

Greenwashing Governance through ESG Disclosure: A Double Face for Artificial Intelligence

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Abstract

The growing use of artificial intelligence (AI) in producing, interpreting, and verifying information on the environmental, social, and governance (ESG) information. Companies are under increasing pressure to report on ESG information that is extensive, useful, credible, comparable, and decision-useful. However, the proliferation of ESG disclosure does not guarantee more transparency. Rather, it has increased the risk of symbolic disclosure, narrative inflation, and greenwashing. In this context, AI is emerging as an attractive governance technology but also as a new source for reporting risk. In this narrative review, we discuss how AI could influence ESG disclosure quality, or even the governance of greenwashing. Here, we argue that we need to understand AI beyond its use as a technological solution to process sustainability information, but also as a socio-technical form of governance that transforms the production, evaluation, and contestation of sustainability claims. Drawing from the literature on ESG disclosure, greenwashing, computational text analysis, sustainability reporting and ESG assurance, our contribution is to develop a three-level framework in which AI can be used both as a disclosure mechanism and as an audit instrument, with the potential of also promoting indirect normative behavior. The work presented here builds on this triple role of AI. We find AI can improve ESG disclosure through automated processing and anti-greenwashing monitoring, yet generative AI may enable sophisticated symbolic compliance. AI offers opportunities for ESG disclosure and governance, but its actual effects depend on organizational incentives, disclosure environments, and accountability mechanisms.

Keywords

artificial intelligence, ESG disclosure, greenwashing, sustainability reporting, ESG assurance, governance

1. Introduction

The environmental, social, and governance (ESG) disclosure has been the focus point in recent years for modern day corporations. As sustainability reporting moves closer toward the mainstream of financial and nonfinancial accountability, companies are being called upon to report ESG data in a manner that is credible, comparable, and useful. The previous literature has suggested that the sustainability report can diminish information asymmetry, influence the assessment in markets or impact the judgement of stakeholders, especially where disclosure is material and sufficiently reliable. Christensen, Hail, and Leuz [1] for instance synthesize the economic consequences of mandatory CSR and sustainability reporting and show why nonfinancial disclosure has emerged as a growing area

of policy and research importance. Dhaliwal et al.[2] also demonstrate that the start-up of CSR reporting is related to a lower cost of equity capital, at least in some cases, while Friede, Busch and Bassen [3] present general proof of the connection between ESG and financial performance.

Yet with the growth in ESG reporting came an enduring tension. More disclosure is not necessarily indicative of greater transparency. Companies can issue extensive sustainability reports, ambitious climate pledges, complex ESG narratives, and high-profile greenwashing when there is little to no evidence of the corresponding environmental/social performance underneath these narratives (Mott et al., 2018). In this way, ESG disclosure is not just an information channel, it is also a battleground of contention where accountability and impression management can co-exist.

This tension is particularly evident in the literature on greenwashing. Greenwashing generally refers to misleading or selectively framed communication that exaggerates a firm's sustainability performance, commitments, or intentions. As the field has evolved, scholars have moved away from viewing greenwashing merely as explicit deception and toward understanding it as a broader problem of narrative-performance decoupling. In the ESG context, firms may appear highly transparent because they disclose abundantly, while their actual practices remain only weakly aligned with the narratives they promote. Marquis, Toffel, and Zhou [4] show that selective disclosure is shaped by scrutiny and norms of transparency, while Yu, Van Luu, and Chen [5] explicitly extend the greenwashing problem into ESG disclosure research.

Meanwhile, artificial intelligence (AI), also known as machine learning and predictive analytics, is revolutionizing information creation, organization, analysis, and proving. In ESG reporting, machine learning, NLP, and LLMs make parsing long disclosures easier, classify reporting contents, detect semantic patterns, compare claims vs. external indicators and assist in the assurance process. The early literature suggests that AI could help make ESG reporting and assurance more efficient, as well as more effective: particularly in light of the heterogeneous, text-heavy, and weakly standardized nature of sustainability information. Li et al.[6] contend that AI may help to improve ESG assurance as it helps in processing the huge and heterogeneous environment of data, whilst Mustafa, Smolarski, and Elamer [7] review the wide range of AI application to sustainability reporting, identifying opportunities as well as challenges. Even more recent work is beginning to demonstrate how AI-based textual analysis could quantify ESG communication directly [8], detect ESG-washing in sustainability reports [9] and can even mitigate greenwashing incentives in some organizational circumstances [10].

Yet AI does not have a uniformly beneficial role. The same technologies that help stakeholders detect inconsistencies may also help firms generate more coherent, persuasive, and technically refined sustainability narratives at low cost. AI may therefore strengthen transparency and accountability, but it may also enable more sophisticated forms of symbolic compliance. This dual possibility makes AI especially important for understanding the future of ESG reporting and the governance of greenwashing.

Against such a backdrop, this paper poses these questions: How and in which ways would AI transform the role of ESG disclosure quality as it relates to greenwashing governance? To answer that question we integrate in our literature review three streams of literature on ESG disclosure research, greenwashing studies and nascent research on AI in reporting, textual analytics, and assurance. This paper makes three contributions. It first unifies these disparate literature streams. Second, it reconceptualizes AI as a socio-technical device for governing—not just a technological tool—but also, thirdly, identifies when AI is most likely to bolster substantive accountability over and above its ability to enhance the rhetorical delivery of symbolic disclosure.

This is an explicitly theme-bound narrative review paper, covering the following four (related) fields of interest: ESG and CSR disclosure, greenwashing and symbolic disclosure, computational text analysis and AI-enabled reporting, and AI-assisted ESG assurance. Consequently, the review focuses on works clarifying mechanisms, boundary cases for using AI in sustainability disclosure and anti-greenwashing monitoring; and governance issues.

2. ESG Disclosure, Greenwashing, and the Problem of Disclosure Quality

2.1 ESG Disclosure as An Accountability Mechanism

The general justification of ESG disclosure is the reduction of asymmetric information to allow for stakeholders' assessment and improving accountability [1,2]. The further institutionalization of the

nonfinancial disclosure process means that ESG reporting is now seen less as a complement to financial reporting in some discretionary form, but rather at the heart of how companies talk about risk, strategy, and legitimacy. Christensen et al. [1] demonstrate how CSR/sustainability reporting has economic ramifications in other parts of the capital market as well as more broadly with stakeholders, and firm behavior highlighting the significance of disclosure design and reporting mandates.

But disclosure's presence doesn't guarantee its usefulness. ESG disclosure quality is multidimensional. High-quality disclosure should be material, similar, adequately comprehensive, and appropriately related to actual behavior or results; and (b) not too vague. It's hard to meet these conditions as ESG information is disparate, frequently qualitative data that resides in a wide range of reporting formats and standards.

2.2 Why More ESG Disclosure Does Not Necessarily Mean More Transparency

The fundamental problem with ESG is that disclosure has expanded, while questions of comparability and credibility remain. Even if firms disclose lots of information, it can be difficult for stakeholders to ascertain whether the report is meaningful, selective, and/or strategic in its framing; this point is particularly pertinent with respect to ESG ratings. Kölbel, Rigobon [11], show that ESG ratings can differ significantly due to the difference in scope, measurement, and weightings. They conclude that there is a structural contestability of ESG assessment despite the abundance in reporting, which then raises questions about how to treat ESG data by investors or policy makers.

More recent textual work also indicates that the information content of ESG reporting is not just a function of disclosure quantity. Ferjančič et al. [12], e.g., apply topic modeling on the huge collection of annual reports and demonstrate how ESG topic salience evolves as regulation changes and other external shocks occur). Their results suggest that the value of ESG disclosure is determined less by amount and more by organization of stressed, and converted to categories readable for external reviewers.

2.3 Greenwashing and Narrative-Performance Decoupling

The literature on greenwashing can help explain why evaluating an ESG disclosure cannot rely solely on its volume. According to Delmas & Burbano [13], greenwashing represents a misleading communication regarding environmental performance or practices, while Lyon and Montgomery [14] extend it, differentiating between greenwash's strategic means and ends.

This issue becomes more acute in the ESG setting because disclosure often combines quantitative indicators with narrative statements, forward-looking commitments, and values-oriented claims. Yu et al. [5] explicitly show that greenwashing can be embedded in ESG disclosures, particularly where firms' rhetoric appears substantially stronger than their measurable performance. Walker and Wan [15] similarly show that symbolic environmental actions and communications can have financial implications and may damage firms when inconsistencies become visible. Marquis et al. [4] add that selective disclosure is shaped by scrutiny, norms, and exposure to civil society pressure, implying that greenwashing is not merely a communication problem but a governance problem.

More recent studies have also started to make the notion of ESG-washing more operational via computational approaches: Lagasio [9] builds an ESG-washing Severity Index using sustainability reports by listed firms, combining sentiment analysis of the text along with frequency counts for terms related to sustainability in an effort to detect when positive stories about sustainability do not match probable actual behaviors.

Together these literature suggest that the fundamental concern with ESG reporting is not so much the amount of disclosure as its credibility – whether company stories actually reflect actual environment or social impacts.

3. The Dual Role of AI in ESG Disclosure and Greenwashing Governance

3.1 AI as Disclosure Infrastructure

AI matters in the ESG domain because sustainability information is unusually difficult to process. ESG reports are often lengthy, text-heavy, weakly standardized, and rich in firm-specific language. Relative to

conventional financial statements, they pose greater challenges for extraction, comparison, and verification. This is why AI's first major role can be understood as infrastructural.

NLP and ML may be able to pull out and categorize ESG-related information from reports, filings, websites, and media reporting. Such tools may identify themes, organize unstructured disclosures, flag missing information and map different expressions onto comparable conceptual categories [7]. More recent work indicates that AI can do more than process disclosure at scale; it may also enhance the quality of ESG measurement itself. Schimanski et al.[8] train ESG specific NLP models with millions of texts, and demonstrate the ability for domain specific language models to quantify environmental, social, and governance communication to a higher level of detail and can better explain the crossfirms differences in ESG assessment.

A second infrastructural use case relates to text assessment. Computer-based text analysis enables researchers and professionals to evaluate tone, readability, semantic emphasis, repetition, and rhetorical complexity of corporate disclosure. This is useful as weak ESG reports often do not fail by saying nothing; they lose by saying too much that's vague, generic and/or strategically inflated. AI-based textual analysis can thus aid the distinction of genuinely informative disclosure from boilerplate sustainability language. Ferjančić et al. [12] furthermore show that AI assisted topic modelling can reveal how disclosure content develops in reaction to regulation change and what disclosure topics are more related to external ESG scores.

Third, we can play a supporting role in the development of standards. Given that ESG reporting crosses many standards, industries and institutional settings, AI could also assist in translating heterogeneous disclosures to more comparable forms. This would not eliminate conceptual disagreements about how to measure ESG, but that nonetheless lowers one of the pragmatic obstacles for large scale analysis. In this way, AI can help turn fractured and non-structured stories about sustainability into better analysable information environments.

The fourth role is the processing of evidence to support assurance. According to Li et al. [6], ESG assurance is more complex than financial audit as ESG report covers a wide range of topics, data types, and evidence sources. They conclude that AI could increase confidence through assistance to the auditor with processing large amounts of unstructured information, detect outliers, and test disclosure claims with external information.

Viewed together, these mechanisms suggest that AI can improve ESG disclosure quality by making sustainability information easier to extract, compare, interpret, and verify. In this first sense, AI functions as a disclosure infrastructure that reduces information frictions and broadens analytical capacity.

3.2 AI As a Monitoring Mechanism in Greenwashing Governance

AI's significance is not limited to disclosure production. Its second major role is governance-oriented: AI changes the scale and economics of monitoring. Historically, greenwashing detection has relied on qualitative scrutiny by journalists, NGOs, activists, investors, auditors, and regulators. Such scrutiny remains indispensable, but it is difficult to scale in a reporting environment characterized by growing document volume and rhetorical sophistication.

AI renders mass surveillance possible. With NLP and other tools, actors may cross-reference company stories against emission figures, records of controversy, regulatory filings and ratings, or other third-party information to detect anomalous story development, semantic inflation, disconnects in theme vs. metric, or perceived disconnects from reported commitment to underlying performance. This allows us to shift from a disjointed human analysis towards automated, ongoing observation.

This matters because greenwashing may involve cherry picking rather than outright falsehoods. Firms may decide which behaviors to highlight, ambiguous bad signals, or interpret isolated interventions as significant sustainable development progress. Machine learning analysis could be particularly helpful here since machine learning algorithms can discern trends not readily apparent by just scanning the text of a document.

The policy implication is clear. Greenwashing flourishes where reputational signaling is easy and monitoring expensive. When AI reduces the cost of finding inconsistency, it might change firms' incentives through increased perceived risk of exposure. The results from Marquis et al. 's [4] study of scrutiny and

selective disclosure are immediately applicable: if firms are subject to greater surveillance and transparency standards, selective disclosure is less appealing.

Recent firm-level evidence also shows that AI can mitigate the incentive for greenwashing in practice. He & Wang [10], by employing a firm-level indicator of AI use built upon LLM-based methods, show that the use of AI greatly decreases greenwashing and that this result is related to increases in operational efficiencies, human capital structure, and green innovation. Similar findings are found for the work of Tian & Shi [16], who also argue that AI use could reduce the greenwashing behavior of firms under higher pressure to transform; although this is likely situation specific and needs more empirical testing with different institutions: it offers more direct empirical evidence to the case of seeing AI as enabling a type of governance, not simply convenient reporting tool.

Artificial intelligence could also shift monitoring power around. Granular ESG evaluation is currently performed by a handful of big institutional investors, specialized auditors, and highly resourced civil society actors. Capability gaps will remain, but AI tools might help overcome certain information barriers to allow for greater participation among other actors in assessing corporate sustainability claims.

3.3 AI as Enabler of More Sophisticated Symbolic Compliance

Any optimistic account of AI in ESG governance must be balanced against a fundamental paradox: the same technologies that strengthen verification may also strengthen impression management.

Generative AI could write clean, logical and professional sustainability stories with very low marginal cost. Large language models show stunning abilities for language generation and contextual synthesis [17], who are very much a part of the present day newsroom landscape. A recent literature review confirms that LLMs are becoming more relevant to SR, since they enable semantic extractions, automated categorization, compression, and the detection of misleading claims from unstructured disclosures [18]. But it is precisely this capability that sharpens the governance paradox of ESG communications: technologies that can identify weakly substantiated claims might also help firms make their disclosures smoother, coherent, and persuasive sustainability stories for a low price.

For stakeholders, coherence, sophistication, and comprehensiveness are likely to be used as proxies for credibility. To the extent that AI can improve the rhetoric of a sustainability report more quickly than underlying ESG performance, disclosure appearance and disclosure integrity could diverge even more starkly. In these circumstances, AI does nothing to solve the greenwashing problem; which enhances that.

This concern resonates with prior scholarship on symbolic disclosure. Cho et al. [19] argue that changes in CSR disclosure practices should not automatically be interpreted as evidence of deeper accountability, because legitimacy-oriented communication remains a persistent feature of corporate reporting. Read in light of generative AI, this insight becomes even more important. The risk is no longer simply that firms may disclose symbolically, but that they may do so with unprecedented fluency and persuasive force.

Therefore, AI must not be seen to be progressive per se when it comes to ESG. Rather it should be viewed more as a multiplier; it can multiply transparency, comparability, and verification, but could also increase narrative complexity and symbolic conformity. What outcome occurs will depend upon the embedding of AI into organisational incentive schemes and control mechanisms.

4. An Integrated Framework: Reframing the Dual Role of AI

The literature reviewed above suggests that AI's "dual role" should be specified more precisely. In practice, AI operates along three analytically distinct but interconnected dimensions.

First, AI as disclosure infrastructure. In this role, AI improves the extraction, classification, standardization, and processing of ESG information. Its primary contribution is informational: it reduces the practical frictions associated with heterogeneous, unstructured, and text-intensive sustainability disclosure.

Second, AI as a monitoring mechanism. In this role, AI strengthens stakeholder scrutiny by helping identify narrative inflation, internal inconsistency, and narrative-performance gaps. Its primary contribution is

governance-oriented: it reduces the cost of oversight and increases the feasibility of detecting potential greenwashing.

Third, AI as a strategic tool. In this role, AI may be used by firms to craft more refined sustainability narratives that are stylistically impressive but only weakly grounded in actual performance. Its primary implication is cautionary: improved narrative quality does not necessarily imply improved disclosure integrity.

This three-part framework provides a more useful interpretation than either technological optimism or technological pessimism alone. AI neither automatically improves ESG transparency nor necessarily worsens symbolic disclosure. Its effects are conditional. Data quality, model transparency, assurance arrangements, institutional scrutiny, regulatory enforcement, and firms' strategic incentives all shape whether AI strengthens substantive accountability or merely improves the packaging of symbolic compliance.

This is why we cannot reduce the governance question to asking if AI is "good" or "bad" for ESG disclosure; instead, the more important question is how AI reshapes the relationship of information production, oversight, and outreach.

In this sense, AI should be understood as a socio-technical governance mechanism rather than a neutral technical instrument. Its effects emerge not only from computational capability, but also from its interaction with standards, assurance systems, investor expectations, media scrutiny, and regulatory enforcement. When assurance is credible, external monitoring is active, and reporting claims undergo verification, AI is more likely to enhance substantive accountability. Where such conditions are weak, AI may simply make symbolic compliance more efficient and more persuasive.

5. Future Research Directions

Several lines of future research emerge from this review.

The first concerns causal identification. Much of the literature about AI and ESG reporting is either conceptual, or correlational. Rigorous empirical design is needed to establish whether there is a material improvement in using AI for disclosure quality, reduces the risk of greenwashing, or affects stakeholder behavior in quantifiable ways. Quasi-natural experiments, difference-in-difference models, and cross-regime comparisons could help move the literature away from descriptive claims.

A second frontier is measurement development. Existing research continues to rely upon heterogeneous proxies of AI usage and the quality of ESG disclosures, and greenwashing intensity. More transparent, theoretically based indicators would greatly enhance the stock of knowledge. Promising first steps, recent work using NLP models for quantifying ESG communication [8] or constructing ESG-washing indices based on SRs [9], is but further verification is required to establish the extent to which such indicators transfer between sectors, languages, and reporting systems.

A third area is related to the human-AI interaction. The AIs don't work on their own, but are integrated into reporting routines, audit processes, board oversight, and regulatory practice. Future research should thus explore the role of managers, auditors, how regulators, and investors engage with AI and the effect that engagement has on governing outcomes. It will be important to understand when human judgement augments an AI tool, as opposed to being displaced or weakened by one in order to evaluate the true governance implications of AI-enabled reporting.

A fourth direction is institutional comparison. The effects of AI will not likely be the same in all reporting regimes, law systems, industries, and assurance environments. Cross-country and cross-regime studies would help to clarify if the operation of AI differs across regimes. For instance, AI may be having a greater anti-greenwashing effect in areas with more developed reporting standards and greater enforcement capability, and assurance practices are more mature.

Last but not least, future work needs to deal with governing explainable disclosure by AI in and of itself. Explainability, accountability, auditability, and training data provenance are likely to grow ever more relevant as the use of artificial intelligence tools becomes embedded within sustainability reporting and assurance. These questions are also highlighted in recent review works of LLMs for sustainability reporting [18], but

there is little evidence to date as to how we may be confident that the AI based sustainability analysis would provide enough information for assurance and regulation. Therefore, future work should not only ask whether AI helps with ESG reporting, not only how we can design them, but when their outcomes will be reliable, disputable, and socially legitimate.

6. Conclusion

This review has argued that AI is changing the nature of ESG disclosure not simply as an instrumental reporting technology, but as a socio-technical governing mechanism which changes the ways in which sustainability claims are made, interpreted, and disputed. Through enhancing the retrieval, indexing, and analysis of complex disclosure ecosystems, Artificial intelligence could enhance the information quality of ESG disclosures. This enables automatic screening and lowers the cost for checking stories against external facts, thus strengthening regulation of greenwashing.

Meanwhile, AI does not solve automatically the credibility issues of ESG disclosure. It might generate new opacities via black-boxes, inherit bias from weak data environments, and enable richer varieties of symbolic compliance in which generative tools are leveraged to improve the rhetoric of appearances while not actually enhancing substantive performance. The key issue thus becomes less about if artificial intelligence could be used to improve the delivery of ESG communications and more about how well governance structures might constrain this application sufficiently that it would promote disclosure as aligned with accountability.

The larger point here is that the future of AI-enabled ESG transparency may well rest less on computing power than on the institutional circumstances in which it was implemented: where credibility exists, accountability matters, and identified discrepancies matter too. AI may aid a transition to more substantive ESG reporting. Where those conditions are weak, AI may do no more than enhance the appearance of symbolic compliance.

In this sense, the future of ESG governance will depend not only on better disclosure technologies, but also on stronger systems of verification, assurance, and institutional accountability capable of governing the uses of those technologies. AI may become one of the most powerful tools in the ESG field, but whether it ultimately curbs greenwashing or refines it will depend on how it is governed.

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Conflicts of Interest

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