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Greenwashing: a systematic review of the literature on forms of identification and their determining factors

Greenwashing: una revisión sistemática de la literatura sobre las formas de identificación y sus determinantes

Greenwashing: uma revisão sistemática da literatura sobre formas de identificação e seus fatores determinantes

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KEYWORDS
Greenwashing.
ESG. Sustainability.

Abstract: Growing concerns about ethical, social and environmental issues encourage discussions on the ESG agenda. However, when not accompanied by regulation and inspection, it can lead to greenwashing, which refers to the difference between what companies say they do and what they do in fact. This research aims to investigate, through a systematic review, models of measurements and evaluations of the practice of greenwashing and the determining factors of companies likely to engage in greenwashing, available in the Spell, Science Direct, Web of Science and Scopus databases, in the temporal limitation until May 2023. 17 articles published in 13 journals were analyzed. In general, the contemporaneity of the articles was observed, considering that 88% of them were published in the last three years (2021, 2022 and the first five months of 2023), with predominance of Chinese research (39%). As a result, 8 greenwashing measurement models proposed in the evaluated articles were surveyed, with the model proposed by Yu et al. (2020) being the most used partially or fully. Regarding motivations and effects, the association between greenwashing and financial performance (28%) stands out, followed by the relationship between greenwashing and the political and regulatory context (17%). Finally, the increase in research published in recent years indicates the relevance and contemporaneity of the research topic for the academy, market and society. This research empirically contributes to the understanding and improvement of research on greenwashing, being a parameter for future works.

PALABRAS CLAVE
Greenwashing. ESG. Sostenibilidad.

Resumen: *Las crecientes preocupaciones sobre cuestiones éticas, sociales y ambientales fomentan las discusiones sobre la agenda ESG; sin embargo, cuando no van acompañadas de regulación e inspección, pueden conducir al lavado verde, que se refiere a la diferencia entre lo que las empresas dicen que hacen y lo que hacen de hecho. Este estudio tiene como objetivo investigar, a través de una revisión sistemática, modelos de medición y evaluación de la práctica de greenwashing y los factores determinantes de las empresas susceptibles de realizar greenwashing, disponibles en las bases de datos Spell, Science Direct, Web of Science y Scopus, en la limitación temporal hasta mayo de 2023. En total se analizaron 17 artículos publicados en 13 revistas. En general, se observó la contemporaneidad de los estudios, considerando que el 88% de los estudios fueron publicados en los últimos tres años (2021, 2022 y los primeros cinco meses de 2023), con predominio de los estudios chinos (39%). Como resultado de este estudio, se relevaron 8 modelos de medición de greenwashing propuestos en los estudios evaluados, siendo el modelo propuesto por Yu et al. (2020) el más utilizado de forma parcial o total. En cuanto a motivaciones y efectos, se destaca la asociación entre greenwashing y desempeño financiero (28%), seguida de la relación entre greenwashing y contexto político y regulatorio (17%). Finalmente, el incremento de estudios publicados en los últimos años indica la relevancia y contemporaneidad del tema de investigación para la academia, el mercado y la sociedad y el presente estudio contribuye empíricamente a la comprensión y mejora de los estudios sobre greenwashing, siendo un parámetro para futuros trabajos.*

PALAVRAS-CHAVE
Greenwashing. ESG. Sustentabilidade.

Resumo: *As crescentes preocupações com as questões éticas, sociais e ambientais incentivam as discussões da agenda ESG, porém, quando não acompanhada pela regulação e fiscalização, pode ensejar em greenwashing, que se refere à diferença entre o que as empresas dizem que fazem e o que fazem de fato. Este estudo objetiva investigar, por meio da revisão sistemática, modelos de medições e avaliações da prática de greenwashing e os fatores determinantes das empresas propensas a se envolverem com o greenwashing, disponíveis nas bases de dados Spell, Science Direct, Web of Science e Scopus, na limitação temporal até maio de 2023. Ao todo, foram analisados 17 artigos, publicados em 13 periódicos. De forma geral, observou-se a contemporaneidade dos estudos, considerando que 88% dos estudos foram publicados nos últimos três anos (2021, 2022 e os primeiros cinco meses de 2023), sendo predominantes os estudos chineses (39%). Como resultado desse estudo, tem-se o levantamento de 8 modelos de mensuração de greenwashing propostos nos estudos avaliados, sendo o modelo proposto por Yu et al. (2020) o mais utilizado parcial ou integralmente. Em relação às motivações e efeitos, destaca-se a associação do greenwashing com o desempenho financeiro (28%), seguido da relação do greenwashing com o contexto político e regulatório (17%). Por fim, o aumento de estudos publicados nos últimos anos indica a relevância e contemporaneidade do tema de pesquisa para a academia, mercado e sociedade e o presente estudo contribui empiricamente para a compreensão e aperfeiçoamento dos estudos sobre greenwashing, sendo um parâmetro para futuros trabalhos.*

Introduction

In recent decades, there has been a demand for investors to incorporate environmental, social, and governance (hereafter ESG) factors into their investment processes (Yu et al., 2020). These growing concerns about social and environmental issues have made corporate social responsibility the focus of the business community (Uyar et al., 2020), leading organizations to develop green marketing strategies to demonstrate their good corporate image and social responsibility to stakeholders (Zhang et al., 2018).

As of the growing discussion of the ESG agenda not being matched by regulatory developments, greenwashing arises (Bertão, 2022), a term that refers to the disparity between what companies claim to do and what they actually do (Yu et al., 2020; Lee & Raschke, 2023; Zhang, 2023a; Ruiz-Blanco et al., 2022).

Thus, this mismatch between company rhetoric and practice reinforces that intention is important and necessary, yet insufficient to ensure the effectiveness of actions (Hornos, 2022). In this context, Miller (2018) states that sustainability has become a watchword for commitment, with greenwashing as one of its main tools.

According to Castro et al. (2019), even though the term greenwashing has an environmental connotation, when considered in the context of corporate social responsibility, it can also refer to social, cultural, educational, ethical, or other actions that may suffer from potential ambiguous interests and commit the irregularities indicated, which are considered disharmonious with the construction of sustainability (Huang et al., 2022).

When researching the term greenwashing in the Scopus database, it is noted a significant increase in research about it over the past five years. Specifically, the years 2021, 2022, and the first five months of 2023 (i.e., until May) add up for 50% of the publications since 1996, highlighting that it is a contemporary and relevant topic. Recent work have assessed the scientific production on greenwashing, covering studies up to 2020, through bibliometric analysis (Costa, 2021; Costa et al., 2020; Torrente, 2020) and through systematic reviews focusing mainly on the analysis of greenwashing in multinationals in developing markets (Yang et al., 2020), the identification of different definitions of greenwashing and its forms (De Freitas Netto et al., 2020), and the investigation of stakeholders and how they can be affected by greenwashing actions (Santos et al., 2023).

Although the term greenwashing is widely discussed in the media, research on the determining factors and possibilities of detection are scarce and recent. Therefore, the aim of this research is to conduct a systematic literature review of scientific publication that has investigated the models for measuring and evaluating the practice of greenwashing and the determining factors for companies likely to engage in greenwashing. In this sense, specific questions guiding the research emerge.

1. How to detect and measure greenwashing?
2. What are the motivations and determinants for the practice of greenwashing?

The results aim to contribute empirically to the understanding and improvement of research on greenwashing, serving as a benchmark for future work. By exploring the findings, the research also benefits investment analysts, investors, and other stakeholders by highlighting possible means to detect greenwashing and the signals that may be emitted by companies more likely to engage in such practices, in addition to recognizing companies committed to environmental, social, and governance (ESG) factors. Moreover, the results of this investigation are particularly relevant given the importance and timeliness of the topic of greenwashing.

Theoretical elements of the research

The word greenwashing, derived from the English terms green—referring to the color associated with the environmental movement—and washing, meaning to cleanse, is known in Portuguese as "lavagem verde" or "maquiagem verde," in the sense of hiding or disguising something (Fialho & Marquesan, 2018). Bowen (2014) defines greenwashing as the misinformation disseminated by an organization to project an environmentally responsible image.

According to Junior et al. (2012), the term

whitewashing represents the act of painting a house with lime to superficially improve its appearance, as rain droplets can damage the paint. Similarly, the term greenwashing represents the superficial and ineffective appearance of good environmental conduct.

The term was coined in 1986 by Jay Westerveld to criticize hotels that encouraged guests to reuse towels for the sake of the environment but did nothing to recycle waste (Fialho & Marquesan, 2018). Although it is expected that companies implement sustainability activities more proactively, there may be a discrepancy between the expected activities and the actual ones, which increases the likelihood of greenwashing (Nishitani et al., 2021).

The authors Yu et al. (2020) identified motivations for the practice of greenwashing in literature and categorized them into three types. The first refers to the interest in manipulating disclosure to enhance the company's valuation, or what Brito et al. (2022) classifies as misleading rhetoric; the second type relates to selective disclosure aimed at deceiving investors; and finally, the third type concerns a product-level focus intended to influence consumers (Yu et al., 2020). Additionally, other types of greenwashing include empty green claims and policies to impress stakeholders without consistency and continuity of actions, as well as lies and a lack of evidence for claims, distorting reality without legitimacy (Brito et al., 2022).

Greenwashing has been classified at the company level (the focus of the present research) and at the product or service level, by Delmas and Burbano (2011), with the former referring to the act of deceiving consumers regarding an organization's environmental practices and the latter concerning the environmental benefits of a product or service. In this regard, the Canadian agency TerraChoice established a classification of greenwashing at the product level, known as the seven sins of greenwashing, which are: i) hidden environmental costs; ii) lack of proof; iii) uncertainty or ambiguity; iv) false labels; v) irrelevance; vi) the lesser of two evils; and vii) deception or falsification (De Freitas Netto et al., 2020; Costa et al., 2020; Santos et al., 2023).

Due to the subjective nature of perceptions, identifying true greenwashing is a challenge for stakeholders (Ruiz-Blanco et al., 2022), as symbolic corporate environmentalism is deeply embedded in the institutional field and can be shaped by a range of actors or by their interactions (Bowen, 2014).

For Huang et al. (2022), from the perspective of impression management, greenwashing can be considered as companies aim to meet legal requirements, seeking legitimacy rather than greater efficiency. In this sense, companies are increasingly using advertising strategies solely for the purpose of enhancing the corporate image (Fialho & Marquesan, 2018). In addition to legitimization and positive reputation, Zhang (2022a) points out that the practice of greenwashing may be motivated by financial pressures and constraints.

In this regard, there are various justifications for the practice of greenwashing by companies, specifically due to economic-financial criteria, the context in which the company operates, social or regulatory pressures, internal motivations related to advertising, among others.

Methodological elements of the research

A systematic literature review is a method for identifying, analyzing, and interpreting research related to a phenomenon or research question through a systematic process that involves several activities, which can be grouped into three phases: planning, execution, and reporting (Kitchenham & Charters, 2007).

According to Kitchenham and Charters (2007), the first planning stage involves defining the objectives, research questions, keywords, research sources, selection criteria, and criteria for data analysis. The second stage of execution involves searching for articles by identifying and selecting research based on the keywords, selecting research based on inclusion and exclusion criteria, data extraction, and data analysis. Finally, the reporting stage refers to documenting the analyses conducted.

The guidelines proposed by Kitchenham and Charters (2007) for the systematic review of national and international scientific literature were adopted as means to evaluate the research

conducted on greenwashing, which propose methods for the detection and assessment of greenwashing and identify characteristics of companies likely to engage in greenwashing.

The method used for the research was constructed according to the PICOS strategy (Population, Intervention, Comparison, Outcome, and Study), as described in Table 1:

Table 1
PICOS Research Question Framework

Investigated Criteria	Description of the criteria
P - Population	Empirical research on greenwashing.
I - Intervention	Articles that propose methods for detecting and assessing the risk of greenwashing and identify characteristics of companies likely to engage in greenwashing.
C - Comparison	Not applicable.
O - Outcome	Evaluate how the topic of greenwashing is being studied in the literature and what relationships have been detected.
S - Study	Empirical studies.

Research questions, databases and keywords

The objective of this systematic review is to identify methods for detecting and assessing the risk of greenwashing and the characteristics of companies likely to engage in greenwashing. Thus, it aims to answer the research questions described in Table 2.

Table 2
Research questions

Research questions		Description
Q1	How to detect and measure greenwashing?	The objective of this question is to identify the measurement and detection models of the practice of greenwashing by companies.
Q2	What are the motivations and determinants for the practice of greenwashing?	The objective of this question is to identify the main reasons and determining factors that lead companies to engage in greenwashing.

The search was conducted carefully in two stages to mitigate biases and the exclusion of relevant articles, with the first occurring in October and November 2022 and the second between February and May 2023. The search was carried out systematically in the databases Spell, Science Direct, Web of Science, and Scopus, aiming to find published scientific articles on greenwashing related to the research questions.

It was used predefined keywords according to the research questions. The search strategy was tailored to each platform, utilizing the keywords: Greenwashing; *Lavagem Verde*; and *Maquiagem Verde*. Additionally, combinations of the word Greenwashing were searched with: ESG; *Risco*; Risk; Investor; *Investidor*; Cost of Debt; *Custo da Dívida*; Cost of Capital; *Custo de Capital*; Audit; *Auditoria*; Measurement; *Mensuração*; Determinants; *Determinantes*; Sustainability; *Sustentabilidade*; Environmental; *Ambiental*; Social; Governance; *Governança*; Disclosure; *Divulgação*; Rating; Market Value; *Valor de Mercado*; Performance; *Desempenho*; Stakeholders; *Partes Interessadas*; Report; *Relatório*; Integrated Report; *Relato Integrado*; Sustainability Report; *Relatório de Sustentabilidade*; Investment; *Investimento*; Asset Manager; *Gestor de Ativos*; Funds; *Fundos*; Actions; *Ações*; Corruption; e *Corrupção*.

Selection criteria

At this stage, it was necessary to evaluate and classify the data according to the inclusion and exclusion criteria described in Table 3.

Table 3
Selection criteria

Inclusion criteria	
1	Articles that contain defined keywords.
2	Articles published in any year up to May 2023.
3	Articles published in journals.
4	Articles published in Portuguese and English.
5	Articles related to research questions.
Exclusion criteria	
1	Duplicate articles
2	Articles not fully available in the freely accessible databases of the Federal University of Uberlândia.
3	Articles that do not relate to research questions.

Data extraction

For data extraction, a spreadsheet was created in Excel containing fields to record and classify the

data according to the objectives described in Table 4.

Table 4
Data extraction form

Data	Objective
Title, Authors, Year, Country	Overview of the article.
Journals	Overview of the article.
Objectives, Hypotheses, Conclusion	To answer question 2.
Research Technique, Data Source for Greenwashing, and Greenwashing Measurement Model	To answer question 1.

Presentation and discussion of results

This section describes the results, providing an overview and discussions of the responses to each research question separately. The selection process resulted in a total of 17 articles that met the inclusion and exclusion criteria.

Overview

Initially, 826 documents were identified, 626 found in the Scopus database and the others in Science Direct (169), Spell (17), and Web of Science (14).

Through the evaluation of titles and abstracts that met the inclusion criteria presented in Table 3, 98 of them were selected. Subsequently, an analysis of the introduction, methodological procedures, and conclusions was conducted, followed by the application of the exclusion criteria, as indicated in Table 3, resulting in 34. Later, a critical analysis of the selected articles was performed through a complete reading of the articles, which resulted in 17 eligible articles for the systematic review, as shown in Figure 1.

The 17 articles were classified according to their year of publication. As shown in Figure 2, the contemporaneity of the research was identified, as 88% of the articles were published in the last three years (2021, 2022, and the first five months of 2023).

Figure 1
Article selection process

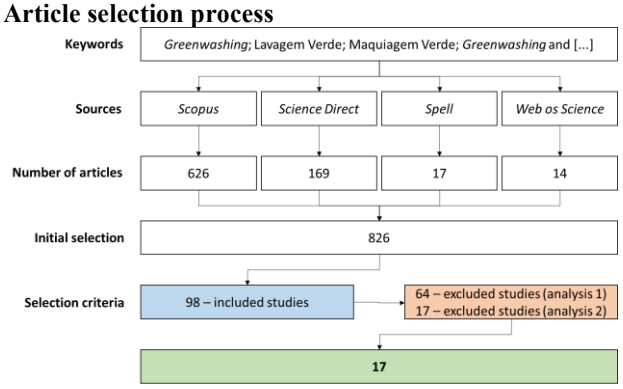
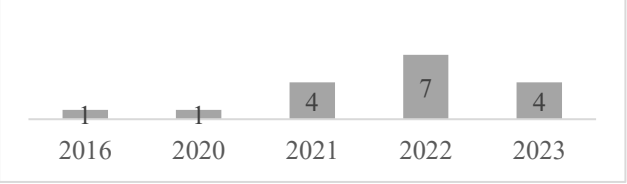
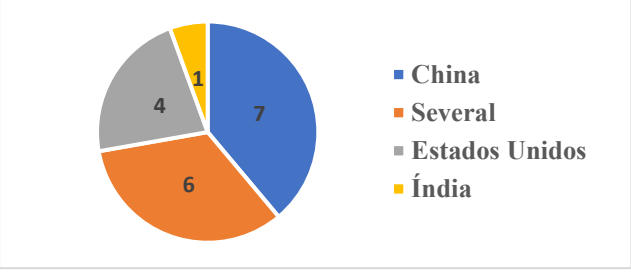


Figure 2
Articles by year of publication



Regarding the geographical distribution of the works, according to Figure 3, Chinese research is predominant, with 7 out of the 17 articles (39%). This is followed by global research with 6 articles (33%), North American with 4 articles (22%), and 1 article (6%) conducted in India.

Figure 3
Number of eligible articles by country of study focus



Regarding the journals in which the articles were published, 13 journals were identified (Table 5), with 76% of their articles being classified as having the maximum Qualis stratification of A1 in the four-year period from 2017 to 2020 for the areas of Public and Business Administration, Accounting Sciences, and Tourism – ACT, and 24% are not included in the classification.

Table 5
Eligible articles by Qualis and by journal

Qualis	Journal	Quantity	Citations
A1	*Energy Economics*	4	Zhang (2022a); Zhang (2022b); Zhang (2023a); Zhang (2023b)
	Journal of Business Research	2	Gatti et al. (2021); Lee e Raschke (2023)
	Finance Research Letters	1	Arouri et al. (2021)
	Journal of Cleaner Production	1	Mateo-Márquez et al. (2022)
	Environment, Development and Sustainability	1	Ruiz-Blanco et al. (2022)
	International Review of Financial Analysis	1	Zhang (2022c)
	Journal of Financial Economics	1	Flammer (2021)
	Organization Science	1	Marquis et al. (2012)
	Research in International Business and Finance	1	Yu et al.(2020)
Without Qualis	*Australasian Accounting, Business and Finance Journal*	1	Sensharma et al. (2022)
	Chinese Journal of Population, Resources and Environment	1	Huang et al. (2022)
	Journal of International Financial Management & Accounting	1	Zhang (2022d)
	Pacific-Basin Finance Journal	1	Hu et al. (2023)

Research questions

Following the selection criteria, the eligible works were evaluated based on their adherence to the research questions shown in Table 6. Subsequently, the questions will be answered in bullet points.

Table 6
Addressing the questions through article

Article	Q1	Q2
Marquis et al. (2012)	Yes	Yes
Yu et al. (2020)	Yes	Yes
Arouri et al. (2021)	Yes	Yes
Flammer (2021)		Yes
Gatti et al. (2021)		
Ruiz-Blanco et al. (2022)	Yes	Yes
Huang et al. (2022)	Yes	Yes
Mateo-Márquez et al. (2022)	Yes	Yes
Sensharma et al. (2022)	Yes	Yes
Zhang (2022a)	Yes	Yes
Zhang (2022b)	Yes	
Zhang (2022c)	Yes	
Zhang (2022d)	Yes	Yes
Hu et al. (2023)	Yes	Yes
Lee e Raschke (2023)	Yes	Yes
Zhang (2023a)	Yes	Yes
Zhang (2023b)	Yes	Yes

How to detect and measure greenwashing?

The objective of this question is to identify the measurement and detection models of the greenwashing practice by companies. In this context, six models were identified.

Marquis et al. (2012) examined selective disclosure (a type of greenwashing) in a multinational context, seeking to identify the organizational and institutional circumstances in which companies are less likely to engage in such selective disclosure. The research considered a panel dataset of 4,750 public companies across various sectors headquartered in 45 countries during the period from 2004 to 2007. The sample was determined based on the coverage of Trucost

Plc., an organization that calculates the environmental impacts of companies' operations, supply chains, and investment portfolios.

In this regard, the authors measured the magnitude of selective disclosure, which refers to the transmission of accurate, yet selective information to create a misleading impression of transparency at the expense of information that accurately represents their environmental harms. The measurement considers the difference between the absolute disclosure rate and the weighted disclosure rate, both indices developed by Trucost. The absolute disclosure index is the proportion of relevant environmental indicators disclosed publicly in annual reports and the corporate website, regardless of their relative relevance, while the weighted disclosure index shows how much of the most important information has been disclosed and incorporates the environmental impact associated with each environmental indicator (Marquis et al., 2012; Arouri et al., 2021)

Following the model proposed by Marquis et al. (2012) to measure greenwashing, Arouri et al. (2021) empirically studied how companies' greenwashing practices are associated with the intensity of the product market (PMC), and for this purpose, the authors evaluated 324 American companies during the period from 2005 to 2015.

The research by Yu et al. (2020) aimed to study mechanisms to reduce companies' greenwashing behavior with a holistic view of the three ESG dimensions. For this purpose, the authors created relative ESG greenwashing scores for peers, comparing their relative position to the Bloomberg ESG disclosure score (a measure of the amount of disclosure) with the Asset4 ESG score (a measure of ESG performance). The authors had a sample of 1,925 large-cap companies from the MSCI All Country World Index, after excluding companies based in tax havens and financial companies, based in 47 countries and territories during the period from 2012 to 2016.

To measure a company's ESG disclosure, the Bloomberg ESG disclosure score was used, which starts at 0.1 for companies that disclose a minimal amount of ESG data and can go up to 100 for those that disclose information on all ESG data points collected by Bloomberg. The higher the Bloomberg ESG disclosure score, the more non-financial information is disclosed. To measure companies' performance in the ESG dimensions, the scores from the three pillars of Asset4 were established, which range from 0 to 100, where higher values represent better performance (Yu et al., 2020).

However, to obtain a meaningful comparison between the disclosure score and the performance scores, the authors performed a weighting on the scores by converting both scores into proportions by dividing by 100. They then subtracted the mean and divided by the standard deviation to normalize. A company's relative peer greenwashing score is the difference between its normalized ESG disclosure score and its ESG performance score. In this sense, a company's relative peer greenwashing score is the result of the subtraction between a normalized measure of the Bloomberg ESG disclosure score and a normalized measure of the Asset4 ESG performance score. The greenwashing score will be positive in cases where the relative ESG disclosure position compared to its peers is better than the ESG performance score (Yu et al., 2020).

This greenwashing measurement model has been used by several researchers (Zhang, 2022a; Zhang, 2022b; Zhang, 2022c; Zhang, 2022d; Sensharma et al., 2022) and adapted by others (Zhang, 2023a; Zhang, 2023b; Hu et al., 2023). Regarding these articles, Zhang (2023a) aimed to investigate the mechanisms that motivate companies to engage in greenwashing when government subsidies come to an end, either due to reaching their expiration date or when subsidy payments are halted by the government. Meanwhile, Zhang (2023b) aimed to investigate the relationship between green financing, ESG performance, and the risk of greenwashing. For the calculation of greenwashing in both articles, the author followed the model proposed by Yu et al. (2020) but used a divergent performance database. The ESG disclosure score was extracted from the Bloomberg ESG database, and the performance score was obtained from the Sino-Securities Index Information Service (Huazheng Database). Hu et al. (2023), on the other hand, analyzed how classification disagreement impacts corporate greenwashing behavior in Chinese companies from 2015 to 2020, using Bloomberg's environmental

rating for the disclosure score and Wind's environmental rating for the performance score

Ruiz-Blanco et al. (2022) investigated the 100 largest publicly listed companies in the U.S. included in the Bloomberg database for the year 2016, with the aim of identifying characteristics that make companies more or less prone to greenwashing. The greenwashing score is a measure that includes environmental and social issues and is calculated as the difference between the average environmental and social disclosures, considered as a component of discourse, and the average standardized Bloomberg environmental and social scores, considered as a component of action. The disclosed discourse was measured through content analysis of sustainability disclosures in sustainability reports and annual reports, with linguistic sentences structured using the "RapidMiner" tool. Then, the words were identified based on target-concept sentences. The disclosed discourse on Corporate Social Responsibility was measured by the ratio of the total number of weighted sentences to the total number of sentences in the report, with a standardized value ranging from 0 to 1. This weight score assigned weight 1 to less precise discourse (text), weight 2 to a more precise measure (quantitative), and weight 3 to discourse with monetary values. The action component is represented by the Bloomberg ESG score, excluding governance scores (Ruiz-Blanco et al., 2022).

For Huang et al. (2022), the corporate greenwashing strategy can involve selective disclosure, meaning choosing what to report, and expressive manipulation, where the discourse is not accompanied by action. The disclosure of environmental information was assessed through content analysis, scoring 1 for relevant information and 0 for irrelevant information. The level of greenwashing is calculated by the geometric mean of the levels of selective disclosure and expressive manipulation. Selective disclosure is measured by the ratio of disclosed emissions to the emissions that should be disclosed, and expressive manipulation is calculated by the symbolically disclosed emissions divided by the number of disclosed emissions. The authors analyzed the isomorphic mechanism of corporate greenwashing based on institutional theory and conducted an empirical test using data from 318 Chinese companies listed in highly polluting sectors during the period from 2010 to 2016. In this regard, isomorphic pressure was measured by the average value of the greenwashing levels of the three leading companies in an industry or region in terms of assets and the average value of the greenwashing levels of companies in that industry or region.

Mateo-Márquez et al. (2022) analyzed the relationship between climate change regulations and effective international compliance regarding engagement in greenwashing. To this end, the authors examined data from companies listed in the 2015 Carbon Disclosure Project (CDP) report, a tool used for carbon disclosure. Companies from 12 different countries were selected, including Australia, Canada, France, Germany, India, Italy, Japan, South Africa, South Korea, Turkey, the United Kingdom, and the United States of America, belonging to 9 different sectors.

The measurement of greenwashing proposed by the authors considers the CDP 2015 score and the carbon intensity index. The CDP 2015 score presents companies that report positive communication regarding their performance, considering a score above 94 points, which is the median of the sampled companies. The carbon intensity index classifies companies as having good or poor environmental performance and is calculated by dividing the total Scope 1 GHG emissions of the companies by their total revenues (in thousands of U.S. dollars). The authors tabulated the index by quartiles to compare it with the average of their sector quartile. Greenwashing is equal to 1 when a company has a CDP disclosure score above 94 points and its carbon intensity lies in quartiles 3 or 4, depending on its sector; conversely, the greenwashing variable equals zero when the company falls within quartiles 1 and 2, indicating that the company is one of the least carbon-intensive in its sector and has a CDP disclosure above 94 points (Mateo-Márquez et al., 2022).

Lee and Raschke (2023) examined ESG conduct, ESG performance, and the financial performance of companies, relating them to greenwashing by assessing 39 companies from the automotive, technology, and food and beverage

sectors. The measure of greenwashing was calculated by the frequency of the words E, S, and G through text analysis in several rounds. The weights of the companies' communications were used to calculate the weighted average of the ESG score by the text analysis weights with the scores ranked by Refinitiv. The level of greenwashing (positive or negative proportion) was measured by dividing the weighted average ESG score by the standardized Refinitiv weighted ESG score (minus 1), with greenwashing being the positive proportions.

To summarize the types of measurement found, Table 7 presents the six methods of measuring greenwashing identified in the literature.

Table 7
Methods of measuring greenwashing

	Model proposed by	Data	Model used by
1	Marquis et al. (2012)	Absolute disclosure index – Trucost, Relative disclosure index – Trucost	Marquis et al. (2012); Arouri et al. (2021)
2	Yu et al. (2020)	ESG disclosure – Bloomberg ESG performance – Thomson Reuters	Yu et al. (2020); Zhang (2022a); Zhang (2022b); Zhang (2022c); Zhang (2022d); Sensharma et al. (2022)
		ESG disclosure – Bloomberg ESG performance – Huazheng	Zhang (2023a); Zhang (2023b)
		ESG disclosure – Bloomberg ESG performance – Wind	Hu et al. (2023)
3	Ruiz-Blanco et al. (2022)	Sustainability Reports and Annual Reports (content analysis)	Ruiz-Blanco et al. (2022)
4	Huang et al. (2022)	Sustainability Reports and Annual Reports (content analysis)	Huang et al. (2022)
5	Mateo-Márquez et al. (2022)	Carbon Disclosure Project (CDP) Carbon emissions – Datastream	Mateo-Márquez et al. (2022)
6	Lee e Raschke (2023)	Sustainability Reports and Annual Reports (text analysis)	Lee and Raschke (2023)

What are the motivations and determinants for the practice of greenwashing?

The objective of this question is to identify the main reasons or determining factors for the adoption of greenwashing practices. To this end, the findings were categorized into 8 (eight) groups, as shown in Table 8 at the end of this section.

The association between greenwashing and the financial performance of companies has been investigated by several researchers analyzing financial constraints, bankruptcy risk, profitability, financial leverage, and financial management. In this regard, researchers (Zhang, 2022a; Zhang, 2022c; Zhang, 2022d; Hu et al., 2023; Zhang, 2023a; Zhang, 2023b) have convergently identified that financial constraints motivate companies to engage in greenwashing. Conversely, according to Lee and Raschke (2023), greenwashing does not significantly affect the company's financial performance. Zhang (2022a; 2022d; 2023a) pointed out that financial constraints can be alleviated with green financing, reducing the greenwashing behavior of companies (Zhang, 2023b).

Corroborating the previous research, Hu et al. (2023) identified that the estimates of classification disagreement in the environmental dimension are greater in companies with financial constraints, mitigating greenwashing. Additionally, Zhang (2022d) identified that greenwashing is more prevalent in companies facing financial pressures due to being highly leveraged, both in the short and long term, and that financial constraints can be alleviated through good financial intermediation, including cash flow efficiency, working capital management, and trade credit, asserting that the financial environment is a determinant of greenwashing behavior.

According to Zhang (2023a), companies at

risk of bankruptcy that lose government subsidies are more motivated to engage in greenwashing, also because of reduced investments combined with increased costs of green innovation when there is a risk of bankruptcy. Furthermore, the motivation to engage in greenwashing at the end of the subsidy only exists in highly polluting companies. This research demonstrates the relationship between greenwashing and the political and regulatory context in which companies operate. Thus, Zhang (2022b) points out that companies involved in greenwashing that receive government subsidies do not promote environmental innovations.

In this regard, with respect to regulation and oversight, the greater the rigor and enforcement, the lower the risk of greenwashing (Marquis et al., 2012; Yu et al., 2020; Mateo-Márquez et al., 2022). Furthermore, companies located in countries with low levels of corruption may provide more openness to relevant stakeholders (Yu et al., 2020) and are more exposed to scrutiny and global standards, reducing the propensity to engage in selective disclosure or greenwashing (Marquis et al., 2012; Yu et al., 2020).

Mateo-Márquez et al. (2022), in analyzing the relationship between regulatory pressures related to climate change and companies' engagement in greenwashing, found that the volume and rigor of climate-related regulations influence negatively the propensity of companies to engage in greenwashing.

Regarding green finance guidelines, in highly polluting companies, their implementation facilitates greenwashing, reducing sustainable efficiency. Additionally, the author identified that these regulations affect highly polluting private companies (Zhang, 2022a). In contrast, Zhang (2023b), while exploring green financing as a driver of sustainable growth, identified that green innovation is driven by green financing, reducing the level of greenwashing.

According to Zhang (2022c), highly polluting companies that exhibit greenwashing and face financial constraints generate negative effects on environmental regulations and green innovations, noting that limiting greenwashing restricts the effectiveness of environmental regulations on green innovation. Furthermore, companies in environmentally sensitive or highly polluting sectors engage in less greenwashing due to being more exposed to scrutiny and regulations (Marquis et al., 2012; Ruiz-Blanco et al., 2022; Zhang, 2023b). Flammer (2021) indicates that companies achieve higher environmental ratings through corporate green bonds, which serve as a reliable signal regarding companies' commitment to the environment and do not represent a tool for greenwashing. On the other hand, environmental rating disagreement confuses the market, and its impact on greenwashing is greater and more significant in highly polluting companies (Hu et al., 2023).

Regarding governance factors, companies with a higher level of oversight from investors and greater transparency are less likely to engage in greenwashing (Yu et al., 2020; Sensharma et al., 2022; Hu et al., 2023). Yu et al. (2020) identified that the risk of greenwashing can be mitigated by increasing the number of independent directors, increasing institutional investors, and enhancing public influence through a less corrupt country system and the status of cross-listing. Additionally, Sensharma et al. (2022) point out that market capitalization significantly influences companies' greenwashing behavior, suggesting that the greater the market capitalization, the lower the propensity for involvement in greenwashing. Furthermore, a company's presence in any Indian ESG fund has the potential to mitigate greenwashing behavior even more significantly.

Hu et al. (2023), in investigating how environmental rating disagreement impacts greenwashing behavior, found that companies with higher-paid executives, lower financial constraints, and more independent directors mitigate environmental rating disagreement and the practice of greenwashing, considering the robustness for internal oversight. Similarly, Ruiz-Blanco et al. (2022), in studying the characteristics that make companies less or more prone to greenwashing, found that companies that issue and assure sustainability reports and those that follow the Global Reporting Initiative (GRI) guidelines are less likely to engage in greenwashing, demonstrating that the greater the governance, transparency, and reliability, the lower the propensity for greenwashing.

Huang et al. (2022), in analyzing the isomorphic mechanism of corporate greenwashing based on institutional theory, identified that isomorphism significantly occurs in greenwashing behavior and exists as a form of legitimacy, strengthening these companies' capacity for risk-taking. The legitimacy of stakeholders positively affects ESG performance and negatively affects greenwashing, meaning that companies with low ESG performance are more likely to engage in greenwashing. Financial performance is impacted by ESG performance; however, it does not experience significant effects from the practice of greenwashing (Lee & Raschke, 2023).

Gatti et al. (2021) investigated how forms of greenwashing fraud can affect investor intentions, considering individual persons or small private investors, and conclude that poor environmental performance and bad behaviors are detrimental to attracting investors; that is, the actions of stakeholders can prevent companies from engaging in greenwashing.

Arouri et al. (2021) point to product market competition (PMC) as a disciplinary mechanism that negatively impacts greenwashing, depending on the level of environmental costs. Moreover, the companies that are more harmful to the environment exhibit more significant disclosure when faced with higher PMC.

Finally, to support and summarize the analysis, the articles were categorized by research focus, highlighting that the association of greenwashing with financial performance was the most studied (28%), followed by the relationship between greenwashing and the political and regulatory context (17%), governance aspects (14%), green financing and bonds (14%), and environmentally sensitive sectors (14%). All research objectives are presented in Table 8.

Table 8
Articles by research objectives

Research objectives	%	Article
Financial performance	28%	Sensharma et al. (2022); Zhang (2022a); Zhang (2022c); Zhang (2022d); Hu et al. (2023); Lee and Raschke (2023); Zhang (2023a); Zhang (2023b)
Political and regulatory context	17%	Marquis et al. (2012); Yu et al. (2020); Mateo-Márquez et al. (2022); Zhang (2022b); Zhang (2023a)
Governance	14%	Yu et al. (2020); Ruiz-Blanco et al. (2022); Sensharma et al. (2022); Hu et al. (2023)
Environmentally sensitive sector	14%	Ruiz-Blanco et al. (2022); Zhang (2022a); Zhang (2022c); Hu et al. (2023)
Green financing and bonds	14%	Gatti et al. (2021); Flammer (2021); Hu et al. (2023); Zhang (2023b)
Environmental performance and rating	7%	Hu et al. (2023); Lee and Raschke (2023)
Isomorphism	3%	Huang et al. (2022)
Product market	3%	Arouri et al. (2021)

Final considerations

This article presented a systematic literature review of research up to May 2023 that identified the measurement and assessment models of greenwashing practices and the determining factors for companies more likely to engage in greenwashing. To this end, 17 articles published in 13 journals were analyzed.

In general, the contemporaneity of the research was observed, considering that 88% of the articles were published in the years 2021, 2022, and the first five months of 2023, with Chinese research being predominant (39%), followed by global (33%). Additionally, research published in 13 journals were selected, with most appearing in A1-ranked journals (76%) and the remainder not classified.

The eligible articles were selected in accordance with the selection criteria and evaluated based on their adherence to the research questions, with 88% of the articles addressing question 1 on how to detect and measure greenwashing, and 82% answering question 2 regarding the motivations

and determinants for the practice of greenwashing.

Regarding question 1, 7 (seven) models for measuring greenwashing were identified, with particular emphasis on the model proposed by Yu et al. (2020), which was used partially or entirely by 9 of the 15 articles that presented measurements of greenwashing. Regarding question 2, according to the categorization by research focus, the association of greenwashing with financial performance was the most studied (28%), followed by the relationship between greenwashing and the political and regulatory context (17%), governance aspects (14%), green financing and bonds (14%), and environmentally sensitive sectors (14%).

The increase in published articles in recent years indicates the relevance and contemporaneity of the research topic for academia, the market, and society, and the present research demonstrates the nascent nature of the research in the Brazilian context.

As this is scientific research, the present research demonstrates some limitations. These include: the limitation of databases for searching research; the selection of scientific articles available in full in the freely accessible databases at UFU; despite the concern to include all possible keywords for searching the articles for analysis, it is possible that some terms related to greenwashing were overlooked. However, the limitations can be considered opportunities for new research.

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