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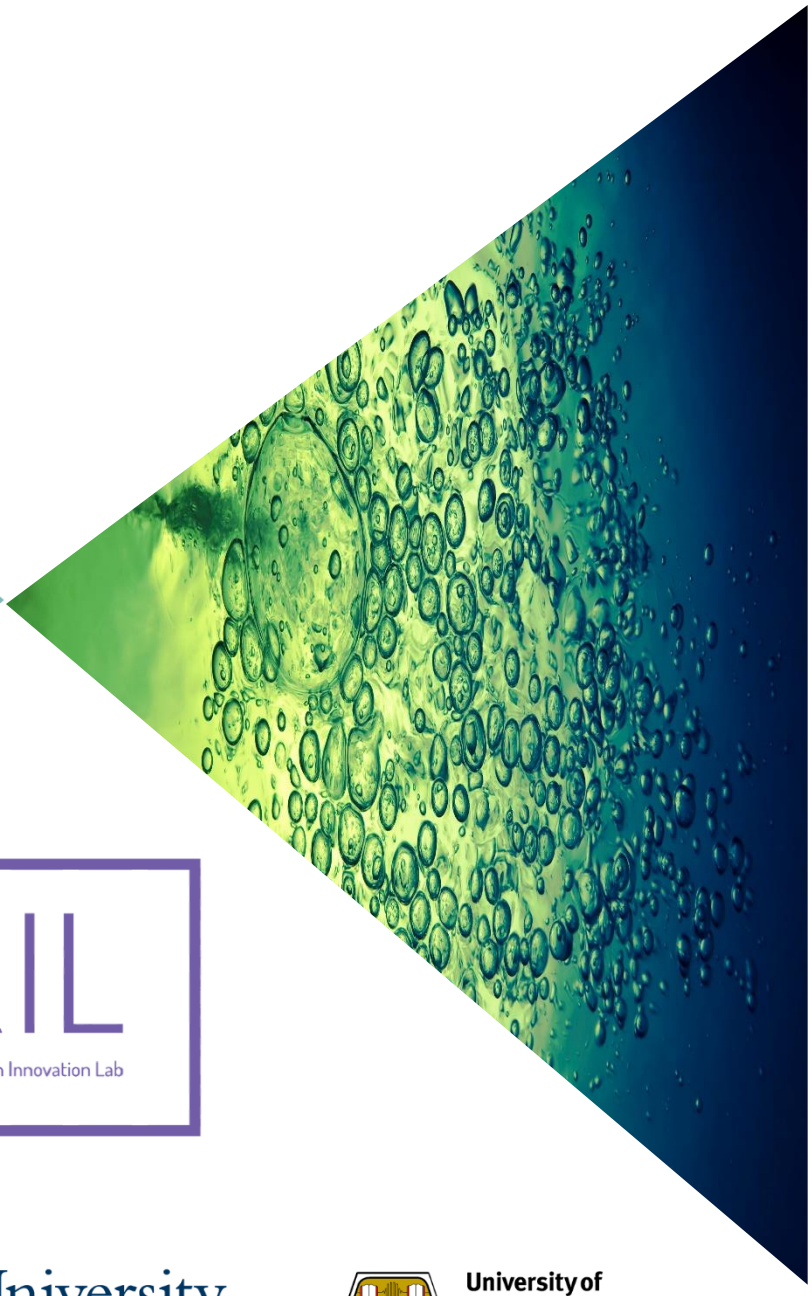
ESG Greenwashing and Applications of AI for Measurement



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ESG GREENWASHING AND APPLICATIONS OF AI FOR MEASUREMENT

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Abstract: "ESG greenwashing" refers to the strategic communication tactics firms use to selectively disclose their ESG conduct to stakeholders. ESG greenwashing strategy, while it may attract and satisfy stakeholders at the beginning, may cause different issues for firms later, such as adverse publicity, lobbying, or boycott campaigns by consumer or pressure groups or divestment by socially responsible investors. The complex impacts of ESG greenwashing underscore the imperative of discerning and quantifying instances of such practices. We aim to consolidate recent literature reviews of ESG greenwashing, methodologies to measure ESG greenwashing and developing applications of AI, text analysis and machine learning models to advance such measurement. This white paper makes significant contributions to policy developments, such as the greenwashing regulations of the UK FCA and the European Parliament.

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1.PROBLEM STATEMENT

Sustainability is increasingly recognized as a critical concern among all stakeholders within the market. Since the introduction of the United Nations Principles for Responsible Investment (PRI) in 2006, there has been a significant escalation in the number of signatories, thus showing their commitment to sustainable development. Existing literature presents mounting evidence regarding the significance of sustainability and Environmental, Social, and Governance (ESG) factors, such as widespread investor appreciation for sustainability (Bauer et al., 2021; Hartzmark and Sussman, 2019), the incorporation of ESG into financial decision-making processes (Edmans and Kacperczyk, 2022), and the emergence of new roles within large corporations, e.g. Chief Sustainability Officers, tasked with overseeing ESG strategic initiatives. BlackRock CEO Larry Fink has also stated that ESG concerns may result in a "fundamental reshaping of finance" and "significant reallocation of capital".

Along with the heightened attention that ESG receives from a variety of stakeholders, some firms may “greenwash” their ESG claims (Lyon and Montgomery, 2015) by providing misleading communication (Lee and Raschke, 2023), aimed at garnering greater interest from stakeholders in the short run. This strategy is incentivized for several reasons. First, ESG disclosures are largely voluntary, especially for small businesses and low regulated markets. Second, ESG is an intangible investment, not the core business of firms, thus reducing the pressure for disclosure of relevant information. Third, stakeholders will encounter some substantial challenges in validating the ESG claims against the actual ESG performance of firms. While official ESG performance assessments by agencies are accessible for large firms, inconsistencies in methodologies and divergence in scores undermine reliability and create uncertainty for stakeholders. For small firms, the constraints in authenticating ESG claims are even higher with limited disclosed information and lack of ESG performance scores from agencies. However, in the long run, those firms engaging in ESG greenwashing are compelled to uphold their ESG commitments to stakeholders, risking a loss of legitimacy if they fail to fulfil their claims diligently. Thus, ESG greenwashing strategy, while it may attract and satisfy stakeholders at the beginning, may cause different issues for firms later, such as adverse publicity, lobbying, or boycott campaigns by consumer or pressure groups or divestment by socially responsible investors (Brooks and Oikonomou, 2018; Sinclair-Desgagné and Gozlan, 2003), resulting in market disruptions and loss of trust.

The complex impacts of ESG greenwashing underscore the imperative of discerning, conceptualizing and quantifying instances of such strategy. On the policy front, the issue of greenwashing has emerged as a prominent concern for society and government authorities. For instance, in response to this issue, on 17 Jan 2024, the European Parliament has formally endorsed the Greenwashing Directive regulating firms’ communication of their sustainability, environmental, and social or ethical efforts. In the UK, the Financial Conduct Authority has brought into effect its anti-greenwashing rule as of 31 May 2024.

Given the importance of understanding ESG greenwashing, this white paper aims to:

- Consolidate recent literature reviews of ESG greenwashing to conceptualize greenwashing practice;
- Summarize recent methodologies to measure ESG greenwashing, then, point out some gaps for further development.

In the solution framework, we propose some approaches to address these gaps by developing applications of AI, text analysis and machine learning models. This white paper makes significant contributions to policy developments, such as the greenwashing regulations of UK FCA and European Parliament. The structure of this white paper entails conceptualisation of ESG greenwashing and measurement in Section 2, followed by

details of the solution framework in Section 3, and concluding remarks in Section 4.

2. CONCEPTUALSATION OF ESG GREENWASHING AND MEASUREMENT

2.1. Conceptualisation of ESG Greenwashing

Greenwashing is the term describing the act of firms misleading consumers about environmental practices (Delmas and Burbano, 2011). Some examples have been given in the research paper of Delmas and Burbano (2011) to clearly define the term, such as General Electric's "Ecomagination" campaign and LG Electronics and its mis-certified Energy Star refrigerators. These cases show the discrepancies between environmental standards the firms promote (*the talk*) and the actual activities the firms do (*the walk*). Generally, a firm can be categorized as engaging in "greenwashing" when satisfying two conditions: positive communication about environmental practices and corresponding poor environmental performance. With other combinations of two conditions, Delmas and Burbano (2011) classify firms into other four categories: (I) greenwashing firms, (II) vocal green firms, (III) silent brown firms, and (IV) silent green firms (Figure 1).

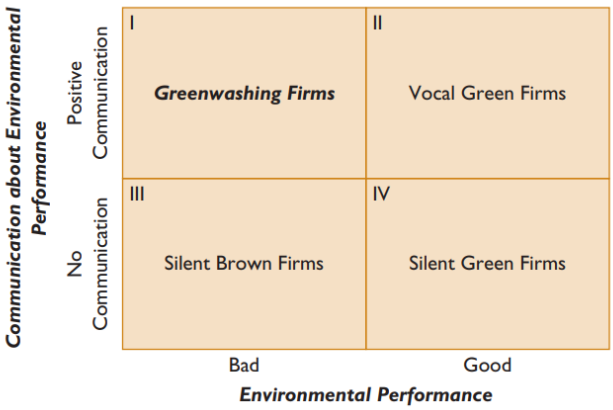

Figure 1: Greenwashing classification (Delmas and Burbano (2011))

Lyon and Maxwell (2011) define greenwashing as some form of misleading environmental communication, thus leading to overly positive belief of stakeholders regarding the environmental performance of firms. Patten (2002) underscores that certain firms, particularly those facing unfavourable media coverage, tend to resort to making unverifiable soft claims regarding their environmental commitment as a means to restore their corporate image. Some entities may strategically choose to disclose specific environmentally impactful activities while simultaneously concealing their true overall performance (Marquis et al., 2016). Following legitimacy and stakeholder theories, Clarkson et al. (2008) assert that firms with weaker environmental track records are more inclined to disclose sustainable information, driven by the motivation to bolster their legitimacy and convince stakeholders.

Roulet and Touboul (2015) refer to ESG greenwashing as the gap between symbolic and substantive corporate social actions. ESG greenwashing is defined as misleading communications in which firms can use verbal mechanisms to deliberately create an overly positive image regarding their sustainable orientation and ESG activities (Lee and Raschke, 2023). This study conceptualises ESG greenwashing via two features: (1) an intrinsic feature that represents the distance from truthfulness and (2) a communicative feature that represents techniques used to mislead or confuse people (Lee and Raschke, 2023). The former feature reflects partial truths, in which little (or no) true environmental, social and governance activities are mixed with no impactful activities (De Jong et al., 2017), while the latter reflects claims that are unsubstantiated or cannot be verified or use fake or questionable certifications (Schmuck et al., 2018). As societal concerns regarding corporate responsibilities escalate, firms have become adept at strategically communicating their sustainable initiatives, prioritizing communication over substantive implementation (Lee and Raschke, 2023).

In a comprehensive examination, across various academic investigations, the concepts of ESG greenwashing can be delineated by the dissonance between two fundamental aspects: (1) *ESG Talk*, which pertains to the

communication of ESG principles by firms to external stakeholders, and (2) *ESG Walk*, which concerns the actual implementation and performance of ESG practices within firms. Consequently, assessments of ESG greenwashing must encompass an analysis of both of these aspects. This white paper aims to consolidate recent approaches for measuring ESG greenwashing in the following section.

2.2.Recent ESG Greenwashing Measurement and Gaps for Developments

Qualitative assessments of sustainability reports and corporate communications are early attempts to evaluate ESG greenwashing, however, their scalability and subjectivity pose limitations (Lagasio, 2023). In response to these challenges, recent studies shift toward quantitative analysis to offer more objective and systematic evaluation of ESG greenwashing (Attig and Boshanna, 2023; Lagasio, 2023; Lee and Raschke, 2023; Yu et al., 2020).

Following conceptualisation of ESG greenwashing, quantitative assessments for gauging ESG greenwashing involve measuring the difference between the two key components of ESG Talk and ESG Walk. The recent study of Lee and Raschke (2023) measures ESG greenwashing as the ratio of the positive communication about ESG performance in sustainability reports to standardized ESG scores provided by Refinitiv. Specifically, to proxy for positive communication about ESG performance, they construct a weighted average ESG performance score by incorporating the Refinitiv-rated environmental (E), social (S), and governance (G) scores of firms (ESG Walk), weighted according to the frequencies of words (as a proportion of total words) related to E, S, and G in ESG reports (ESG Talk). Subsequently, they divide the weighted average ESG performance score by the standardized Refinitiv-weighted ESG score (adjusted by subtracting 1) to yield a positive/negative ratio, serving as an indicator of the degree of ESG greenwashing. This ratio reflects the comparative qualitative emphasis on the use of ESG-related language over the quantitative ESG score. Positive ratios signal greenwashing,

Leveraging some applications of NLP (Natural Language Processing), Lagasio (2023) constructs a Greenwashing Severity Index (GRI) based on ESG focus scores (ESG Talk) and sustainability indicators (ESG Walk). Instead of a single, aggregated ESG Talk score measuring a fixed dictionary like other studies, they opt to disaggregate this measure into three distinct scores representing environmental (E), social (S), and governance (G) dimensions and develop separate corresponding dictionaries for each of them. Specifically, by calculating the ratio of environmental keyword occurrences (e.g.," climate", "biodiversity"," emission") to the total number of tokens (segmented text) in the sustainability report, they discern the strength of a firm's environmental focus. They do similarly with the ratio of social keyword occurrences (e.g.," employee"," equality", "human rights") and governance keyword occurrences (e.g., "board composition", "executive compensation", "accountability") to assess social focus and governance focus respectively. They integrate three focus scores to form ESG Talk. Similar to study of Lee and Raschke (2023), Lagasio (2023) also use Refinitiv ESG performance scores to proxy ESG Walk and then build a weighted average ESG performance to identify ESG greenwashing.

Relevant work of Attig and Boshanna (2023) also measures ESG greenwashing as the difference between ESG Talk and ESG Walk. Regarding ESG Talk, they conduct textual analysis in earning calls of firms. Firstly, following research papers in ESG, they tokenize the text corpus into bigrams using the document-bigram-matrix approach, then, identify the most frequent bigrams to add to an ESG word list (bags-of-words). Based on the ESG word list, they construct two proxies, frequency of ESG bigrams (ESGT BF) and bigram's frequency-inverse document frequency (ESGT BF-IDF) in earning calls. Form these two proxies, they apply Principal Component Analysis (PCA) and use the first principal component as a measure of ESG Talk. To measure ESG Walk, Attig and Boshanna (2023) use the CSR net score in Kinder

Lydenburg Domini (KLD)[1] from MSCI ESG Research, which provides CSR data for publicly traded firms. They measure ESG greenwashing as the difference between the decile rank of ESG Talk and the decile rank of ESG Walk, in which decile ranks are defined following year and sector.

The research of Yu et al. (2020) utilises some public scores to identify ESG Talk and ESG Walk. They use Bloomberg's ESG disclosure metric to represent ESG Talk, which reflects the quantity of ESG data each firm discloses to the public, and they use Asset4 ESG data from Thomson Reuters to proxy ESG Walk, which gathers ESG data from a large number of global firms and scores them on four pillars - Environmental, Social, Corporate Governance, and Economic - summarizing a firm's strength in adhering to ESG principles. They construct a firm's peer-relative greenwashing score as the difference between a normalized measure representing a firm's relative position to its peers in ESG Talk and a normalized measure representing a firm's relative position to its peers in ESG Walk.

While some recent approaches have shown merits for simplicity, they may overlook certain aspects to measure ESG greenwashing. Regarding ESG Talk, relying heavily on text features such as word frequency and position in the text does not account for the semantic context of sentences, treating words as isolated units without considering their syntactic and grammatical relationships, resulting in a lack of coherence and failure to capture the overall meaning in ESG communication (Kang and Kim, 2022). Gaps also persist within the measurement of ESG Walk, as various studies employ disparate scoring systems from different rating agencies to assess firm ESG performance (Kinder Lydenburg Domini, Refinitiv, MSCI, etc.), which show rating divergence, often on the basis of different methodologies (Berg et al., 2022). This results in less robust measurement for ESG performance, and hence, less confidence in the measurement of ESG greenwashing. Additionally, those scoring systems primarily cover publicly traded firms (large firms) in developed markets but lack significant data of ESG performance scores for small and medium-sized enterprises (SMEs) or emerging markets. Consequently, much of the current research focuses on large corporations in developed markets, characterized by sufficient resources and transparent ESG scores. However, exploring the ESG performance and potential greenwashing practices of SMEs or firms in emerging markets, which often lack access to financial resources and official ESG ratings, represents a promising avenue for investigation (Cumming et al., 2024). In the next section, we will propose solution framework to address these gaps and contribute to further developments in researching the topic of ESG greenwashing.

3. SOLUTION FRAMEWORK

3.1. Applications of AI and Text Analysis for ESG Talk (ESG Communication) Measurement

To tackle the limitations of traditional text-mining approaches, some papers have implemented next level pre-trained large language models (LLM) to measure ESG Talk. The most common method being used to extract insights from ESG-related text data is BERT (Bidirectional Encoder Representations from Transformers) and its variants. BERT has widely been used recently in the context of ESG disclosure for its capacity beyond traditional machine learning models (Bingler et al., 2022; Luccioni et al., 2020; Luccioni and Palacios, 2019; Raman et al., 2020; Schimanski et al., 2024). The Transformer models primarily employ self-attention to extract sequence features and evaluate word importance in relation to preceding words or sentences. This architecture enables efficient parallel computation without recurrent units, facilitating scalability with training data and model size. Additionally, its ability to capture extensive sequence features facilitates efficient pre-training on substantial corpora,

[1] https://wrds-www.wharton.upenn.edu/documents/1154/KLD-on-WRDS.pdf.

with recent developments introducing domain-specific models like FinBERT or ESG-BERT, demonstrating superior performance in related classification tasks. Consequently, a few recent working papers on ESG greenwashing have started to employ BERT models to measure the level of ESG Talk in firms' reports. For instance, Kim et al. (2023) investigate ESG greenwashing practices among firms listed on the Korean KOSPI 200 by leveraging ESG-BERT to scrutinise textual data from ESG reports and CSR disclosures, while considering the effects of environmental news, financial indicators, and energy usage data. By applying ESG-BERT for the in-depth analysis of sustainability disclosures and coupling it with advanced machine learning techniques, such as Artificial Neural Networks (ANN), Logistic Regression (LR), Random Forest (RF), and XGBoost (XGB), this study presents significant outcomes in ESG greenwashing prediction. Another work of Vinella et al. (2023) detects ESG greenwashing as a linear equation of four characteristics in corporate sustainability reports, including: (1) *Absence of explicit climate-related commitment and action (Commitment)*; (2) *Use of non-specific language (Climate specificity)*; (3) *Overly optimistic sentiment (Sentiment)*; and (4) *Lack of evasive or hedging terms (Hedging)*. The authors fine-tuned the ClimateBERT model for ESG greenwashing risk detection on labelled data, which achieved an average accuracy score of 86.34% and F1 score of 0.67.

However, such application is still in its infancy due to the reliance of BERT models on large amounts of training data, posing challenges in adapting to variations in text corpora across different ESG subdomains during pre-training. Text corpora not only vary between sustainability-related news articles, academic research articles, firm's sustainability reports, but also differ based on taxonomies, typologies, and topics, such as the ones used in TCFD disclosures compared to Global Reporting Initiative Standard documents (Moodaley and Telukdarie, 2023). Moreover, there remain notable limitations such as the inherent vagueness of ESG language, adaptability to each of the E, S and G pillars, and multilingual and cross-cultural adaptability (Zou et al., 2023). To tackle this challenge, our approach suggests the deployment of BERT-based models in ESG Talk measurement, following a conceptual framework for subdomain specific pre-training, as set out by Moodaley and Telukdarie (2023). This requires constructing different subdomain text corpora (STC) within sustainability disclosures. These STC should be sufficiently large, with a reasonable level of vocabulary overlap with main domain text corpora to enhance better model performance. The selected pre-trained BERT model on the sustainability domain would then be further pre-trained on STC for downstream tasks of subdomain text classification. We believe this approach can improve the detection of excessively ESG oriented communications in firms' reporting within specific contexts.

Another issue regarding BERT and other LLMs is the particularly concerning aspect of their black box nature. In this case, Explainable Artificial Intelligence (XAI), applied in the Natural Language Processing domain, offers a promising avenue for interpreting the outcome of BERT models by providing insights into which parts of the input text BERT focuses on when making predictions. The choice of XAI technique may differ, ranging from model-specific or model-agnostic approaches, to focusing either on global or local explanations. Therefore, within the ESG greenwashing context, we would propose the tailored application of appropriate XAI techniques, particularly concerning specific pre-trained BERT models utilised for detecting ESG communications. One suggestion would be leveraging from an adaptation of SHAP for BERT-like classifiers, which assigns each feature (e.g., word or token) in the input text a Shapley value, representing its contribution to the model's output (Kokalj et al., 2021; Mosca et al., 2022).

3.2. Suggestions for ESG Walk (ESG Performance) Measurement

The first big issue in ESG Walk measurement is the divergence of ESG ratings among rating agencies, leading to difficulties in ESG

performance evaluation. Berg et al. (2022) identify three sources of divergence: Scope divergence (when ratings are based on different set of attributes), Measurement divergence (when rating agencies measure the same attributes using different indicators), and Weight divergence (when rating agencies take different views on the importance of attributes). The results show that Measurement contributes 56% of the divergence, followed by Scope (38%) and Weight (6%). To overcome this divergence, we may implement some normalization techniques, such as transforming data and rescaling data to standard scores. Moreover, we can use some machine learning techniques (factor analysis, neural network, random forest, etc.) to reduce dimensions across different ESG performance scores to one representative score. or do various robustness analysis with each score to ensure the credibility of the results.

Another issue is that the coverage of ESG performance measurement is particularly patchy for smaller firms, less regulated industries, and emerging markets. The number of firms covered by major ESG score providers typically ranges between 1,000−10,000, representing a major challenge to extend research in ESG greenwashing to emerging markets and SMEs. Moody's ESG Score Predictor[2] solution is a step in the right direction. The ESG Score Predictor is a set of models designed to provide more than 50 comparable and standardized metrics, including granular ESG scores, an energy transition score, a physical risk management score, and carbon emissions footprints. These predicted metrics allow them to compare firms across industrial sector, any market cap size segment, and location, while accounting for economic, social, natural, and human capital development indicators in the location(s) where a firm operates. Leveraging consistent historical data from Moody's ESG Solutions 2004 through to the present, they construct and calibrate their models on a dataset containing more than 100,000 firms to predict metrics for 600+ industries and 12,000 sub-national locations in 220 countries and territories. The prediction model for each metric consists of individual regressions and alternative machine learning (ML) models, with a variety of drivers combined into one using ensemble methods. The models are then applied to the "unscored" firms to produce interpretable, predicted metrics for expanding coverage in terms of size, location, and industry. The coverage universe for these predicted metrics is many times the size of the covered universe. Following their methods, we can extend predictive machine learning models to cover ESG performance of private firms.

Another solution to verify the ESG performance of emerging markets and SMEs is the RepRisk[3] database. RepRisk screens, on a daily basis, over 100,000 public sources and stakeholders in 23 languages to systematically identify any firm or project associated with an ESG risk incident. 2,000,000+ documents are aggregated through advanced text and metadata extraction from unstructured content and undergo multilingual de-duplication and clustering processes, reducing incoming documents to approximately 150,000 daily observations. Thus, with RepRisk, we can access some extreme cases of firms who have ESG incidences recorded against them but who were overly positive about their ESG performance.

4. CONCLUSION

This white paper furnishes an overview of background information to key concepts underlying alternative measurement of ESG greenwashing and synthesizes recent related literature. It offers insightful perspectives and

[2] https://www.moodysanalytics.com/articles/pa/2022/esg_score_predictor_applying_a_quantitative_approach_for_expanding_firm_coverage#:~:text=Scores%20ranging%20between%200%E2%88%92100,physical%20risks%20of%20climate%20change.

[3] https://www.reprisk.com/solutions#datasets-and-metrics.

proposes pragmatic solutions for advancing research in the domain of ESG greenwashing. From the conceptualisation of ESG greenwashing, we identify two main aspects for its concept: ESG Talk and ESG Walk. Due to the simplicity of current ESG Talk measurement techniques, we propose potential advancements for BERT models by subdomain specific pre-training and applications of Explainable AI (XAI). Additionally, considering the divergence in performance evaluations and the absence of data on ESG practices (ESG Walk), we present alternative approaches for prediction (machine learning applications, forecasting techniques, etc.) and validation (ESG risk incidents). By addressing pertinent issues and suggesting avenues for further exploration, this white paper is expected to be instrumental in elevating awareness of ESG greenwashing and facilitating substantive progress in policy formulation.

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