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Determining greenwashing in global ESG research: A bibliometric analysis of themes, trends, and regional focus

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ABSTRACT

This study aims to explore global research trends on greenwashing in the context of ESG practices using a bibliometric approach. By examining co-occurrence of keywords and the geographical origin of publications, this research identifies how greenwashing is conceptualized and studied across regions. The analysis uses data from the Scopus database, comprising 1,642 documents across all years, and utilizes VOSviewer to map keyword relations and country distributions. The findings reveal that frequently occurring terms are closely related to corporate ethics, transparency, and sustainability claims, indicating the growing academic concern around deceptive environmental practices. The results also show that most research originates from developed economies such as the United States, China, the United Kingdom, and Germany, reflecting the influence of strict regulatory frameworks and advanced ESG standards. However, emerging countries like India, Malaysia, and Indonesia are also gaining visibility in the field, suggesting an increasing awareness of environmental accountability. Furthermore, the uneven global distribution of studies highlights a lack of harmonized approaches in identifying greenwashing, especially in regions with less regulatory oversight. This study contributes by (1) integrating fragmented theoretical perspectives into a coherent analytical framework, (2) identifying regional and institutional research disparities, and (3) proposing a structured future research agenda and policy implications for ESG regulation and sustainability assurance. The study is limited to Scopus-indexed publications and does not assess empirical firm-level outcomes. Practical implications highlight the need for harmonized ESG standards, mandatory assurance, and the use of digital technologies to mitigate greenwashing.

Introduction

Climate change, a significant global challenge, engenders considerable environmental, social, and economic repercussions, thus amplifying the imperative for sustainable approaches among governmental agencies, corporate organizations, and financial institutions. As a result, sustainability has emerged as a central concern within policy guidelines and corporate governance models, with Environmental, Social, and Governance (ESG) principles being actively promoted to align corporate activities with sustainability goals.

As greenwashing becomes more common, countries mandating Environmental, Social, and Governance (ESG) reporting for businesses have grown. This legislative change seeks to increase openness, guarantee responsibility, and rebuild stakeholder confidence in claims on corporate sustainability. Mandatory ESG disclosure rules have been instituted in Indonesia, Malaysia, the European Union, the UK, and the US. While the UK has developed new legislation mandating corporations to provide thorough ESG data, Indonesia has mandated the Financial Sectors Institution and all publicly companies to published the ESG Reporting gradually since 2019, by 2024 all of these business have to published the ESG Reporting. Malaysia has obliged all publicly traded companies to engage in ESG reporting since 2016. Final guidelines needing thorough disclosure of climate-related risks and possibilities are expected to be adopted by the US Securities and Exchange Commission (Harvard, 2023; The Times, 2024).

The difficulties caused by greenwashing have driven a rise in required ESG reporting. Standardized reporting systems force businesses to present verifiable, equivalent ESG data, therefore lowering the possibility of

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unethical behavior. With regulatory agencies equipped to penalize non-compliance or false information, mandatory disclosures let businesses answer for their ESG claims. Reliable ESG data helps investors to make wise decisions and builds faith in businesses dedicated to sustainable development. The worldwide trend toward required ESG reporting shows a deliberate attempt to counter greenwashing and advance real corporate sustainability.

Greenwashing is a deceptive marketing strategy where companies present themselves as environmentally friendly while engaging in unsustainable or unethical practices. This tactic manipulates consumer perceptions by exaggerating sustainability claims, often through unverifiable certifications (Bu et al., 2024; Bennett, 2024). The concept has expanded to include "ESG-washing," where firms inflate their Environmental, Social, and Governance (ESG) metrics without implementing substantial operational changes. Such practices breach corporate ethics by misaligning stated values with actual behaviors, undermining stakeholder trust and the integrity of genuine sustainability efforts (Todaro & Torelli, 2024; Li et al., 2024).

While the adoption of Environmental, Social, and Governance (ESG) principles encourages ethical business practices, it has also resulted in companies favoring symbolic adherence rather than substantive operational modifications, thereby facilitating greenwashing. This misleading behavior deceives both investors and consumers, misrepresenting sustainability data and diminishing confidence in genuine sustainability initiatives. Greenwashing poses a threat to the efficacy of ESG frameworks and market efficiency, inadvertently rewarding companies with subpar performance. Furthermore, companies implicated in greenwashing face substantial repercussions, including reputational damage, legal consequences, and declining stock valuations, thereby highlighting its status as a governance challenge with considerable economic and societal consequences.

The growth of research in the field of ESG and greenwashing is significant and has become a global issue. Scopus has documented that a search for "ESG" and "greenwashing" yielded more than 1,600 journal articles. Since the issue is becoming more important, it is necessary to explore the extent of ESG and greenwashing research nowadays, what the most common ideas related to ESG and greenwashing are, which countries are paying more attention to the greenwashing issues and find the new gaps for future study opportunities. Existing bibliometric studies regarding ESG focused on greenwashing as a minor issue or a subset of marketing and disclosure studies (Ahuja et al., 2024; Dwibedi et al., 2024; Mahat et al., 2025), extensively focus on ESG as a broadly concept with firm level analysis (Senadheera et al., 2022; Zhao et al., 2025; Hazaea et al., 2024; Nguyễn, 2025; Kiflee et al, 2024). Previous bibliometric on ESG and greenwashing studies used theory in a fragmented way, and have the contribution is to map the references (Souza et al., 2024; Chytis et al., 2024). Meanwhile current study is the first comprehensive bibliometric analysis specifically on greenwashing in ESG context, that put the greenwashing within ESG as a core object, focusing on ESG as a global-system level, using theory as integrated point of view, and have contribution as analytical and policy oriented. Addresses a critical dark side of ESG that has been overlooked in bibliometric literature

Utilizing a comprehensive dataset of 1,642 Scopus-indexed publications, novelty of this study is focus on greenwashing as a systemic governance challenge arising from the institutionalization of ESG reporting. By integrating multiple theoretical lenses and linking bibliometric patterns with regulatory maturity and geographical disparities, this study advances existing literature from descriptive mapping toward analytical and policy-relevant insights. In doing so, it offers a novel perspective on how mandatory ESG regimes may simultaneously promote transparency and incentivize symbolic compliance. Therefore, it is important to analyze the global research trends on greenwashing in ESG, and to identify the keywords, authors and regional contributions. The study is expected to contribute on, firstly, providing the trends in greenwashing-related ESG research over recent years. Secondly, identify the demography of authors and institutions in this research domain. Thirdly, to describing the themes and terms are most frequently associated with greenwashing in ESG. Finally, what gaps in across regions and countries regarding the greenwashing and ESG. thereby identifying emerging research directions and policy implications for sustainable corporate practices. To guide the bibliometric analysis, this study addresses the following research questions:

Literature Review

Grand theory of ESG and Greenwashing researches

Research on the evolution of ESG and the emergence of greenwashing has elucidated several grand theories. Among more than 1,600 journals in Scopus, the grand theories used as underlining theories in the most research are the legitimacy theory, which was mentioned in 29 articles; the institutional theory, which was mentioned in 19 articles; the stakeholder theory in 13 articles; the attribution theory in 10 articles; the signalling theory in 13 articles; game theory in 5 articles; the agency theory in 4 articles; and the cognitive theory, which was mentioned in 3 articles.

Legitimacy theory is used to explain how organizations align their operations and public perceptions with societal expectations. Companies often engage in greenwashing to maintain or enhance legitimacy, especially when discrepancies exist between their ESG commitments and actual activities. The board of directors plays a crucial role

in shaping these strategies. Oil companies use legitimacy theory to project sustainability, even if underlying practices remain unchanged (Berredo et al., 2024).

Institutional theory investigates how organizational behavior is influenced by outside forces like industry standards, social, and regulatory ones. Bernini et al. (2024) contend that businesses may use symbolic ESG strategies to satisfy outside needs without major transformation. Li et al. (2024) investigate how blockchain technology might help to reduce greenwashing in supply chains, contending that companies in highly regulated areas embrace open technologies to keep credibility.

Stakeholder theory underlines the need of striking a balance between corporate objectives and stakeholder needs. ESG ratings affect how stakeholders view and make decisions, which drives businesses to use greenwashing to meet environmental needs. Particularly when openness and real ESG performance are expected, this approach is frequently employed to control competing expectations (Peng et al., 2024).

Attribution theory is used to examine how stakeholders perceive and attribute responsibility for greenwashing practices and how transparency tools can mitigate this issues. Li et al. (2024) pointed on how blockchain technology can enable supply chain traceability and attribution of responsibility. Attribution theory helps to understand how, upon greenwashing exposure, stakeholders blame companies. Transparency technologies like blockchain, according to the writers, lessen the possibility of greenwashing by making it more difficult for businesses to market their operations as such.

The signaling theory examines how companies convey their sustainability initiatives to consumers. This theory is used to determine whether greenwashing delivers false signals, thereby preventing green consumption. Xiang et al. (2024), Zhao et al. (2025) and Shen and Shen (2019) contend that the trustworthiness of the signals determines how effective sustainability claims are; greenwashing erodes customer behavior toward truly sustainable items and trust.

Model interactions between companies in the green finance market are modeled using game theory in relation to regulators. Guo et al. (2024), Pinheiro et al. (2023), Karaman et al. (2021) emphasizes how in conditions of asymmetric knowledge businesses and legislators make strategic decisions. Game theory shows how fines and incentives could motivate companies to follow real green policies and discourage greenwashing (He et al., 2020; Chen et al., 2023).

In the framework of ESG reporting and greenwashing, agency theory helps to clarify tensions between managers and investors. Mao et al (2024), Velte (2023) looks at how differences in ESG ratings could motivate managers to practice earnings management, therefore stressing the need of corporate governance in matching managerial actions with shareholder interests to reduce opportunistic behavior (Pinheiro et al., 2023; Cordeiro & Sarkis, 2007).

Employee perceptions of greenwashing and how this affects their working behavior are investigated using cognitive theory. According to Ma et al. (2024), greenwashing influences workers' cognitive assessments of the ethical standards of the company, therefore lowering their drive to participate in environmentally friendly actions. The results highlight the psychological consequences of distortions of business sustainability (Xiang et al., 2024).

As previously discussed, the various theoretical perspectives—legitimacy, institutional, stakeholder, signaling, and agency theories—offer mutually reinforcing frameworks for understanding greenwashing. Legitimacy and institutional theories elucidate the symbolic adherence of firms to ESG standards, while signaling and stakeholder theories illuminate the impact of these actions on market perceptions. Agency theory draws attention to governance deficiencies that facilitate greenwashing, and cognitive theory accounts for the behavioral ramifications for both employees and consumers. This synthesis of theories emphasizes that greenwashing transcends a simple communication breakdown, representing instead a complex issue of governance and accountability.

Research Method

Research Design

This study adopts a bibliometric analysis to explore trends and collaborations in research on Environmental, Social, and Governance (ESG) and greenwashing. By using this approach, the study aims to map the development of these fields, identify thematic areas, and highlight influential contributors and collaborations.

Database Selection (Scopus)

To gather comprehensive and high-quality data, Scopus was selected as the primary database. Scopus is widely recognized for its extensive collection of peer-reviewed publications and bibliometric data. A total of 1,642 journal articles published between 1996 and 2024 were included in the analysis, ensuring a broad and representative dataset.

Search Strings

The bibliometric data were obtained from the Scopus database through an exhaustive search technique aimed at identifying all pertinent papers on ESG and greenwashing. The search strings were utilized on article titles, abstracts, and keywords to ensure comprehensive coverage of pertinent study terminology. The ultimate search query employed was:

TITLE-ABS-KEY ("greenwashing" AND "ESG" AND "sustainability")

This query was designed to encompass articles that address both conceptual and empirical dimensions of greenwashing in the contexts of ESG and sustainability reporting. No limitations were placed on topic areas to facilitate multidisciplinary engagement in accounting, finance, management, and environmental studies. The search, undertaken in early 2024, yielded a total of 1,642 journal articles published from 1996 to 2024.

Inclusion/exclusion criteria

The Scopus query yielded 2,350 entries. Following the elimination of 238 duplicates, 2,112 records were evaluated based on titles and abstracts, resulting in 320 exclusions for evident out-of-scope subjects. We evaluated 1,792 complete records for eligibility and removed 150 items (86 non-article kinds, 24 non-English, and 40 deemed out-of-scope upon thorough review). The final dataset consisted of 1,642 peer-reviewed journal articles, which were exported for bibliometric analysis as shown in Figure 1.

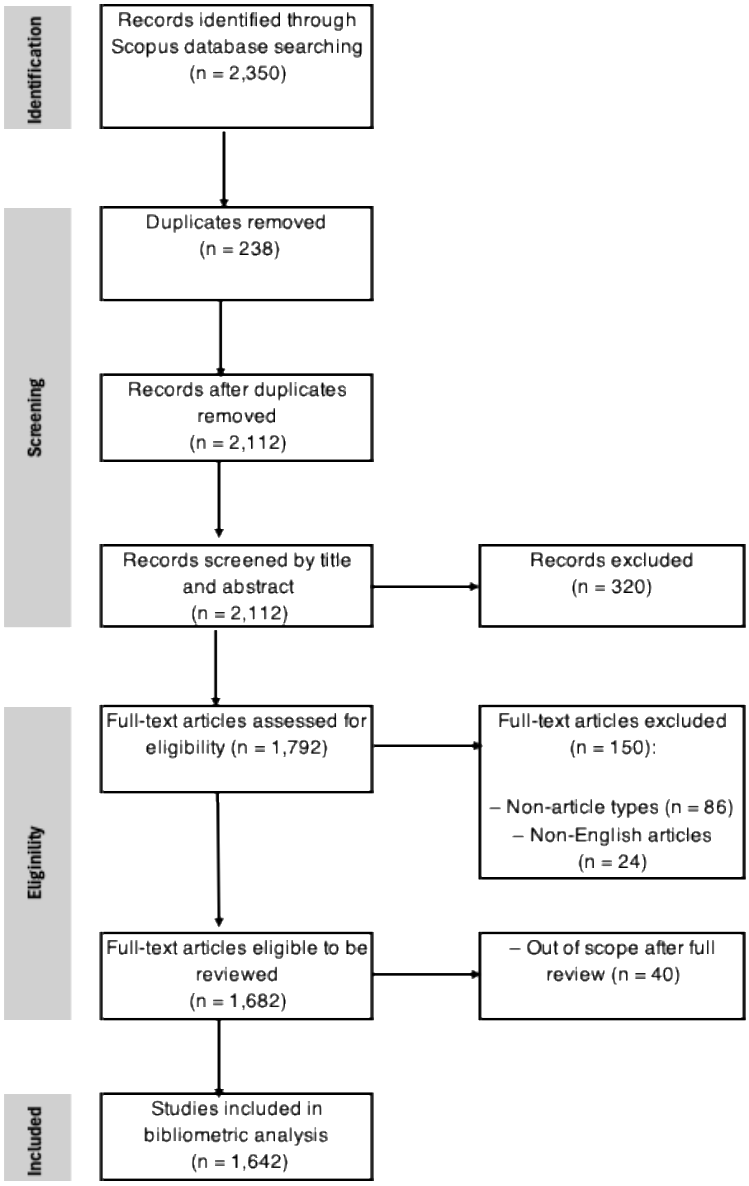

Figure 1. PRISMA Flow Diagram of Literature Selection Process

Data Validation and Tools (VOSviewer)

The analysis was conducted using VOSviewer, a widely used software tool for visualizing bibliometric networks. VOSviewer was employed to map keyword co-occurrences, visualize research density, and identify collaborative networks, providing a clear understanding of research trends. The bibliometric analysis was validated through several steps to ensure its reliability and replicability. These steps included keyword sensitivity checks, threshold robustness tests, outlier verification, descriptive cross-checks, and a reproducibility audit. The search combinations were tested to capture relevant publications without excessive noise, and the inclusion of terms like "decoupling," "CSR greenwash," "ESG disclosure," and "green marketing" produced minimal variation in total records. The VOSviewer analyses were repeated using different minimum thresholds for keyword co-occurrence and author collaboration links, confirming the stability of the main clusters. Outlier verification was done to determine if articles and keywords appearing only once represented genuine emerging topics or noise. Descriptive cross-checks were performed to confirm consistency of author names, institutional affiliations, and publication years. Finally, a reproducibility audit was conducted to ensure data transparency. These steps collectively confirm that the bibliometric mappings and thematic clusters accurately reflect the underlying literature structure and are not sensitive to minor parameter or keyword adjustments.

Data Analysis

The data analysis is based on keyword co-accurence, which is the identification process of terms frequently appearing together to reveal dominant research themes. The analysis is continued by identification of author networks, such as mapping collaborations to highlight key researchers and institutions. The last analysis steps is the thematic clusters, by grouping related studies to understand the major areas of focus and their connections.

Results and Discussion

Publication Trends

The first analysis is among 1,642 articles which published start in 1996 until 2024 and the trend is as follow:

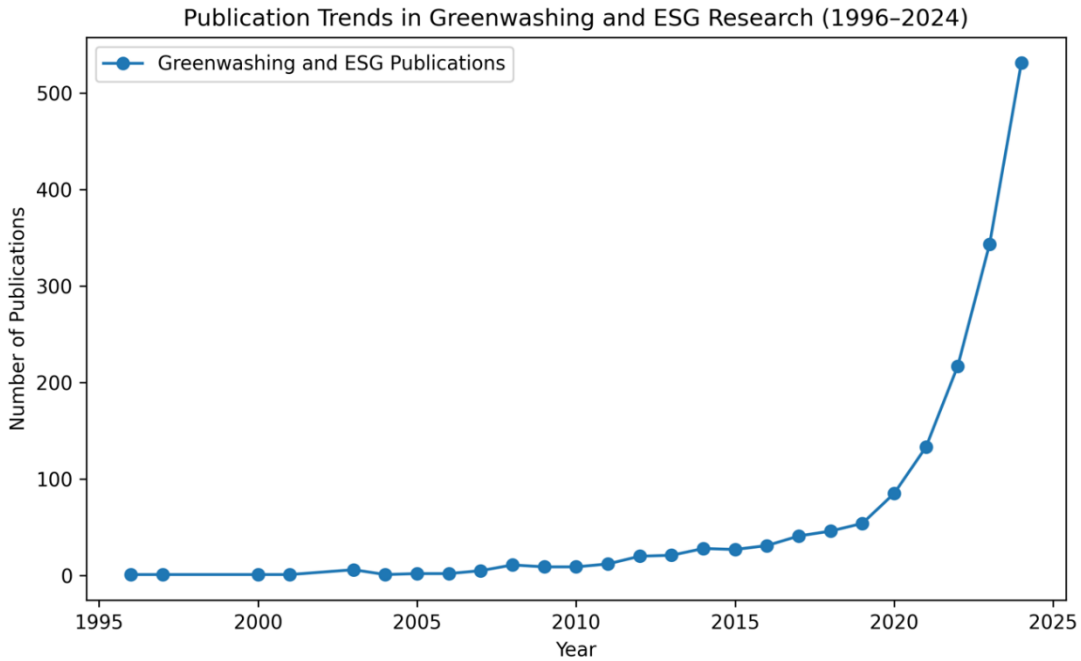

Figure 2. Publication Trends of Greenwashing and ESG Studies 1996-2024

Figure 2. reflecting the growing worldwide attention on sustainability and corporate responsibility, the publishing patterns in greenwashing and ESG studies from 1996 to 2024 show an obvious upward trajectory. From the figure, we can say that in the early period, that is from 1996 untill 2010, even though yearly contributions were intermittent, the total number of articles stayed modest. The study emphasis was still developing, and ideas of ESG and greenwashing were quite understudied. The trend shows steady growth starting 2011 untill 2018, which is on 2011, a slow rise in publications started in line with growing knowledge of corporate sustainability and the necessity of open ESG policies. Plastun et al. (2020) highlight that the last decade has seen significant advancements in regulatory disclosure tools focused on ESG criteria and SDGs. Over 300 of these instruments, both governmental

and non-governmental, mandatory and voluntary, have been introduced across the 50 largest economies in the world, encompassing both developed and developing nations. It acknowledges that 50 largest economies shows significant regulatory attention to the formation of national ESG disclosure regulations according to SDGs. Continue to rise up along with the mandatory of ESG publication in many countries globally. Basic studies that prepared the ground for later investigation emerged during this time. Beginning in 2019, the volume of articles surged significantly under the influence of rising regulatory attention, corporate ESG pledges, and public knowledge of greenwashing techniques. Publications surged considerably by 2023, mirroring the worldwide focus on business ethics and sustainability. The 2023 saw the most research done, indicating maximum intellectual curiosity. Though statistics for 2024 could still be lacking, the drop in numbers could point to continuous publishing cycles or indexing delays. Research on these subjects shows an exponential increase generally, and major contributions help to shape the debate on sustainability and governance.

Author Collaboration

Based on the data, the study continues to analyze author collaboration networks and identify influential authors and institutions. From centrality score, the top 5 authors that are identified as influential authors are:

1. Nagy L.B.; Nayga R.M., Jr.; Temesi Á.
2. Keitel S.S.; Öner M., Dr
3. Abudu H.; Wesseh P.K., Jr.; Lin B.
4. Marchant G.E.; Cooper Z.; Gough-Stone P.J., VI
5. Correa C.M.; De Camargo Ferraz MacHado J.G.; Braga S.S., Jr.

The degree centrality was computed, indicating the ratio of an author's direct partnerships to the total potential linkages within the network. If an author possesses a centrality score of 0.1, they are directly linked to 10% of the total authors inside the network. This score identifies prominent individuals in the field who engage in extensive collaboration and may be deemed significant in directing research trajectories. Please inform me if you like to investigate alternative forms of centrality or more profound interpretations.

The analysis from the authors' affiliation or institutions and the number of collaboration as follow:

Table 1. The Top 10 Affiliation or Institutions and Number of Collaboration in ESG and Greenwashing Research

Institution	Collaboration Count
Department of Accounting and Finance, The University of Auckland, Auckland, New Zealand	4
School of Economics and Management, China University of Mining and Technology, Xuzhou, China	4
School of Economics, Capital University & Economics and Business, China	4
School of Economics and Management, China University of Geosciences, Wuhan, China	4
School of Economics, Capital University of Economics and Business, 121 Zhangjialukou, Huaxiang Fengtai District, Beijing, 100070, China	3
School of Business, International University, Ho Chi Minh City, Vietnam	3
University of Vienna, Vienna, Austria	3
Business School, Hunan University, Changsha, 410082, China	3
Uppsala University, Uppsala, Sweden	3
University of California San Diego, La Jolla, CA, United States	2

Table 1 above indicates that the list of institutions' contributions to research on ESG and greenwashing is represented by a number, which means their frequency of involvement. This number indicates the number of publications authored by affiliated researchers and the institution's collaboration with other institutions on the included publications.

The list reflects international participation, with contributions from institutions in New Zealand, China, Vietnam, Sweden, Austria, and the United States. It highlights the multinational collaboration in ESG and greenwashing research, showing its global importance. Table 1 also indicate the most active institutions, which is institutions like the University of Auckland, China University of Mining and Technology, and Capital University of Economics and Business are relatively active contributors with 4 publications each. Meanwhile, Universities such as the University of Vienna and Uppsala University are also notable with 3 publications. In terms of relative institutions, the institutions with higher counts of publications are likely to have a more substantial influence in the research domain, either through producing significant studies or through collaboration.

Keyword Analysis

Based on VOSViewer result, the top combined keywords from the dataset, highlighting their frequencies in research on greenwashing and ESG. The Figure 2 and Figure 3shows the dominant keywords as follow:

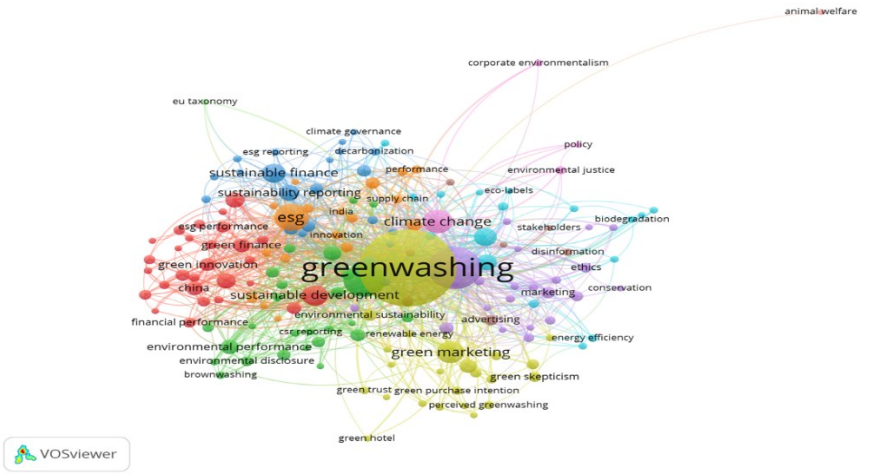

Figure 3. VOSViewer Result Based on Keywords

From Figure 4, the keywords reflect dominant themes such as "greenwashing," "ESG," and "sustainable development", it suggest that the ESG research is most likely correlated with greenwashing and sustainable development issues. Furthermore, the study also reveals that from the frequencies of keywords used by the authors, as follow:

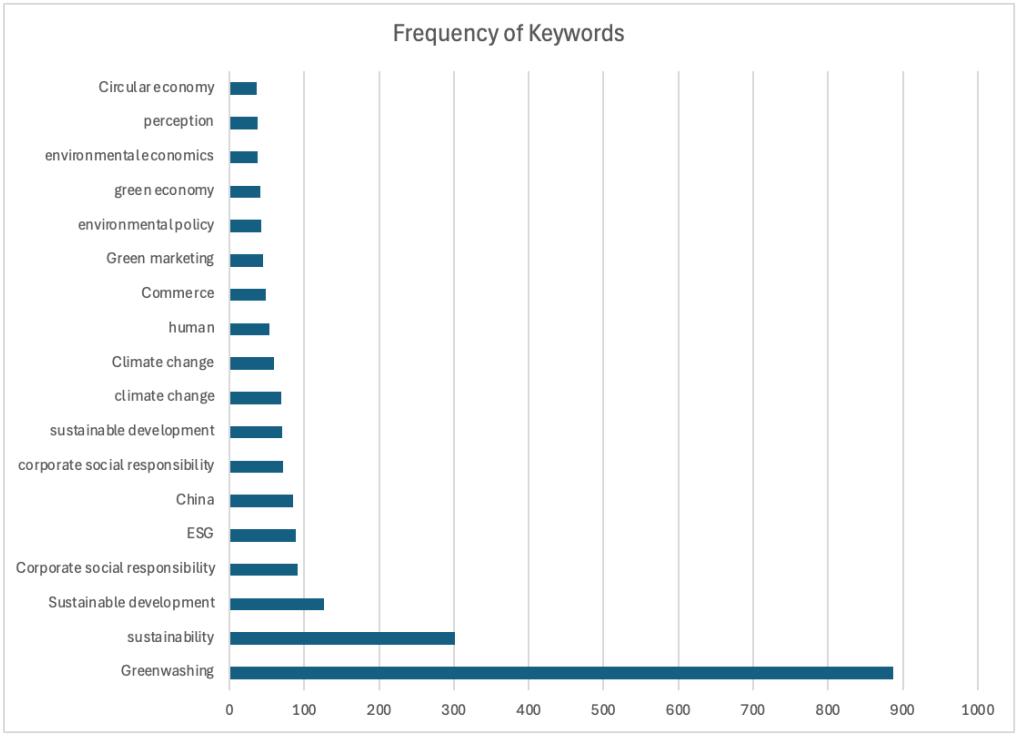

Figure 4. Chart of Keywords Frequencies of ESG and Greenwashing Scopus Article Journals

A Figure 4 shows the frequently discussed keyword in sustainability research, greenwashing reflects its essential relevance in the subject. Second most often used keyword is sustainability, which strongly relates to debates on social and environmental responsibility. Often noted as also emphasizing ethical business practices and long-term environmental plans are Corporate Social Responsibility (CSR) and Sustainable Development. Emerging issues include ESG (Environmental, Social, and Governance) as a paradigm for handling responsibility and sustainability in business environments. Greenwashing studies are related to climate change, implying convergence of studies on corporate accountability and global environmental issues. Emerging themes are the circular economy

and green economy, which highlight substitute economic models meant to challenge unsustainable practices. China's importance in environmental challenges, manufacturing, and sustainability legislation points to a high regional concentration. Often connected to greenwashing techniques, green marketing emphasizes how businesses present their efforts at sustainability.

The predominance of Greenwashing, Sustainability, and CSR indicates that most of the studies center on comprehending business conduct, responsibility, and ethics. Climate-related words, economic models, and green marketing point to an interdisciplinary approach connecting environmental science, business ethics, and economic frameworks. Emerging terms like Circular Economy point to a move toward investigating structural changes in corporate operations.

ESG Research on Regional Focus

The study analyses the distribution of 1,642 Scopus article journals from key regions, or the countries of authors' origins. Figure 4 shows the result as follow:

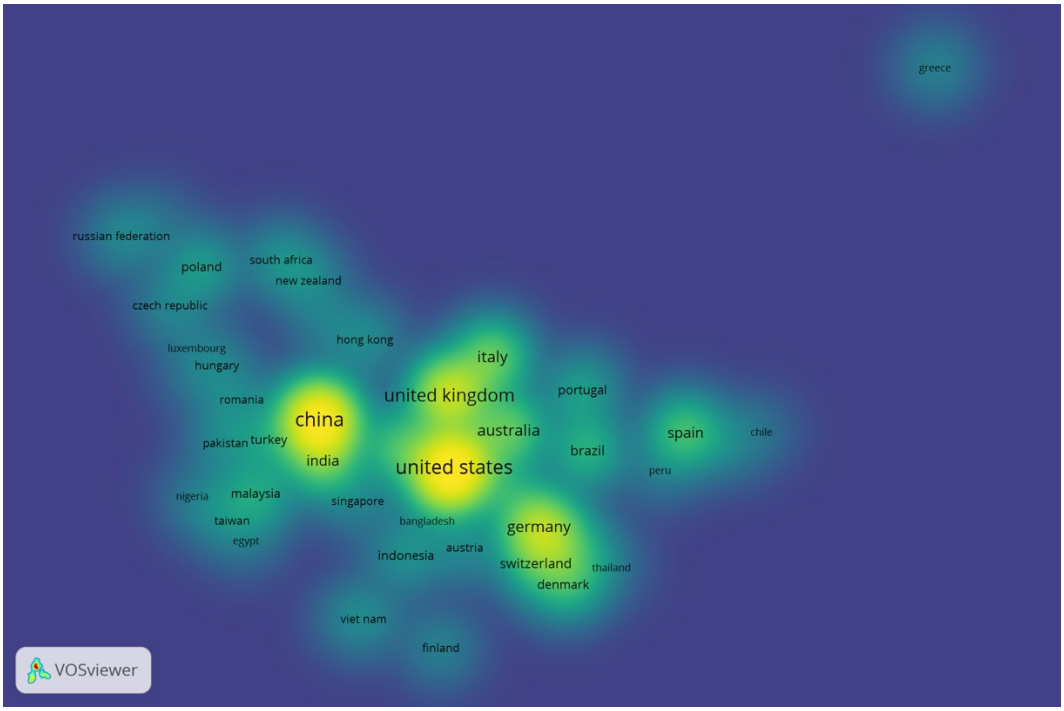

Figure 5. The ESG and Greenwashing Scopus Article Journals Based on Countries

Figure 5 shows the likely produced from a bibliometric network analysis using VOSviewer, heatmap visualizes geographical collaborations and research activity in greenwashing and ESG issues. The most notable areas (bright yellow areas) showing they are essential to research activities and partnerships in ESG and greenwashing are United States, United Kingdom, China, and Germany. Their great publicity reflects such as a great volume of books published and active involvement in international projects. Figure 4 reveals that countries such India, Australia, and Italy are rather active in this field—that is, in the lighter yellow/green sections. These areas might be increasingly important for research environment. Meanwhile, countries with lower research activity or less cooperation show up in the periphery of the network: Greece, Poland, South Africa. Though not major players, their existence points to involvement in ESG and greenwashing niche markets.

The Figure 5 also indicates the clusters of cooperation, which is the heat map highlights areas cooperating, China and India are closely linked, suggesting major cooperation probably resulting from regional ESG concerns and policies in similarity. Germany, Switzerland, Denmark, and other European nations exhibit great cooperation to create a coherent research hub. Acting as global centers, United States and United Kingdom link to many other areas. With representation on continents spanning Europe, Asia, North America, and rising contributions from Africa and South America, the map emphasizes the worldwide character of ESG and greenwashing research.

Exponentially Growing Trends on Publication

The publication trend exhibits an exponential trajectory that reflects the global institutionalization of sustainability regulation. The initial decade (1996–2010) has irregular publication trends, indicating the conceptual formation of greenwashing as a marketing and ethical issue rather than a governance matter. From 2011 to 2018, a consistent

acceleration transpired, corresponding with the implementation of global reporting frameworks, such the Global Reporting Initiative (GRI Standards 2016) and the EU Non-Financial Reporting Directive.

The significant increase from 2019 onwards corresponds with regulatory enforcement in both established and emerging markets, such as Malaysia's Bursa ESG disclosure in 2016 and Indonesia's OJK Regulation No. 51/2017. This indicates that scholarly focus is influenced by the spread of regulations and requirements for corporate transparency. The temporary decrease in 2024 may stem from indexing delays rather than diminished academic interest. The trend demonstrates that ESG reporting and greenwashing have transitioned from marginal to central study topics as corporate sustainability evolves into a mandated requirement rather than a voluntary initiative.

Addressing the Global Disparities in ESG Research

The United States leads in greenwashing and ESG research globally, driven by corporate responsibility systems, investor interest in sustainable finance, and academic organizations focused on sustainability issues. The UK, with its strong ESG disclosure rules and commitment to climate action, is a key focus for studies on greenwashing detection and ESG incorporation into company governance. China's rapid industrialization has led to a focus on ESG standard implementation in an economy experiencing high growth, addressing supply chains and company operations. Germany, with its robust regulatory systems and emphasis on renewable energy and corporate responsibility, leads in Europe and acts as the center of European Union cooperative research.

Emerging markets like Africa, South America, and Southeast Asia are marginal contributors to greenwashing research, dealing with special ESG issues such as inadequate environmental policy application and concerns in rapidly expanding industries like mining, textiles, and agriculture. Regional comparisons in cooperation are limited, with dominant players like the US, UK, and China being well-linked. Peripheral contributors like Greece, South Africa, and Brazil may struggle with institutional capability and research funding.

The bibliometric analysis reveals a significant concentration of research activity in developed countries, including the United States, the United Kingdom, China, and Germany. This finding aligns with these nations' robust regulatory environments, mature markets, and widespread investor interest in ESG disclosures. For instance, the United States' emphasis on corporate sustainability through investor-driven mechanisms has catalyzed substantial scholarly and practical focus. Similarly, Europe's stringent ESG disclosure mandates, exemplified by regulations such as the EU Taxonomy, have fostered a fertile environment for greenwashing detection studies.

However, the relative scarcity of research from emerging markets like Africa, South America, and Southeast Asia highlights a critical gap. While countries like Indonesia and Malaysia are increasingly implementing mandatory ESG frameworks, the academic contributions from these regions remain limited. This imbalance may stem from institutional capacity constraints, funding disparities, or lower prioritization of academic research in sustainability. Targeted capacity-building initiatives and cross-regional collaborations could help bridge this divide.

Based on the VOSviewer analysis, the most prominent countries in research on greenwashing and ESG reporting are China, the United States, the United Kingdom, and Germany. These countries represent developed markets characterized by mature economic systems and advanced regulatory frameworks. From a legal perspective, these nations follow distinct legal traditions—China adheres to a civil law system influenced by socialist principles, while the United States operates under a common law system. The United Kingdom also utilizes a common law framework, whereas Germany adopts a civil law system rooted in Roman law traditions. Despite these differences, all four countries demonstrate a shared characteristic in implementing mandatory ESG reporting regulations, utilizing both incentives and penalties ("carrot and stick" approaches) to ensure corporate compliance. This shared regulatory emphasis suggests that greenwashing behaviors may arise as a consequence of stringent legal requirements and the growing societal demand for transparency (Delmas & Burbano, 2011; Lyon & Montgomery, 2015).

It is believed that this participation of countries is in line with the awareness on the importance of poverty reduction, gender equality, and universal education for the well-being and health of humanity. Additionally, sustainable economic growth, urban development, infrastructure improvement, and environmental preservation are critical to safeguarding countries' resources. Singhania and Saini (2022) in their study has identified Norway, Sweden, Denmark, Finland, the United Kingdom, Belgium, and France as having high ESG scores, classifying them as Countries with Well-Developed ESG Frameworks. Germany, Italy, the USA, Australia, Switzerland, Canada, Japan, Brazil, and South Africa have medium to high ESG scores and are categorized as Countries with Rapidly Improving ESG Frameworks. In contrast, Singapore, India, China, the Philippines, Malaysia, and Argentina are classified as having an ESG Framework at the Developing Stage. Lastly, Russia, Indonesia, Thailand, Nigeria, and Vietnam are categorized as Countries with Early-Stage Frameworks due to their low ESG scores. In addition, the recent emergence of ESG issues has led to a new form of greenwashing that extends beyond the environmental sphere to include social and governance concerns as well. Todaro and Torelli (2024) highlight that the recent

emergence of ESG issues has led to a new form of greenwashing that extends beyond the environmental sphere to include social and governance concerns as well.

The maturity of investors and broader societal perspectives in these markets has shifted away from purely financial performance metrics toward a more holistic understanding of corporate success, incorporating environmental, social, and governance (ESG) dimensions. This reflects the growing relevance of the triple bottom line concept, where financial, social, and environmental performance are equally valued. Such dynamics further emphasize the need for robust enforcement mechanisms and investor vigilance to mitigate greenwashing and ensure genuine corporate accountability in sustainability practices (Marquis & Toffel, 2012; Parguel et al., 2011; Siano et al., 2017; Testa et al., 2018; Walker & Wan, 2012).

Collaboration networks indicate that writers from OECD nations predominate the intellectual framework of ESG and greenwashing research. The prominence of universities such as the University of Auckland and Capital University of Economics and Business signifies a synthesis of Western methodological precision and Asian data-centric strategies.

The centrality rankings suggest that these authors function as "knowledge brokers," linking subfields including environmental economics, sustainable finance, and corporate reporting. Such cross-regional collaborations enhance theoretical development by integrating legitimacy, signaling, and stakeholder theories under the ESG framework. The comparatively marginal roles of writers from emerging markets indicate the possibility for enhancing South–South collaborative networks. Establishing co-authorship connections between ASEAN and EU institutions may expedite methodological transfer and comparative studies pertinent to policy.

Geographical mapping reveals that global research is predominantly concentrated in the United States, the United Kingdom, China, and Germany, which collectively possess robust regulatory frameworks and developed financial markets. The supremacy of the US and UK is indicative of entrenched traditions of corporate accountability, propelled by vigorous investor involvement and disclosure requirements. Concurrently, China's swift ascent signifies an increasing convergence between national sustainability strategies and scholarly research.

The restricted involvement from Africa, South America, and Southeast Asia highlights the institutional disparity in research capabilities and financial resources. The increasing prominence of ASEAN nations, particularly Malaysia and Indonesia, indicates a rising academic interest in their developing ESG disclosure rules. This geographic disparity indicates that next bibliometric and comparative studies ought to investigate how local legal origins, governance frameworks, and cultural influences affect the nature and reliability of ESG disclosures. Enhancing research collaboration via regional networks like ASEAN+3 or APEC may promote equitable global knowledge generation.

Implications of Thematic Trends in Greenwashing Research

This analysis underscores the expansive opportunities for future research in this area, particularly in fostering interdisciplinary studies. Collaborative efforts among fields like environmental sciences, business ethics, corporate governance, and marketing can yield deeper insights into the mechanisms of greenwashing and its implications for achieving authentic sustainability. Such an approach also provides a pathway to address the practical challenges posed by greenwashing, contributing to policy development and organizational practices that enhance the credibility of ESG reporting. To address this gap, multidisciplinary and cross-regional research can be conducted through cooperative networks, emerging markets as research centers, and policy and regulation focus. Comparative research between developed nations and emerging markets can highlight best practices and guide international norms.

The keyword co-occurrence analysis delineates three principal clusters: (1) Disclosure and Governance, comprising “ESG,” “reporting,” and “legitimacy”; (2) Market and Behavior, revolving around “green marketing,” “consumer trust,” and “signaling”; and (3) Climate and Transition, concentrating on “climate change,” “taxonomy,” and “sustainable finance.”

This clustering pattern indicates a transition from communication-focused studies to accountability-oriented research. The conjunction of "ESG" and "greenwashing" suggests that experts increasingly view the two as interconnected phenomena—one signifying transparency, the other its perversion. The increasing prevalence of terminology such as “blockchain” and “circular economy” indicates a nascent study domain that incorporates digital traceability into anti-greenwashing strategies. These findings suggest a prospective research trajectory centered on technical validation, sustainability verification, and regulatory harmonization.

The keyword analysis conducted using VOSviewer reveals significant interconnectedness between research on greenwashing and broader ESG reporting themes. Keywords such as "climate change," "sustainable development," "green marketing," "sustainable finance," and "sustainability reporting" emerge as prominent clusters, highlighting the multidisciplinary nature of greenwashing research.

Greenwashing is positioned as a critical, negative behavioral aspect of ESG reporting. This not only situates it within the domain of accounting and corporate governance studies but also bridges connections to disciplines

such as marketing, finance, and environmental science. For instance, the interplay between green marketing and greenwashing underscores its relevance in consumer behavior studies, while its ties to sustainable finance reflect implications for investment and financial performance research.

The prominence of terms like "green marketing" and "sustainability reporting" underscores the role of corporate communication in shaping consumer and stakeholder perceptions. This aligns with studies by Seele and Gatti (2017) and Siano et al. (2017), which argue that greenwashing's impact extends beyond regulatory concerns to influence consumer trust and brand equity. The integration of signaling theory into marketing strategies, as highlighted in this research, provides an avenue for firms to authentically engage with sustainability.

Policy and Regulatory Implications

This study's findings emphasize the need for more standardized frameworks to detect and mitigate greenwashing. Current practices rely heavily on voluntary disclosures and third-party certifications, which are often susceptible to manipulation. Policymakers could benefit from leveraging technologies like blockchain, as explored by Li et al. (2024), to enhance transparency and traceability in supply chains.

Additionally, the variations in ESG reporting requirements across regions underscore the necessity for harmonized global standards. For example, while the EU employs strict disclosure mandates with enforcement mechanisms, many emerging markets lack robust compliance systems. Collaborative international efforts, such as those driven by the United Nations or the Global Reporting Initiative (GRI), could facilitate knowledge exchange and standard-setting across borders.

Bibliometric research indicates that regulatory pressure and the institutionalization of ESG reporting are the primary factors driving both scientific and practical focus on greenwashing. Countries with established governance frameworks and compulsory disclosure regulations—such as the United States, the United Kingdom, Germany, and the European Union—predominate the research domain. This concentration illustrates a beneficial cycle: regulatory enforcement generates disclosure data, which subsequently promotes empirical study, facilitating additional policy enhancement.

Conversely, emerging markets—despite becoming more dynamic—encounter institutional deficiencies that hinder the efficacy of ESG adoption. Inadequate monitoring capabilities, disjointed reporting structures, and insufficient assurance methods frequently enable superficial compliance and narrative-driven sustainability assertions to endure. The literature clusters discovered in this study, specifically for "ESG disclosure," "assurance," and "green marketing," suggest that regulatory architecture significantly influences the mitigation or facilitation of greenwashing behavior.

1. Enhancing Regulatory Consistency

   The variability in ESG disclosure mandates between jurisdictions poses issues for comparison and enforcement. The findings indicate that the subsequent stage of policy formulation ought to emphasize regulatory coherence—specifically, the harmonization of national ESG disclosure regulations with international frameworks like the IFRS Sustainability Standards (ISSB S1 & S2) and the EU Corporate Sustainability Reporting Directive (CSRD). Harmonization would mitigate informational asymmetry and discourage firms from engaging in "forum shopping" for more lenient jurisdictions.

   Countries such as Indonesia and Malaysia can bolster global credibility by aligning domestic legislation, such as OJK Regulation No. 51/2017 and Bursa Malaysia's Sustainability Framework, with international standards while preserving contextual relevance. Regional harmonization within ASEAN or APEC could enhance accountability through the implementation of mutual recognition of ESG assurance standards.

2. Augmenting Enforcement and Assurance Mechanisms

   Regulation devoid of enforcement risks becoming merely symbolic. The results indicate that greenwashing flourishes in contexts where assurance procedures are either voluntary or inadequately institutionalized. Policymakers should consequently advocate for obligatory sustainability assurance to authenticate ESG assertions, akin to financial audits. This may entail:

   a. Certifying independent ESG assurance entities;
   b. Mandating the disclosure of the assurance scope and methodology; and
   c. Implementing sanctions for deceptive or unaudited ESG disclosures.

   Such procedures would convert ESG reporting from a promotional narrative into a verifiable component of corporate governance, aligned with the values of transparency and investor protection.

3. Utilizing Technology for Transparency

   Innovative technology instruments—especially blockchain and AI-driven content verification—provide novel methods for identifying discrepancies between corporate assertions and real behaviors. Blockchain facilitates unalterable audit trails throughout supply chains, minimizing opportunities for selective disclosure. AI-powered

textual analysis can identify exaggerations or inconsistencies across various reporting mediums (annual reports, sustainability reports, websites). Governments and regulators ought to collaborate with data scientists to incorporate such technologies into ESG monitoring frameworks.

4. Enhancing Institutional Capacity and Research Infrastructure

   The bibliometric data reveal an academic disparity: the majority of ESG–greenwashing research is produced by developed economies. This underscores the necessity for capacity-building activities in emerging nations. Governments can cultivate local expertise via financed research networks, public–private data-sharing platforms, and collaborations between universities and regulators. Collaborative initiatives between ASEAN universities and capital market authorities could produce localized evidence to inform context-specific ESG policies.

5. Enhancing Global Governance Against Greenwashing

   The rising issue of "sustainability assurance" in global research advocates for the creation of an international anti-greenwashing framework, akin to anti-money-laundering norms. This would encompass protocols for claim verification, standards for transparency, and penalties for recurrent non-compliance. The United Nations and OECD might assume crucial roles in coordinating these guidelines, ensuring that ESG disclosures function as tools of accountability rather than just public relations.

The Role of Technology in Combating Greenwashing

Advancements in technology offer promising solutions for addressing greenwashing. Blockchain technology, for example, has the potential to revolutionize supply chain transparency by providing immutable records of transactions. This ensures that companies' sustainability claims are verifiable and traceable, reducing the likelihood of deceptive practices. Similarly, AI and machine learning algorithms can analyze large datasets to detect inconsistencies in ESG reporting, enhancing accountability.

Moreover, the use of digital platforms for stakeholder engagement can foster greater transparency. Interactive tools that allow consumers and investors to access real-time ESG performance data can empower them to make informed decisions, thereby incentivizing companies to prioritize genuine sustainability efforts.

Technological innovation has become an essential tool in bridging the ongoing credibility gap between corporate sustainability statements and actual environmental or social performance. The bibliometric study indicates a rising co-occurrence of keywords like "blockchain," "artificial intelligence," and "digital transparency" in the greenwashing literature since 2020, implying a trend towards data-driven accountability methods. These technologies are crucial in alleviating information asymmetry, a systemic issue that allows greenwashing to endure despite established ESG disclosure frameworks.

1. Blockchain for Traceability and Validation

   Blockchain technology aids anti-greenwashing initiatives by providing immutability, traceability, and decentralization. Blockchain facilitates the verification of environmental and social claims at the source by documenting each stage of a supply chain transaction on a distributed ledger. A corporation claiming carbon-neutral output can be validated using blockchain records that monitor energy sources, emissions offsets, and supplier certifications.

   These solutions diminish dependence on self-reported company data and incorporate third-party verifiability. The implementation of blockchain-based traceability platforms is especially pertinent for sectors with intricate global supply chains—such as mining, textiles, or palm oil—where the risks of reputational damage from greenwashing are significant.

   Policymakers and standard-setters might utilize this technology by promoting or requiring blockchain-based data reporting under ESG disclosure frameworks. Incorporating blockchain technology with regulatory portals, such as carbon registries or sustainable finance taxonomies, will improve data accuracy and auditing efficiency.

2. Artificial Intelligence and Big Data Analytics for Detection

   Artificial Intelligence (AI) and machine learning algorithms facilitate extensive content and sentiment analysis of corporate reports, press releases, and digital media. These methods can detect linguistic patterns characteristic of greenwashing, such excessive positive sentiment, ambiguous environmental assertions, or inconsistencies between financial and sustainability disclosures.

   Recent research have utilized natural language processing (NLP) to create "greenwashing dictionaries" that algorithmically identify deceptive sustainability assertions. In bibliometric mapping, concepts connected to AI are increasingly associated with ESG, signifying academic acknowledgment of its capacity to facilitate accountability.

From a governance perspective, regulators and assurance providers might employ AI-driven analytics to correlate corporate assertions with external data sources (e.g., emissions databases, satellite imagery, NGO reports), so facilitating a more impartial evaluation of ESG performance. This signifies a transition from static compliance to ongoing monitoring, in accordance with the real-time disclosure standards advocated by IFRS S2 (Climate-related Disclosures).

3. Digital Platforms and Stakeholder Involvement

In addition to verification, digital technologies help enhance the transparency interaction between corporations and stakeholders. Interactive dashboards, open-data portals, and ESG performance trackers provide investors, customers, and civil society with access to real-time sustainability measurements. This democratization of knowledge diminishes corporate monopolization of ESG narratives and facilitates multi-directional responsibility.

Initiatives such as the EU's ESAP (European Single Access Point) and Indonesia's OJK Sustainable Finance Information Hub exemplify how digital public platforms may improve the accessibility of disclosures. These projects establish the groundwork for worldwide interoperability in sustainability reporting and promote competition based on verified impact rather than marketing storylines.

4. Integration with Regulatory Frameworks

Technological integration must not be optional or disjointed. Regulators play a pivotal role in ensuring that digital tools reinforce, rather than bypass, formal ESG reporting frameworks. The future of anti-greenwashing legislation is dependent on "regtech" solutions, which utilize technology to streamline compliance, standardize disclosures, and automate verification processes.

National financial authorities might, for example, establish digital submission mechanisms necessitating machine-readable ESG data that aligns with global taxonomies, such as XBRL-based sustainability labeling. This will enable automated analysis for discrepancies or omissions prior to public dissemination, so averting false ESG narratives at the origin.

5. Obstacles and Prospective Pathways

Notwithstanding their potential, technology solutions possess inherent limitations. Blockchain adoption faces high energy costs and data privacy concerns, while AI models require continuous training to avoid bias. Furthermore, digital infrastructures are inconsistent between regions, thus exacerbating the North–South disparity in sustainability verification capabilities.

Therefore, technology ought to be regarded as a supplementary tool—not a substitute—for institutional reforms including mandated assurance, enhanced auditing capabilities, and standardized ESG criteria.

Future research should empirically examine the effectiveness of technology-enabled verification by comparing firms with digital traceability systems against those relying solely on traditional reporting. Studies could also explore the socio-technical implications of algorithmic assurance, ethical AI use in ESG monitoring, and the governance of digital sustainability data. Below is the relation of research result and the suggestion for future studies:

Table 3. Future Research Agenda in Greenwashing and ESG Studies

Key Theme	Identified Research Gap	Potential Research Questions	Suggested Methodological Approaches
ESG Regulation and Institutionalization	Despite a sharp increase in publications following mandatory ESG disclosure regimes, empirical evidence linking regulatory changes to firms' greenwashing behavior remains limited.	How do greenwashing strategies evolve before and after the introduction of mandatory ESG reporting? Does stricter ESG regulation lead to substantive sustainability practices or merely symbolic compliance?	Longitudinal studies; difference-in-differences designs; regulatory impact analysis
Corporate Governance and Accountability	Greenwashing research remains weakly integrated with corporate governance mechanisms such as ownership structure, board oversight, and internal controls.	How do ownership concentration, board characteristics, and governance quality influence greenwashing behavior under ESG pressure?	Panel data analysis; governance indices; in-depth case studies

Key Theme	Identified Research Gap	Potential Research Questions	Suggested Methodological Approaches
Stakeholder Responses and Market Reactions	Existing studies often examine investors and consumers separately, limiting a holistic understanding of stakeholder responses to greenwashing.	Do investors and consumers respond differently to greenwashing signals? How do these responses affect firm valuation and market discipline?	Event studies; experimental designs; surveys combined with market data
Theoretical Integration	The literature is dominated by legitimacy and stakeholder theories, while agency, signaling, and cognitive perspectives remain underutilized and fragmented.	How can multi-theoretical frameworks better explain the persistence of greenwashing within ESG regimes? What complementarities exist between governance-based and behavioral theories?	Conceptual model development; theory-driven empirical testing
ESG Assurance and Disclosure Credibility	Empirical research on the effectiveness of external ESG assurance in mitigating greenwashing remains scarce.	Does third-party ESG assurance reduce greenwashing risk and improve disclosure credibility? Under what institutional conditions is assurance most effective?	Quasi-experimental methods; matched-sample analysis; assurance quality assessment
Technology-Enabled Transparency	Digital technologies related to ESG transparency have only recently emerged in the literature and lack empirical validation.	Can digital tools such as AI and blockchain enhance ESG transparency and reduce greenwashing? What new risks or unintended consequences may arise?	Field experiments; design science research; qualitative case studies
Emerging Market Contexts	Bibliometric evidence shows strong concentration of studies in developed economies, with limited representation of emerging markets.	How does greenwashing manifest in emerging markets with mandatory ESG rules but weaker enforcement mechanisms?	Cross-country comparative studies; institutional analysis
Temporal Dynamics of Greenwashing	Most studies adopt a static perspective, despite evidence that greenwashing intensifies during regulatory transitions.	How does greenwashing behavior change as ESG regimes mature over time? Are early-stage ESG adopters more prone to symbolic compliance?	

Conclusion

This study's bibliometric analysis of greenwashing within ESG practices provides a comprehensive overview of global research trends, themes, and regional contributions. The majority of Scopus article journals focus on understanding business conduct, responsibility, and ethics, with a focus on climate-related terms, economic models, and green marketing. Emerging terms like Circular Economy suggest a shift towards investigating structural changes in corporate behavior. Additional research should explore localized greenwashing techniques, relationships between keywords like "China," and the reasons why some terms, like Circular Economy, appear less frequently despite increasing relevance.

The United States and the United Kingdom are global leaders in research and cooperation in creating ESG criteria and handling greenwashing. China's increasing interest in sustainability research reflects its growing interest in environmental issues. Research clusters show regional parallels, such as Asia's commitment to developing markets and Europe's emphasis on regulatory systems. Underrepresented nations like South Africa, Nigeria, and Vietnam could offer unrealized research potential in tackling local regional sustainability issues. Future studies should promote more studies from underprivileged areas, examine themes motivating cooperation within clusters, and share best practices through cross-continental cooperation, especially between developed and developing countries.

The bibliometric analysis identifies several gaps that future studies can address. First, the limited representation of certain regions in greenwashing research calls for localized studies that consider cultural, economic, and institutional nuances. For instance, the mining and textile industries in Africa or the agricultural sector in Southeast Asia present unique challenges and opportunities for examining ESG practices.

Second, there is a need to explore the psychological and behavioral dimensions of greenwashing. How do employees' perceptions of greenwashing influence organizational culture, and what strategies can mitigate such perceptions? Cognitive theory, as applied by Ma et al. (2024), offers a promising framework for these inquiries.

Third, interdisciplinary collaborations can enhance understanding by integrating insights from fields like artificial intelligence (AI), behavioral economics, and environmental science. AI-driven sentiment analysis, for example, could identify discrepancies between corporate communications and public perceptions, aiding in greenwashing detection.

Finally, comparative studies between developed and emerging markets could yield valuable insights into the efficacy of different regulatory approaches. By analyzing the outcomes of mandatory ESG disclosures in regions like the EU versus voluntary frameworks in Southeast Asia, researchers can identify best practices and inform policy development

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