

AI-Driven ESG Intelligence: A Conceptual Framework for Disclosure Integrity and Financial Resilience in Indian Firms

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Abstract: Environmental, Social and Governance (ESG) considerations now sit at the centre of corporate strategy and regulation in India, yet disclosures under the Securities and Exchange Board of India's Business Responsibility and Sustainability Reporting (BRSR) regime remain uneven, narrative-heavy and vulnerable to selective reporting and greenwashing, while rating methodologies diverge widely—limiting comparability and weakening the link between compliance and financial outcomes. This paper proposes a conceptual framework that integrates Artificial Intelligence—specifically machine learning and natural language processing—with ESG analytics, governance indicators and financial-performance measures within a single empirical architecture purpose-built for the Indian market, treating governance quality as a moderator of AI-enabled ESG outcomes. Synthesising the literature, the paper shows that existing work treats AI, ESG, governance and greenwashing largely in isolation and is concentrated in developed markets, leaving no integrated, BRSR-calibrated framework; it then articulates how AI can strengthen disclosure integrity, help predict firm resilience, and support the quantification of greenwashing. The framework offers a structured research agenda and a foundation for decision-support tools usable by regulators, investors, boards and assurance providers seeking transparent, evidence-based ESG assessment.

Keywords: ESG; Artificial Intelligence; Natural Language Processing; Greenwashing; Corporate Governance

Introduction

Over the past decade, Environmental, Social and Governance (ESG) considerations have moved from the periphery of corporate responsibility to the centre of business strategy, investment decision-making and regulatory oversight. In India, this shift has been formalised through the Securities and Exchange Board of India (SEBI), whose Business Responsibility and Sustainability Reporting (BRSR) framework now requires the country's largest listed companies to disclose detailed sustainability information [1]. ESG performance is increasingly treated as a proxy for long-term value creation and organisational resilience, and a growing body of Indian evidence links stronger ESG disclosure to better financial and market performance [2], [3].

Despite this momentum, the gap between regulatory intent and market reality remains wide. ESG disclosures in India are still uneven and heavily narrative in character, leaving them open to selective reporting and greenwashing [8]. Rating methodologies diverge sharply across providers, and much of this divergence has been traced to differences in measurement rather than to genuine differences in performance [4]. The practical consequence is that the information meant to guide capital allocation is noisy, inconsistent and difficult to verify. Artificial Intelligence (AI)—particularly machine learning (ML) and natural language processing (NLP)—offers a credible response, because it is well suited to processing the large volumes of unstructured corporate text that BRSR and annual reports generate and to separating substantive disclosure from rhetorical claim. In the Indian context, however, the role of AI in strengthening ESG performance and disclosure quality remains under-researched. This paper proposes an integrated conceptual framework to address that gap, and sets out a research agenda for testing it empirically.

Related Work

Three strands of literature are relevant. The first examines the ESG–financial-performance relationship in India. Using panel-data techniques, studies report that ESG disclosure is positively associated with profitability and market value, with returns measured through indicators such as

return on assets, return on equity and Tobin's Q [2], [3]. These studies establish that ESG is value-relevant, but they rely largely on traditional rating inputs and treat governance as one component of an aggregate score rather than as a distinct conditioning factor.

The second strand concerns the reliability of ESG measurement itself. Berg, Kölbel and Rigobon [4] document substantial divergence among major rating providers and show that measurement differences—not scope or weighting alone—are the dominant source, introducing noise into any decision based on a single rating. This motivates measurement approaches that are transparent and auditable rather than dependent on a single proprietary score.

The third strand applies NLP to corporate disclosures. Bingler and colleagues use a domain-specific language model to show that voluntary climate-risk reporting is often “cheap talk,” with firms cherry-picking favourable, non-material information [5], [6]. More recent work applies transformer-based models to detect and quantify greenwashing directly from sustainability text, including in the Indian setting [7], and empirical assessments of Indian listed firms confirm that greenwashing is measurable and material [8]. Across these efforts, the common thread is comparing what firms claim against what independent evidence shows—but the techniques are rarely integrated with governance analysis or with firm-level financial-resilience outcomes, and they are overwhelmingly developed for non-Indian regulatory regimes. Table 1 positions the present work against representative prior studies.

Table 1. Comparison of this work with representative prior research.

Reference	AI / NLP-based	Indian / BRSR context	Governance as moderator	Integrated AI–ESG–resilience
[4]	No	No	No	No
[5]	Yes	No	No	No
[7]	Yes	Yes	No	No
[2]	No	Yes	No	No
[8]	No	Yes	No	No
This work	Yes	Yes	Yes	Yes

Key Contribution

The contribution of this paper is conceptual and integrative rather than experimental. It adds to the existing body of knowledge in four ways. First, it brings three previously separate literatures—AI-based disclosure analytics, ESG–performance research, and corporate-governance studies—into a single coherent framework. Second, it reframes governance quality not as one ingredient of an ESG score but as a moderator that conditions how effectively AI translates into improved ESG and financial-resilience outcomes. Third, it situates the framework explicitly within the Indian BRSR regime, an emerging-market context that the dominant developed-market literature does not address. Fourth, it converts these observations into a structured, testable research agenda, identifying the variables, data sources and analytical techniques required to validate the framework empirically. Consistent with the aims of proceedings, the emphasis is on organising and extending existing knowledge rather than on claiming a finished empirical result.

Proposed Conceptual Framework

The framework is organised around a single guiding question: can AI adoption enhance ESG performance, reduce disclosure bias and improve the financial resilience of Indian firms, and how does governance quality shape that effect? It links inputs, a moderator and outcomes within one architecture.

Inputs and moderator. The principal explanatory construct is an AI Adoption Index, derived from NLP-based analysis of corporate disclosures, capturing the extent to which firms deploy data-driven and AI-enabled practices. A Governance Quality Index serves as the moderating construct. Standard firm-level controls—size, leverage, age and industry—are included to isolate the relationships of interest.

Outcomes. The framework distinguishes two outcome layers: ESG outcomes, expressed as composite and individual environmental, social and governance scores; and financial-resilience indicators such as return on assets, return on equity and Tobin's Q, alongside firm-level risk measures. A third, integrity-oriented outcome concerns disclosure quality—specifically, the degree to which narrative claims are consistent with independently observable performance, the divergence between the two being the recognised signature of greenwashing [4], [5], [8]. The present paper treats this integrity dimension at the conceptual level; its precise operationalisation is reserved for subsequent empirical work.

Data and analytical approach. The framework is designed for firm-level panel data spanning five to seven years for a sample of listed Indian firms across manufacturing, IT, BFSI, energy and infrastructure, drawing together ESG data (including SEBI BRSR filings and established ESG databases), financial data, and market data into one empirical base. The intended analytical pipeline combines supervised ML models (such as Random Forest, gradient boosting and support vector machines) for prediction, NLP-based sentiment and topic modelling for disclosure analysis, and econometric techniques—panel regression, difference-in-differences and structural equation modelling—for causal and moderation testing, with generalised method of moments estimation used for robustness. The explicit modelling of governance as a moderator, and the calibration of the NLP components to the language and structure of Indian BRSR disclosures, distinguish the framework from generic, developed-market approaches.

Discussions

Positioning AI, ESG and governance within one framework has several implications. It responds directly to the measurement-noise problem [4] by favouring transparent, auditable analytics over reliance on a single proprietary rating. It extends the NLP-disclosure literature [5]–[8] beyond the detection of greenwashing toward an account of how disclosure integrity relates to financial resilience, and how governance conditions that relationship. And by anchoring the design in the BRSR regime, it speaks to an emerging-market context of growing global importance that remains under-served by existing research. For regulators, such a framework points toward evidence-based supervision of disclosure quality; for investors and boards, toward more reliable inputs for capital allocation and oversight. The framework is deliberately specified at a level that supports empirical testing and, in time, the development of practical decision-support tools, without prejudging the specific methods by which the integrity and prediction components will ultimately be implemented.

Conclusions

- **Problem addressed:** ESG disclosures of Indian firms are uneven, narrative-heavy and prone to greenwashing, and divergent ratings weaken the link between ESG compliance and financial outcomes.
- **Approach:** A conceptual framework integrating AI/ML and NLP with ESG analytics, governance indicators and financial-performance measures, with governance quality modelled as a moderator and the design calibrated to the SEBI BRSR regime.
- **Key observations:** Existing studies treat AI, ESG, governance and greenwashing in isolation and are concentrated in developed markets; an integrated, BRSR-calibrated framework can plausibly

strengthen disclosure integrity, support resilience prediction, and enable transparent greenwashing assessment.

- **Limitations and future work:** As a conceptual contribution, the framework is not yet empirically validated; it also depends on the quality of underlying corporate reports and on adapting NLP techniques to Indian disclosure language. Future work will construct the indices, assemble the panel dataset, and empirically test the proposed relationships, leading toward a validated decision-support tool.

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