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Analysis of Greenwashing Indications in Mining Companies in Indonesia

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Abstract

Objective – This study aims to analyze indications of greenwashing practices among mining companies in Indonesia through environmental disclosure in Sustainability Reports based on GRI 300, PROPER ratings, and online news coverage related to environmental issues.

Research methodology – This study employs a qualitative approach using content analysis. The sample was selected using purposive sampling and consists of 15 mining-sector companies listed on the Indonesia Stock Exchange during the 2022–2024 period. Research data were obtained from sustainability reports, PROPER ratings, and online news coverage related to environmental issues. Indications of greenwashing were identified by comparing the level of environmental disclosure with PROPER ratings and information on environmental issues reported in online news during the study period.

Findings – The results show that three companies are indicated as engaging in greenwashing, while the other twelve companies are not indicated as doing so. The findings also show that high levels of environmental disclosure do not necessarily correspond to lower indications of greenwashing, because high disclosure may coexist with inconsistencies in environmental information obtained from external sources.

Research implications – This study contributes to the development of accounting research, particularly the application of legitimacy theory to explain inconsistencies between corporate environmental disclosures and environmental information from external sources.

Limitations and implications – This study uses GRI 300, PROPER, and online news coverage as the basis for identifying indications of greenwashing. Future research may employ other indicators, such as ESG performance, environmental certifications, or assessments by independent institutions, to obtain a more comprehensive picture of greenwashing practices in Indonesia.

Keywords: Greenwashing, GRI 300, media coverage, PROPER rating, sustainability report.

Article Type: Research paper

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Introduction

The mining sector is one of the important sectors of the Indonesian economy. Based on data from Statistics Indonesia (Badan Pusat Statistik, 2024), the mining and quarrying sector contributed 10.37% to Indonesia's Gross Domestic Product (GDP). However, mining activities also pose substantial environmental risks, such as pollution, waste management, emissions, and landscape alteration. These conditions encourage mining companies to increase their responsibility and transparency in communicating information about the environmental impacts of their activities.

One form of such transparency is through sustainability reporting. Environmental disclosure in sustainability reports may refer to the Global Reporting Initiative (GRI), particularly the GRI 300 Series, which covers information on materials, energy, water and effluents, biodiversity, emissions, waste, environmental compliance, and supplier environmental assessment.

However, high levels of environmental disclosure do not always indicate that a company's environmental conditions correspond to the information disclosed. Research has long cautioned that environmental reporting can serve both informative and strategic purposes: firms may selectively emphasize favorable impacts, while the relationship between disclosure and environmental performance remains context-dependent (Cho & Patten, 2007; Lyon & Maxwell, 2011; Marquis et al., 2016).

Previous studies have examined greenwashing and sustainability reporting using various approaches. For example, research on standalone CSR reports distinguishes substantive signaling from attempts to cultivate a favorable image (Mahoney et al., 2013), while counter-accounting research shows that highly rated sustainability reports may still present an idealized account that obscures significant environmental problems (Boiral, 2013).

Based on these previous studies, there remains an opportunity to strengthen the identification of greenwashing through the use of external information sources. This study uses three sources with different functions: GRI 300 to examine corporate environmental disclosure, PROPER to assess environmental performance as evaluated by the regulator, and online news coverage to identify public information concerning corporate environmental issues. These three sources are not treated as equivalent measures but are compared to examine the consistency or inconsistency of information.

The use of external sources is important because information in sustainability reports originates from the company and therefore needs to be compared with information from other parties. PROPER provides an environmental assessment by the regulator, while online news provides information about environmental issues developing in the public sphere. By comparing these three sources, the study can assess whether high environmental disclosure is supported by information on the company's environmental performance and conditions or instead reveals inconsistencies that may indicate greenwashing.

Accordingly, this study positions greenwashing not only as an issue of sustainability communication but also as an issue of information credibility in corporate reporting. This approach distinguishes the study from research that focuses only on sustainability report disclosure or a single information source. This study aims to analyze indications of greenwashing among mining companies listed on the Indonesia Stock Exchange during 2022–2024 by comparing environmental disclosure based on GRI 300, PROPER ratings, and online news coverage related to environmental issues.

Literature Review

Legitimacy Theory

Legitimacy theory was introduced by Dowling and Pfeffer (1975), who explain that companies are part of a social system characterized by values, norms, and beliefs prevailing in society. Legitimacy is obtained when corporate activities are consistent with prevailing social values and expectations. In the context of sustainability, disclosure of social and environmental information can be used by companies to demonstrate that their activities are consistent with the expectations of society and stakeholders (Vitolla & Rubino, 2017).

Suchman (1995) divides legitimacy into three forms: pragmatic, moral, and cognitive legitimacy. Pragmatic legitimacy concerns acceptance of a company based on the benefits it provides to

stakeholders. Moral legitimacy concerns judgments that corporate activities are right and consistent with prevailing values and norms. Cognitive legitimacy concerns acceptance of a company when its existence and activities are regarded as natural or comprehensible within the social environment.

In this study, moral legitimacy is relevant because mining activities affect the environment and society. Legitimacy-oriented disclosure may help firms respond to social expectations, particularly after environmental controversies, but the form and credibility of those responses depend on whether claims are supported by observable practices (O'Donovan, 2002; Walker & Wan, 2012).

Greenwashing

Greenwashing refers to a practice in which a company builds a positive image or perception of environmental concern that is not fully supported by its actual actions or environmental conditions. Delmas and Burbano (2011) describe greenwashing as a form of information asymmetry in which companies attempt to influence public perceptions through information about their environmental performance. In sustainability reporting, greenwashing may occur when companies emphasize positive environmental information while relevant information about negative impacts or environmental conditions is not adequately disclosed (Nemes et al., 2022).

Forliano et al. (2025) show that greenwashing is associated with corporate communication strategies for shaping positive perceptions of sustainability. Prior work also treats greenwashing as a gap between symbolic communication and substantive environmental action (Walker & Wan, 2012), and highlights how stakeholder scrutiny and information shared beyond corporate channels can constrain selective disclosure (Lyon & Montgomery, 2013; Marquis et al., 2016).

Program for Assessment Ratings of Company Performance (*PROPER*)

The Program for Assessment Ratings of Company Performance in Environmental Management (*PROPER*) is an instrument used by the Ministry of Environment and Forestry (KLHK) to assess companies' environmental management performance. *PROPER* assessment results are presented using Gold, Green, Blue, Red, and Black ratings, indicating levels of environmental performance and compliance.

Niandari and Handayani (2023) explain that environmental assessment relates to various aspects of corporate environmental management. In this study, PROPER is used as an external information source provided by the regulator to assess corporate environmental performance. PROPER is not positioned as the same measure as *GRI 300* disclosure because the two have different functions. *GRI 300* shows environmental information disclosed by companies, whereas PROPER provides an assessment by the regulator.

Global Reporting Initiative (GRI) 300 Series

The Global Reporting Initiative (GRI) is a sustainability reporting standard used by companies to disclose information about economic, social, and environmental impacts. The GRI 300 Series specifically addresses environmental aspects and is used in this study because it directly relates to the environmental impacts of mining activities. GRI 300 covers several environmental topics, namely materials, energy, water and effluents, biodiversity, emissions, waste, environmental compliance, and supplier environmental assessment. Disclosure based on GRI 300 provides a basis for examining environmental information communicated by companies through sustainability reports.

In this study, *GRI 300* is used to identify and measure the level of corporate environmental disclosure. The list of indicators and the disclosure calculation process are described in the research methods section. The measurement results are then used together with PROPER information and online news coverage to examine the consistency of environmental information communicated by companies in meeting formal standards compared with the portrayal of actual environmental impacts.

Online News Coverage Related to Environmental Issues

Online news coverage concerning environmental issues can serve as an external source of information about environmental activities and events related to companies. The media can draw attention to corporate environmental issues and increase external pressure for companies to communicate environmental information more transparently (Zakaria et al., 2023).

In this study, online news coverage is used as a source of public information that complements sustainability reports and PROPER. This approach is consistent with research emphasizing that sustainability-report content should be evaluated against external performance indicators rather than treated as a self-validating account of corporate conduct (Papoutsi & Sodhi, 2020).

The three sources serve different functions. Sustainability reports based on GRI 300 are used to examine corporate environmental disclosure, while PROPER is used to assess environmental performance by the regulator, and online news is used to examine public information concerning environmental issues. The comparison of the three sources provides the basis for identifying consistency or inconsistency in information that may indicate greenwashing.

Research Method

This study uses a qualitative method with content analysis to identify indications of greenwashing among mining companies in Indonesia. The data consist of secondary data obtained from sustainability reports, PROPER publications issued by the Ministry of Environment and Forestry (KLHK), and online news coverage. Data analysis follows the stages proposed by Miles and Huberman, consisting of data reduction, data display, and conclusion drawing.

The population comprises mining companies listed on the Indonesia Stock Exchange (IDX) during 2022–2024. The sample was determined using purposive sampling based on criteria aligned with the research objectives. The criteria were: (1) mining companies listed on the IDX during 2022–2024; (2) companies that published sustainability reports containing environmental disclosure based on GRI 300 consecutively throughout the study period; and (3) companies that were listed and received PROPER ratings from KLHK during 2022–2024.

Based on these criteria, 15 companies were selected as the sample, with a three-year observation period, resulting in 45 observations. The sample selection was intended to ensure the availability of environmental disclosure documents that could be analyzed consistently throughout the study period. Companies that did not meet the criteria for consecutive sustainability reports containing GRI 300 disclosure or did not meet the PROPER criteria were excluded from the sample.

Sustainability report data were obtained from the official IDX website and the official websites of the respective companies. PROPER data were obtained from official KLHK publications, namely the PROPER Decree for 2022–2023 and the PROPER Decree for 2023–2024. Online news was used as external information concerning companies' environmental conditions and issues. News sources were selected from national mass media verified by the Press Council, namely Kompas.com, Antara News, Bisnis.com, Kontan.co.id, Tempo.co, Detik.com, CNBC Indonesia, Tribunnews.com, Liputan6.com, and Media Indonesia. The analyzed news covered information on companies' environmental achievements, awards, and programs, as well as environmental issues, conflicts, or violations during 2022–2024.

Measurement of Environmental Disclosure

Environmental disclosure was analyzed based on GRI 300 indicators using content analysis. The study uses 32 GRI 300 indicators relevant to corporate environmental disclosure. Each indicator identified in the sustainability report was recorded and counted to obtain the company's level of environmental disclosure.

The percentage of environmental disclosure was calculated using the following formula.The measurement results were then presented as percentages to show the breadth of environmental disclosure for each company.

Environmental Disclosure (%) = (No. of *GRI 300* indicators disclosed/Total no. of *GRI 300* indicators used) × 100%

PROPER Analysis

PROPER ratings were used as an external information source to compare corporate environmental disclosure with environmental performance assessments conducted by KLHK. PROPER ratings were not converted into a score combined with the percentage of *GRI 300* disclosure because the two have different measurement functions. *GRI 300* is used to examine environmental information disclosed by companies, whereas PROPER is used to assess environmental performance based on government evaluation.

Accordingly, PROPER ratings were used as one basis for identifying consistency or inconsistency between information presented by companies in sustainability *report*s and environmental performance assessments by external parties.

Online News Analysis

Online news was analyzed using *content analysis* by classifying news into favorable (positive) and unfavorable (negative) categories. Positive news included information on corporate environmental achievements, awards, and programs. Negative news included information on environmental issues, conflicts, or violations involving companies.

News was collected from national mass media verified by the Press Council and was limited to the 2022–2024 period. News analysis was supported by Artificial Intelligence (AI) based on Natural Language Processing (NLP) to classify *media tone*. The AI classification results were subsequently verified by the researchers to ensure consistency with the research context.

The percentages of positive and negative news were calculated by comparing the number of news items in each category with the total number of news items analyzed for the respective company. The final results are presented as percentages of positive and negative news.

In this study, online news is not used as a direct measure of companies' environmental performance. Rather, news serves as external information indicating environmental achievements, programs, issues, conflicts, or violations reported to the public.

Analysis of *Greenwashing* Indications

Indications of greenwashing were identified by comparing three information sources: environmental disclosure based on GRI 300, PROPER ratings, and online news coverage. The three sources were not combined into a single score because they serve different functions. GRI 300 disclosure indicates environmental information communicated by the company, PROPER indicates environmental performance assessed by KLHK, while online news indicates public information about companies' environmental conditions and issues.

A company was categorized as being indicated as engaging in greenwashing when it showed a high level of environmental disclosure but exhibited inconsistencies with its PROPER rating and environmental information identified in online news during the study period. Conversely, a company was categorized as not being indicated as engaging in greenwashing when its environmental disclosure was consistent with information reflected in PROPER and online news.

The absence of a *PROPER* rating for a company was not automatically interpreted as poor environmental performance. In such cases, interpretation was based on information available from other sources, and no negative assessment was assigned solely because the company was not found in the *PROPER* list.

Data Analysis and Triangulation

Data analysis was conducted using the Miles and Huberman model, consisting of data reduction, data display, and conclusion drawing. At the reduction stage, data related to *GRI 300* disclosure, PROPER ratings, and environmental news were selected according to the research focus. The data were then presented as percentages of environmental disclosure, *PROPER* ratings, and percentages of positive and negative news.

At the final stage, findings from the three sources were compared to identify consistency and inconsistency in the information. This triangulation follows the broader methodological argument that firm-level greenwashing should be evaluated through the relationship between disclosed claims and external evidence, rather than inferred from disclosure volume alone (Mateo-Márquez et al., 2022).

Results

The analysis of greenwashing indications was conducted by comparing the level of environmental disclosure, PROPER ratings, and online news coverage related to environmental issues during 2022–2024. The comparison was conducted to examine the consistency between environmental information disclosed by companies and environmental conditions reflected in other information sources. Environmental disclosure and online news coverage are presented as percentages to facilitate comparison, while PROPER is used as supporting information in assessing corporate environmental performance. The analysis results are presented in Table 1.

Table 1. Results of the analysis of greenwashing indications in the research sample

No.	Code	Company	Avg. Envi. Disclosure	Category	PROPER Rating	Positive News	Negative News	Indication
1	**PT01**	**Firm A**	**74%**	High	Gold (1)	**33%**	**67%**	Indicated
2	PT02	Firm B	91%	High	Gold (1)	67%	33%	Not Indicated
3	PT03	Firm C	86%	High	Green	60%	40%	Not Indicated
4	PT04	Firm D	60%	Moderate	Green	60%	40%	Not Indicated
5	PT05	Firm E	78%	High	Green	67%	33%	Not Indicated
6	**PT06**	**Firm F**	**97%**	High	Green	**40%**	**60%**	Indicated
7	PT07	Firm G	72%	High	Green	100%	0%	Not Indicated
8	PT08	Firm H	77%	High	Green	57%	43%	Not Indicated
9	PT09	Firm I	59%	Moderate	Green	83%	17%	Not Indicated
10	PT10	Firm J	47%	Moderate	Green	100%	0%	Not Indicated
11	PT11	Firm K	96%	High	Green	67%	33%	Not Indicated
12	PT12	Firm L	72%	High	Green	100%	0%	Not Indicated
13	PT13	Firm M	80%	High	Gold (1)	67%	33%	Not Indicated
14	**PT14**	**Firm N**	**89%**	High	Gold (1)	**38%**	**62%**	Indicated
15	PT15	Firm O	53%	Moderate	Green	67%	33%	Not Indicated

Based on the analysis, Companies A, F, and N are indicated as engaging in greenwashing, while the other twelve companies are not indicated as doing so. The results show that a high level of environmental disclosure does not necessarily correspond to environmental conditions reflected in PROPER data or online news coverage.

Analysis of Companies Indicated as Engaging in Greenwashing

Based on the analysis, three companies are indicated as engaging in greenwashing: Companies A, F, and N. These three companies have high levels of environmental disclosure, but inconsistencies were identified when the information in their sustainability reports was compared with PROPER and online news coverage during the study period.

Company A has an environmental disclosure level of 74%, categorized as high, and received a Gold PROPER rating. Through its sustainability report, the company discloses various environmental policies, programs, and performance information. However, analysis of online news shows that negative coverage was dominant at 67%, compared with 33% positive coverage. Positive coverage concerned the company's success in reducing carbon emissions by 126,915 tons of CO_2 and the company's clarification regarding allegations of greenwashing. Meanwhile, negative coverage highlighted the use of coal-fired power generation in an aluminum smelter project, coal expansion, and pressure to end support for coal-related business activities.

These conditions indicate a difference between the environmental information communicated by the company and information circulating through online news. Although Company A received a Gold PROPER rating, environmental issues remained a matter of public concern. Therefore, a good PROPER rating cannot automatically be interpreted as meaning that all aspects of the company's environmental performance are free from problems. This difference forms the basis for identifying an indication of greenwashing in this study.

Company F has an environmental disclosure level of 97% and received a Green PROPER rating. This disclosure level is the highest among the companies indicated as engaging in greenwashing. However, online news shows that negative coverage reached 60%, while positive coverage was 40%. Positive coverage concerned the successful reclamation of former mining land, which reached 100% of the 2022 reclamation target, and the company's commitment to sustainable environmental management. In contrast, negative coverage highlighted environmental losses in the tin trading case, estimated at Rp271 trillion, and environmental damage caused by mining activities affecting more than 170,000 hectares.

The high level of environmental disclosure indicates that the company provides extensive information about environmental management through its sustainability report. However, the dominance of negative news indicates that this information is not fully consistent with external information emerging during the study period. Thus, the indication of greenwashing at Company F is not based solely on the existence of negative news, but on the inconsistency between high environmental disclosure and external information showing that environmental issues remain.

Company N has an environmental disclosure level of 89%, categorized as high, and received a Gold *PROPER* rating. Analysis of online news shows 62% negative coverage and 38% positive coverage. Positive coverage concerned the company's success in reducing energy use in its operations and receiving the Sustainability KCSA award. Meanwhile, negative coverage highlighted environmental issues related to mining activities, including hazardous and toxic waste (B3) management and operational activities in mining areas.

These conditions indicate that the regulator's favorable environmental assessment is not fully consistent with information circulating in the public sphere. This difference indicates a gap between the environmental claims communicated through the sustainability report and external information identified in online news. Therefore, Company N is indicated as engaging in greenwashing.

Analysis of Companies Not Indicated as Engaging in Greenwashing

Based on the analysis, twelve companies are not indicated as engaging in greenwashing. In this group, the environmental information communicated by companies is relatively consistent with information reflected in PROPER and online news. Accordingly, no significant inconsistency was found between the information disclosed by companies and information from external sources.

Companies B and M have high levels of environmental disclosure, at 91% and 80%, respectively, and received Gold *PROPER* ratings. Both companies were also dominated by positive news coverage. Company B received positive coverage concerning its decarbonization strategy, reclamation of 2,222 hectares of former mining land, use of electric buses to reduce carbon emissions, and collaboration on land reclamation and forest management. Company M received positive coverage concerning environmental management, a decarbonization roadmap, a *PROPER* award, and implementation of

ESG principles. These conditions indicate consistency among environmental disclosure, regulatory assessment, and external information identified during the study period.

Companies C, E, G, H, K, and L also have high levels of environmental disclosure and were dominated by positive news coverage. The information identified concerned various environmental activities, such as the use of biodiesel and Hybrid Solar Power Plants, renewable energy development, community empowerment, post-mining community preparation, mangrove planting, TCFD implementation, as well as various awards and ESG implementation. These conditions indicate that the information disclosed by companies is supported by external information concerning environmental management activities, and therefore no indication of *greenwashing* was identified.

Meanwhile, Companies D, I, J, and O have environmental disclosure levels in the moderate category. Although their disclosure levels are not as high as those of the other companies, the four companies received Green PROPER ratings and were dominated by positive news coverage. The reported information concerned reclamation of former mining land, the use of solar panels, environmental activities, sustainability awards, operational innovations, and clarification of environmental issues. These results show that a high level of disclosure is not the sole basis for determining *greenwashing* indications. More important is the consistency between information communicated by companies and information from external sources.

Discussion

Overall, the findings show that a high level of environmental disclosure does not necessarily indicate a low likelihood of *greenwashing*. Of the 15 companies in the sample, three are indicated as engaging in greenwashing, while twelve are not indicated as doing so. This finding shows that the amount of environmental information disclosed in sustainability reports cannot serve as the sole basis for identifying greenwashing; comparison with other information sources is therefore necessary.

Among the companies indicated as engaging in greenwashing, environmental disclosure levels were high, and several companies received Gold PROPER ratings. This condition shows that a favorable PROPER rating does not automatically eliminate indications of greenwashing. PROPER is a regulatory assessment based on specific criteria and scope, whereas online news may contain information about environmental issues developing in the public sphere during the study period. Thus, differences between PROPER assessments and information in online news are an important consideration when identifying indications of greenwashing.

Companies not indicated as engaging in greenwashing show relatively consistent patterns across environmental disclosure, PROPER ratings, and online news. This indicates that greenwashing identification is not concerned only with the level of environmental disclosure but also with the consistency of company information with other information sources.

These findings can be explained through legitimacy theory, which states that companies seek to obtain and maintain legitimacy through disclosure of information consistent with societal values and norms. In the context of mining companies, environmental disclosure is important because corporate activities involve the use of natural resources and environmental impacts. However, sustainability report disclosure may not be sufficient to build legitimacy when other information indicates environmental issues.

These findings are also related to Suchman's (1995) concept of moral legitimacy because the indication of greenwashing in this study concerns judgments about the consistency of corporate environmental actions and information with prevailing values and norms. When environmental information communicated by companies is not fully consistent with information from PROPER and online news, an inconsistency may arise that affects acceptance of corporate environmental responsibility. Thus, greenwashing in this study is assessed not only by the amount of information communicated but also by its consistency with other information sources.

The findings are consistent with Clarkson et al. (2008), who show that environmental disclosure does not always reflect environmental performance. They also align with Cho and Patten (2007), who

explain environmental disclosure as a possible legitimacy mechanism, and with Lyon and Maxwell (2013), who model how selective positive disclosure may be discouraged when outside actors can scrutinize corporate claims. At the same time, Papoutsi and Sodhi (2020) find that some sustainability-report indicators do explain third-party sustainability assessments, underscoring that reporting should be assessed empirically rather than presumed to be either reliable or misleading.

Niandari and Handayani (2023), while the use of online news to identify indications of greenwashing is consistent with Amin et al. (2025). Research on social media and corporate greenwash further suggests that external information channels can expose discrepancies between corporate claims and actions (Lyon & Montgomery, 2013).

Based on these findings, indications of greenwashing among mining companies cannot be assessed solely based on environmental disclosure levels or PROPER ratings. Using sustainability reports, PROPER, and online news together provides a more comprehensive perspective for examining the consistency of corporate environmental information. From a legitimacy theory perspective, these findings indicate that corporate efforts to build legitimacy through environmental disclosure need to be supported by consistency of information across multiple sources, particularly in relation to moral legitimacy.

Conclusion

This study aims to analyze indications of greenwashing practices among mining companies in Indonesia through environmental disclosure in Sustainability Reports based on GRI 300, PROPER ratings, and online news coverage related to environmental issues. This study employs the content analysis on 15 sustainability reports of mining-sector companies listed on the Indonesia Stock Exchange during the 2022–2024 period. The analysis involved Sustainability Reports, PROPER ratings, and online news coverage related to environmental issues. Indications of greenwashing were identified by comparing the level of environmental disclosure with PROPER ratings and information on environmental issues reported in online news during the study period.

The results show that three companies are indicated as engaging in greenwashing, namely Companies A, F, and N, while the other twelve companies are not indicated as doing so. The findings show that a high level of environmental disclosure does not necessarily indicate a low likelihood of greenwashing. Therefore, identifying greenwashing is not sufficient if based only on sustainability report information; environmental disclosure needs to be compared with PROPER ratings and online news coverage.

Theoretically, this study contributes to strengthening the use of legitimacy theory, particularly the concept of moral legitimacy, to explain indications of greenwashing. The findings show that environmental disclosure can form part of companies' efforts to build and maintain legitimacy, but high disclosure still needs to be assessed for consistency with information from external sources. Thus, the study demonstrates that legitimacy theory can be used to understand greenwashing indications through inconsistencies between environmental information communicated by companies and information developing outside the company.

Practically, this study provides implications for companies, regulators, and users of sustainability information. For companies, the findings highlight the importance of maintaining consistency and transparency in environmental information disclosed in sustainability reports. For regulators, the findings indicate the importance of considering multiple information sources when evaluating corporate environmental information. For investors and users of sustainability reports, the study indicates that environmental information should not be assessed solely based on disclosure levels or PROPER ratings but should also take relevant external information into account.

This study has several limitations. First, it includes only mining companies that met the sample criteria during 2022–2024, so the findings cannot yet represent conditions in other corporate sectors. Second, greenwashing identification relies only on environmental disclosure based on GRI 300, PROPER, and online news. GRI 300 disclosure indicates the completeness of information communicated by companies and therefore does not directly measure the quality or truthfulness of

environmental performance. Third, online news used as an external source depends on the availability and relevance of news identified during the study period. Fourth, the analysis and interpretation of consistency across sources may still involve researcher subjectivity.

Based on these limitations, future research is recommended to expand the research objects and study periods and to use additional indicators for identifying greenwashing, such as ESG performance, environmental certifications, or assessments by independent institutions. Future research may also use more diverse external information sources and involve more than one researcher in the coding process to reduce analytical subjectivity. For companies, the findings may be considered in efforts to improve the transparency and consistency of environmental information disclosure so that disclosed information not only demonstrates environmental commitment but also provides a more balanced picture of companies' environmental activities and environmental problems.

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