertainty about AI capabilities, risks, and opportunities, which in turn reduces the information gap between managers and investors. This is the "words → markets" logic, which is consistent with the signaling function of disclosure.

Third, information asymmetry is the specific mechanism through which disclosure quality affects valuation. While disclosure quality may also affect other outcomes such as analyst following, liquidity, or reputation, the capital market benefits of disclosure are primarily channeled through reduced information asymmetry. This is the "information → value" logic, consistent with the classic finding that disclosure affects value primarily through its effect on information asymmetry and liquidity (Diamond & Verrecchia, 1991).

Fourth, alternative models are theoretically inferior. A parallel mediation model, which would suggest that governance can independently affect asymmetry without disclosure, is implausible because investors cannot observe governance directly. A direct governance → valuation model would suggest that governance directly creates value without communication, which contradicts the fundamental logic of information-based markets. Therefore, the serial mediation model is both theoretically necessary and more parsimonious.

Fifth, the serial mediation model has strong theoretical grounding in the Pakistani context. Pakistan's corporate governance environment is characterized by high information asymmetry, limited analyst coverage, and weak investor protection. In such settings, the communication of internal governance actions through high-quality disclosure is particularly important. Firms that invest in governance but fail to communicate through high-quality disclosure may not realize capital market benefits. The serial mediation model captures this institutional reality.

Hypothesis Development

Based on the theoretical framework, we develop four testable hypotheses. Each hypothesis is grounded in the theoretical logic outlined above and is designed to be empirically testable using archival data from PSX-listed firms.

Hypothesis 1 (H1): Corporate governance capability is positively associated with AI disclosure quality.

We argue that firms with stronger corporate governance capabilities produce higher-quality AI disclosures. Governance structures such as board independence, audit committee quality, and institutional ownership create the organizational infrastructure necessary for credible, comprehensive AI communication. These structures ensure that AI-related information is systematically collected, verified, and reported. Firms with stronger governance are more likely to provide detailed, specific, and forward-looking AI disclosures. Research demonstrates that firms adopting responsible AI governance practices see significant performance improvements, with transparency emerging as a key driver (Xia et al., 2025). The theoretical logic underlying H1 is that governance capability reduces managerial opportunism and enhances the board's ability to oversee AI-related communication, leading to higher disclosure quality.

Hypothesis 2 (H2): AI disclosure quality is negatively associated with information asymmetry. High-quality AI disclosures reduce information asymmetry by providing outside investors with credible, decision-useful information about a firm's AI activities, risks, and opportunities.

Specific, balanced, and verifiable disclosures enable analysts to form more accurate forecasts, reducing forecast dispersion. Readable, jargon-free disclosures are more readily processed by market participants, narrowing the information gap between managers and investors. The theoretical logic underlying H2 is that high-quality disclosure, by virtue of its specificity, verifiability, and readability, reduces the uncertainty that investors face in evaluating AI capabilities and risks. This reduction in uncertainty directly mitigates algorithmic opacity the inability of external stakeholders to accurately evaluate AI systems by providing the specific, verifiable information needed to assess AI quality and risk. In this way, disclosure quality serves as the primary mechanism through which algorithmic opacity is reduced in the eyes of outside investors.

Hypothesis 3 (H3): Information asymmetry is negatively associated with firm valuation and positively associated with the implied cost of equity capital.

Information asymmetry imposes real costs on firms. When investors are uncertain about a firm's prospects, they demand higher returns, increasing the cost of equity capital. Higher forecast dispersion is associated with higher information asymmetry and higher cost of capital. Firms with lower information asymmetry benefit from lower financing costs and higher market valuations. The theoretical logic underlying H3 is that information asymmetry, by increasing investor uncertainty and adverse selection risk, raises the cost of capital and reduces firm valuation.

Hypothesis 4 (H4): AI disclosure quality and information asymmetry serially mediate the relationship between corporate governance capability and firm valuation or cost of capital. The indirect effect through governance → disclosure → asymmetry → valuation is expected to be significant.

This hypothesis directly tests the serial mediation logic at the heart of our framework. We predict that governance influences valuation primarily through its effect on disclosure quality, which in turn affects information asymmetry, which ultimately influences valuation. H4 represents the most novel and integrative contribution of the

framework, and its empirical test would provide the strongest evidence for the proposed "actions → words → markets" logic.

Boundary Conditions and Moderators

Every strong conceptual model specifies when it may not work. The proposed serial mediation pathway may be weaker or inapplicable under certain conditions. We identify several boundary conditions that future empirical research should consider. The model may be weaker for family firms, where governance may be informal and disclosure practices less standardized. The model may also be weaker for state-owned enterprises (SOEs), where governance and disclosure may be shaped by political rather than market forces. Firms with no AI investments cannot produce AI disclosures, rendering the pathway inapplicable. In highly regulated industries, disclosure may be mandated rather than voluntary, altering the governance → disclosure relationship. Low analyst coverage may reduce the market response to disclosure, weakening the asymmetry → valuation relationship.

In addition to boundary conditions, several moderators may strengthen or weaken the proposed relationships. Industry AI intensity is one such factor; firms in industries where AI is more central to operations such as technology, finance, and telecommunications may exhibit stronger relationships between governance and AI disclosure quality, as the relevance of AI to firm performance is more salient for investors. Firm size is another important moderator; larger firms typically have more resources to invest in both governance infrastructure and disclosure practices. The governance → disclosure pathway may be stronger for larger firms, while smaller firms may face resource constraints that limit their ability to produce high-quality AI disclosures. Institutional ownership also moderates the relationship. Firms with higher institutional ownership face greater pressure for transparency and governance. The governance → disclosure pathway may be stronger when institutional investors actively monitor firms and demand AI-related information. Finally, the regulatory environment moderates the pathway. The introduction of AI-specific regulation such as

the National AI Policy 2025 and SECP guidance may strengthen the governance → disclosure pathway by creating explicit expectations for AI-related communication and oversight. These moderators can be tested in future empirical studies using interaction terms or subsample analyses.

Methodological Considerations for Empirical Testing

For empirical testing of the proposed framework, researchers should consider non-financial firms listed on the Pakistan Stock Exchange from 2022 to 2025. This period captures the rapid acceleration of AI adoption and disclosure following the release of ChatGPT. Financial firms should be excluded due to their unique regulatory and disclosure requirements. Data sources should include annual reports filed with the PSX and SECP for AI disclosure data, annual reports and proxy statements for corporate governance data, PSX and State Bank of Pakistan for financial and market data, and market data such as bid-ask spread and trading volume for information asymmetry proxies. The sample should be constructed using a systematic approach that ensures representativeness and completeness, with careful attention to missing data and potential selection biases.

The AI Disclosure Quality Index should be constructed through textual analysis of annual reports using Python NLP. The index comprises five dimensions: specificity measured as technical AI terms divided by total AI sentences; balance measured as one minus the absolute difference between risk and opportunity sentences divided by total AI sentences; forward-looking orientation measured as sentences with forward-looking verbs divided by total AI sentences; verifiability measured as quantitative claims divided by total AI sentences; and readability measured as the negative of the Gunning Fog Index. The construction of this index should follow a rigorous protocol, including dictionary development, preprocessing, validation, and reliability testing. The proposed AI keyword dictionary is provided in Appendix A.

The Corporate Governance Capability Index should be constructed manually from annual reports, comprising board independence (proportion of independent directors), audit committee quality (proportion of financial experts), board size (number of directors), institutional ownership (proportion of shares held by institutions), and board expertise (proportion of directors with advanced degrees). All variables should be standardized to z-scores before aggregation. Two independent coders should code a subsample with inter-coder reliability exceeding 0.80. The governance coding protocol is provided in Appendix B.

Information asymmetry should be measured using two proxies: bid-ask spread (relative spread = $(Ask - Bid) / ((Ask + Bid) / 2)$) and Amihud illiquidity (daily absolute return divided by daily volume in PKR). A composite index should be used as the primary measure. These proxies are widely used in the literature and have been validated in the Pakistani context.

Dependent variables should include Tobin's Q, calculated as $(Market\ Value\ of\ Equity + Book\ Value\ of\ Debt) / Book\ Value\ of\ Assets$, and implied cost of equity capital estimated using the Easton PEG model or CAPM. Control variables should include firm size, leverage, profitability, R&D intensity, market-to-book ratio, firm age, industry fixed effects, and year fixed effects.

Panel regression models with firm and year fixed effects should be estimated using temporal ordering: Year t for governance and disclosure, Year $t+1$ for asymmetry, and Year $t+2$ for valuation. The temporal separation strengthens causal inference by ensuring that the proposed antecedents precede their hypothesized outcomes in time. System GMM estimation should be employed as a robustness check to address endogeneity concerns. The Hausman test should confirm the appropriateness of fixed effects. Serial mediation should be tested using bootstrapping (5,000 replications) with the approach of Hayes (2018) and Preacher and Hayes (2008). The bootstrapping procedure generates confidence intervals for indirect effects that account for non-normal distributions and provide a rigorous test of mediation. Identification strategies should include

firm and year fixed effects, System GMM estimation, entropy balancing, and Oster (2019) bounds. These strategies collectively address concerns about unobserved heterogeneity, reverse causality, and omitted variable bias.

Discussion

Theoretical Contributions

This paper contributes to the literature in four distinct ways.

First, to our knowledge, this is among the first conceptual frameworks integrating corporate governance, AI disclosure quality, information asymmetry, and firm valuation. This "actions → words → markets" logic positions disclosure quality as the critical intermediary through which governance creates capital market value. While prior research has examined the performance implications of AI governance (Xia et al., 2025), we demonstrate theoretically that governance actions must be communicated to be valued. This extends the logic of AI disclosure as a signal of firms' underlying technological investment, consistent with recent evidence that disclosures aligned with real AI investment are associated with better firm outcomes (Barrios et al., 2025).

Existing signaling theory assumes that signals communicate observable firm quality. We argue that AI disclosure quality serves as a costly signal specifically designed to reduce algorithmic opacity, thereby extending signaling theory from traditional voluntary disclosure to technologically opaque organizational resources. This extension is significant because it recognizes that the informational challenges posed by AI are not merely a matter of managerial discretion but are rooted in the inherent characteristics of the technology itself. By focusing on disclosure quality as the mechanism through which governance reduces algorithmic opacity, we extend signaling theory to address a form of information asymmetry that is qualitatively different from traditional managerial opportunism.

Second, we conceptualize algorithmic opacity as a new manifestation of information asymmetry. Algorithmic opacity refers to the inability of external stakeholders to accurately evaluate AI systems because of their technical complexity,

proprietary data inputs, and probabilistic behavior. Unlike traditional information asymmetry arising from managerial opportunism or complex financial reporting, algorithmic opacity, as we define it, stems from the inherent characteristics of AI systems: black-box algorithms, proprietary training data, and unpredictable model behavior. As AI systems become more embedded in firm operations, we argue this form of opacity will become an increasingly important, and currently under-theorized, component of the information environment facing investors in emerging markets.

Third, we introduce a multidimensional AI Disclosure Quality construct tailored to emerging markets. The five dimensions specificity, balance, forward-looking orientation, verifiability, and readability are grounded in regulatory guidance and disclosure theory, providing a comprehensive framework for evaluating AI disclosure quality. This construct extends prior work on disclosure quality, which has largely focused on financial disclosure, to the emerging domain of AI-related corporate communication. The dimensions satisfy three criteria: they are grounded in disclosure theory, reflected in emerging AI disclosure guidance, and objectively measurable using textual analysis. This triple grounding ensures that the construct is theoretically sound, practically relevant, and empirically tractable.

Fourth, we extend signaling theory to AI-related voluntary disclosure in an institutional context characterized by high information asymmetry and limited analyst coverage. By integrating signaling theory with the voluntary disclosure and information asymmetry literatures, we provide a more complete theoretical account of how governance, disclosure, and market outcomes are linked in the AI context. The Pakistani setting, with its high information asymmetry and limited analyst coverage, provides a particularly stringent test of signaling theory, as signals must be particularly strong to be credible in such environments.

Conditional Practical Implications

If the proposed hypotheses are supported in future empirical testing, the framework would offer

guidance for corporate boards, investors, and policymakers in Pakistan.

For corporate boards, the framework suggests that investing in governance may not be sufficient firms should also invest in high-quality AI disclosures. Boards should consider connecting governance to communication and focusing on disclosure quality. Specifically, boards should consider ensuring that AI disclosures are specific, balanced, forward-looking, verifiable, and readable. This may involve developing internal guidelines for AI communication, training board members on AI governance, and establishing oversight mechanisms for AI-related disclosures. Boards should also consider appointing directors with AI-related expertise to strengthen their oversight of AI strategy and communication.

For investors, the framework suggests that investors should scrutinize AI disclosure quality, not just its presence. Investors should look for specific, verifiable, and balanced AI disclosures rather than vague or promotional statements. This can help investors differentiate between firms with genuine AI capabilities and those engaged in AI-washing. Consistent with this view, recent evidence shows that AI disclosures substantiated by real investment in AI capabilities are associated with better long-run firm outcomes than disclosures that are not similarly substantiated (Barrios et al., 2025).

For policymakers, the framework, if supported empirically, would suggest that regulators could consider encouraging disclosure quality, not just presence. The SECP could consider issuing AI disclosure guidelines that provide concrete examples of high-quality AI disclosures, similar to the EU AI Act's transparency obligations (Article 50). The SECP could also consider encouraging board-level AI oversight and providing training resources for directors on AI governance. The National AI Policy 2025 provides a foundation for such regulatory developments.

Limitations and Future Research

Several limitations should be acknowledged. The framework, while theoretically grounded, requires empirical testing. Future research should test the proposed hypotheses using archival data from

PSX-listed firms. The AI disclosure quality index, while multidimensional, may not capture all aspects of disclosure quality. Future research could develop more refined measures incorporating qualitative assessments of disclosure content. The findings may not generalize to other emerging markets or to private firms. Future research could examine the generalizability of the findings across different institutional contexts. Finally, alternative mechanisms such as innovation, operational efficiency, or stakeholder trust may also be relevant. Future research could examine these mechanisms and their interactions with the serial mediation pathway identified in this study.

Conclusion and Research Agenda

This paper develops a conceptual framework examining whether and how AI disclosure quality translates into capital market benefits in Pakistan. Drawing on a panel of PSX-listed firms, the framework proposes a serial mediation model wherein corporate governance capability is linked to firm valuation through the sequential pathway of AI disclosure quality and information asymmetry. The framework makes several important contributions to the literature, including the introduction of algorithmic opacity as a distinct manifestation of information asymmetry and the identification of a serial mediation pathway from governance to valuation. To advance this research agenda, this paper suggests the following priorities for empirical investigation. First, collect annual reports for PSX-listed firms from 2022 to 2025, focusing on AI-related disclosures and corporate governance variables. Second, develop and validate the AI Disclosure Quality Index and Corporate Governance Capability Index using the measurement protocols outlined in this framework. Third, test the proposed hypotheses using panel regression models with firm and year fixed effects, serial mediation analysis, and robust identification strategies. Fourth, conduct extensive robustness checks including alternative dependent variables, alternative information asymmetry proxies, alternative weighting schemes, subsample analyses, placebo tests, and endogeneity corrections. Fifth, upon completion of empirical

analysis, prepare a full manuscript for submission to a reputable accounting, finance, or corporate governance journal focusing on emerging markets. As AI continues to reshape Pakistan's corporate landscape, understanding how governance is linked to value creation will become increasingly important. As AI disclosure becomes an increasingly important component of corporate transparency, understanding how governance translates into credible AI communication may become central to firm valuation in emerging capital markets. This framework provides an initial theoretical foundation, and we hope this research stimulates further investigation into the intersection of AI governance, disclosure quality, information asymmetry, and capital markets in emerging economies.

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