

Greenwashing: An Emerging Challenge to Corporate Sustainability.

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Abstract

Greenwashing — the practice of overstating, fabricating, or selectively disclosing the environmental credentials of a firm, product, or service — has become one of the most persistent challenges to corporate sustainability communication. This paper presents a narrative-integrative theoretical review of greenwashing that traces its conceptual origins, maps the dominant theoretical lenses used to explain the phenomenon, synthesizes empirical evidence on its drivers and consequences, reviews emerging computational approaches to its detection, and critically compares the rapidly evolving global regulatory architecture designed to curb it. Drawing on legitimacy theory, stakeholder theory, signaling theory, and institutional theory, the paper argues that greenwashing is best understood not as an isolated act of deception but as a predictable organizational response to conflicting pressures for environmental performance and market competitiveness under conditions of information asymmetry. The review traces the historical evolution of the concept from its coinage in 1986 through its proliferation alongside the modern corporate social responsibility and ESG investment movements; it examines real-world cases spanning the automotive, aviation, fossil fuel, and financial services sectors; and it compares regulatory instruments across seven jurisdictions — the United States, the European Union, the United Kingdom, Canada, India, Australia, and Singapore. The paper concludes by identifying persistent theoretical, empirical, and regulatory gaps, discussing the practical implications for managers and policymakers, acknowledging the limitations inherent in a conceptual review, and proposing directions for future research, including cross-jurisdictional comparative studies, theoretical integration across levels of analysis, and the development of standardized, verifiable measurement instruments for greenwashing.

Keywords: : greenwashing, legitimacy theory, stakeholder theory, signaling theory, institutional theory, environmental claims, ESG, greenhushing, greenwashing regulation, greenwashing detection.

INTRODUCTION

Environmental sustainability has moved from the periphery of corporate strategy to its center. Investors screen portfolios for environmental, social, and governance (ESG) performance; consumers report a willingness to pay a premium for products marketed as eco-friendly; and regulators increasingly treat environmental claims as a matter of consumer protection and financial market integrity rather than voluntary corporate ethics. This shift in expectations has created a powerful incentive for organizations to appear environmentally responsible, whether or not their underlying practices have changed to match that appearance. The gap between symbolic environmental communication and substantive environmental performance is the phenomenon commonly known as greenwashing.

Greenwashing is not a marginal or rare occurrence. Systematic reviews of corporate environmental marketing have repeatedly found that a large share of the green claims made in advertising and on packaging are vague, unsubstantiated, or misleading (de Freitas Netto et al., 2020). A 2020 European Commission inventory of environmental claims found that 53.3% of the claims examined provided vague, misleading, or unfounded information, while 40% were unsubstantiated. These concerns were further supported by a November 2020 EU-wide sweep, in which authorities considered 42% of 344 sustainability claims potentially false or deceptive. In India specifically, Evidence from Indian advertising markets indicates that greenwashing extends beyond isolated instances of misleading communication. Research examining green advertisements in India found that 51.7% of the claims assessed could be classified as greenwashed, while many claims were vague, ambiguous, or lacked adequate specificity and substantiation. These findings suggest that misleading environmental communication

may represent a broader market-level concern rather than being confined to isolated cases (Fernando et al., 2014). This paper pursues six interlocking objectives: (1) to trace the historical emergence of the term "greenwashing" and situate it within the broader trajectory of the corporate environmental movement; (2) to review the principal theoretical frameworks used to explain why firms greenwash; (3) to synthesize empirical evidence on the drivers and consumer- and firm-level consequences of greenwashing; (4) to examine real-world illustrative cases across multiple industries; (5) to survey emerging computational and regulatory approaches to detecting and curbing greenwashing across seven jurisdictions; and (6) to identify the theoretical, empirical, and regulatory gaps that remain. As a theoretical and conceptual review, this paper does not present new primary data; rather, it synthesizes and critically examines existing scholarship, case evidence, and regulatory material to build an integrated understanding of the phenomenon.

2. Review Methodology

This paper adopts a narrative-integrative review methodology, appropriate for a conceptual synthesis that spans theory, empirical findings, and rapidly evolving regulatory developments that a purely systematic protocol (bound by fixed search strings and cut-off dates) would not adequately capture, particularly given that portions of the regulatory landscape discussed here changed within the twelve months preceding this review. The review draws on three categories of sources: (i) peer-reviewed theoretical and empirical literature indexed in Scopus and Web of Science, identified using search terms including "greenwashing," "greenwash," "green claims," "legitimacy theory," "stakeholder theory," "signaling theory," "ESG greenwashing," "greenhushing," and "greenwashing detection"; (ii) official regulatory and legislative texts and regulator publications from the United States Federal Trade Commission and Securities and Exchange Commission, the European Commission, the United Kingdom Competition and Markets Authority, the Canadian Competition Bureau, India's Central Consumer Protection Authority, the Australian Competition and Consumer Commission, and the Singapore Competition and Consumer Commission; and (iii) documented case material from court judgments, regulatory enforcement actions, and reputable news and legal-analysis sources concerning specific greenwashing controversies.

Consistent with established practice in management and business ethics reviews of an emerging, fast-moving phenomenon (Santos et al., 2024, and Forlano et al., 2025), priority was given to studies published in recognized management, marketing, and environmental-policy journals, supplemented by recent working papers and preprints in cases — such as computational greenwashing detection — where the peer-reviewed literature is still consolidating

3. Historical Evolution of the Concept

The word "greenwashing" is generally credited to the environmentalist Jay Westerveld, who coined it in a 1986 essay criticizing the hospitality industry's practice of encouraging hotel guests to reuse towels in the name of environmental conservation (de Freitas Netto et al., 2020). Westerveld's critique was pointed: many of the hotels making such appeals were simultaneously engaged in environmentally damaging expansion projects, and the towel-reuse programs saved the hotels laundry costs far more than they conserved any meaningful quantity of water. The term itself is a play on "whitewashing," a much older idiom describing the concealment of wrongdoing behind a superficial, favorable appearance.

Although the term was coined in 1986, the practices it describes are older. Encyclopedic treatments of the concept trace the earliest instances of corporate environmental image management to the late 1960s, as firms began to respond publicly to the environmental movement catalyzed by Rachel Carson's 1962 book *Silent Spring*. The 1980s saw the environmental movement gain further momentum following a string of high-profile industrial and ecological disasters — the Bhopal gas leak, the Chernobyl nuclear accident, and, at the end of the decade, the Exxon Valdez oil spill — each of which sharpened public scrutiny of corporate environmental conduct and, in turn, corporate incentives to manage public perception of that conduct.

By the early 1990s, opinion polling suggested that consumers were more inclined to purchase from companies with a positive environmental reputation, and firms responded by expanding environmentally themed advertising and product positioning. The term "greenwash" entered the Concise Oxford English Dictionary in 1999, marking its transition from an activist neologism to a term of general and eventually legal currency. The 2000s and 2010s saw greenwashing scholarship expand substantially alongside the growth of corporate social responsibility (CSR) reporting and, later, ESG investing, as researchers observed that voluntary, unverified sustainability disclosure created new opportunities for selective or misleading communication (Lyon & Montgomery, 2015).

Bibliometric analyses of the academic literature confirm this trajectory. A Web of Science-based bibliometric study of 310 documents found that scholarly interest in greenwashing has grown markedly since the early 2010s, with a particular acceleration in studies linking greenwashing to stakeholder outcomes such as branding, purchase intention, and B2B relationships (Santos et al., 2024). A more recent bibliometric mapping of 97 peer-reviewed Scopus and Web of Science articles identified four thematic clusters in the field — symbolic management and CSR communication, environmental regulation and institutional complexity, performance and sustainable

practices, and marketing, perception, and trust — and confirmed the continued dominance of macro-level theories such as legitimacy, institutional, and stakeholder theory (Forliano et al., 2025). A separate systematic review focused specifically on greenwashing within marketing scholarship, analyzing 419 peer-reviewed articles published between 2004 and 2024, similarly documented accelerating publication volume and an increasing focus on consumer trust and brand perception (Negkakis & Pavlopoulos, 2025).

4. Conceptual Definitions and Typology

Despite four decades of use, greenwashing lacks a single, universally accepted definition. Lyon and Montgomery (2015) note that the concept's multifaceted nature has produced a range of definitions that vary according to the analytical lens applied — some scholars emphasize selective disclosure (the reporting of good environmental news while omitting bad news), while others emphasize outright fabrication or exaggeration of environmental attributes. A widely used working definition treats greenwashing as the practice of misleading stakeholders about the environmental performance of an organization or the environmental benefits of a product or service, whether through action, omission, or communication. A recent systematic methodological review similarly concludes that, despite disagreement on its precise boundaries, greenwashing is consistently defined across the literature as a mismatch between a company's environmental communication and its actual environmental performance (Bernini et al., 2024).

One influential early attempt to classify greenwashing practices came from the environmental marketing firm TerraChoice, whose "Seven Sins of Greenwashing" framework identified recurring patterns such as the sin of the hidden trade-off (highlighting one environmental attribute while ignoring more significant harms), the sin of no proof (claims unsupported by accessible evidence), the sin of vagueness (broad, poorly defined terms such as "eco-friendly"), the sin of irrelevance (technically true but meaningless claims), the sin of the lesser of two evils (true within a harmful product category), the sin of fibbing (outright false claims), and the sin of worshiping false labels (implying third-party certification that does not exist) (TerraChoice, 2010). Although developed as an industry commentary rather than a peer-reviewed instrument, this typology has been widely adopted in subsequent academic work as a practical taxonomy of greenwashing behaviors.

More recent academic typologies distinguish greenwashing along at least two dimensions: the level at which it occurs (claim-level greenwashing embedded in advertising and labeling versus firm-level greenwashing embedded in sustainability reporting and disclosure strategy) and the underlying mechanism (decoupling, in which stated commitments diverge from actual practice, versus selective or asymmetric disclosure, in which true information is presented in a misleadingly incomplete way) (Kim & Lyon, 2015). Delmas and Burbano (2011) formalize this insight in an influential two-dimensional model that classifies firms by the interaction between their communication ("Talk") and their actual environmental performance ("Walk"): firms combining high Talk with high Walk are "vocal green" firms; those combining low Talk with high Walk are "silent green" firms, a pattern later termed greenhushing; those combining low Talk with low Walk are "silent brown" firms; and those combining high Talk with low Walk constitute the greenwashing quadrant proper. This Talk–Walk framework has become one of the most frequently cited conceptual anchors in subsequent empirical greenwashing research.

5. Adjacent Phenomena: Greenhushing and Greenwishing

As the regulatory and reputational risks of greenwashing have intensified, two adjacent and partly opposite phenomena have gained prominence in both practice and scholarship: greenhushing and greenwishing. Greenhushing refers to the deliberate practice of under-reporting or withholding communication about an organization's genuine sustainability initiatives. Unlike greenwashing, in which firms exaggerate or fabricate environmental claims, greenhushing occurs when organizations undertake real sustainability measures but choose not to publicize them, effectively representing "communication decoupling" in the opposite direction from greenwashing (Delmas & Burbano, 2011). Scholars and practitioners have identified several drivers of greenhushing, including reputation management and the fear of being accused of hypocrisy or insufficient ambition; political and regulatory uncertainty, particularly amid a wave of anti-ESG legislation enacted across a number of U.S. states since 2021; consumer skepticism toward eco-labeled products, sometimes referred to as a "green stigma" effect in which sustainability claims are associated with lower perceived product quality; and industry-level reluctance to raise sector-wide disclosure benchmarks. Survey-based industry research has found that a majority of large U.S. companies now quietly disclose ESG progress without actively publicizing it, a pattern that some commentators frame as a rational adaptation to the twin risks of greenwashing accusations from sustainability advocates and anti-ESG backlash from other stakeholders.

Greenwishing, by contrast, describes the practice of making aspirational or forward-looking environmental commitments — such as net-zero pledges — without a credible, substantiated pathway to achieving them. Because such commitments are prospective and difficult to falsify in the near term, they occupy a definitional gray zone that existing legal frameworks, built primarily around the model of a present, verifiable factual claim, are not yet well equipped to address (Forliano et al., 2025). The coexistence of greenwashing, greenhushing, and gre

enwishing illustrates that corporate environmental communication operates along a continuous spectrum of disclosure quality and credibility rather than a simple honest/dishonest binary, and it suggests that regulatory and theoretical frameworks calibrated only to detect overstatement risk both under-capturing strategic silence and mis-capturing good-faith but under-substantiated ambition.

6. Theoretical Frameworks

The academic literature on greenwashing draws primarily on four theoretical traditions: legitimacy theory, stakeholder theory, signaling theory, and institutional theory. Recent systematic reviews confirm that these macro- and meso-level theories dominate the field, with legitimacy, institutional, and stakeholder theories serving as the most frequently applied frameworks across empirical and conceptual greenwashing studies (Forliano et al., 2025). Each framework illuminates a different facet of why organizations engage in greenwashing and what consequences follow.

6.1 Legitimacy Theory

Legitimacy theory holds that organizations require ongoing social approval — a "social license to operate" — that depends on the perceived alignment between organizational conduct and prevailing societal norms and values (Suchman, 1995). When public expectations shift toward environmental responsibility, firms face pressure to demonstrate conformity with these expectations in order to preserve legitimacy, even when the underlying operational changes required to genuinely meet those expectations are costly or slow to implement. Greenwashing, from this perspective, functions as a legitimacy management strategy: firms substitute symbolic communication for substantive change because symbolic action is faster and cheaper than operational transformation, yet can still satisfy the perceptual, if not the material, conditions of legitimacy (Bernini & La Rosa, 2024).

Suchman's (1995) distinction between pragmatic legitimacy (based on the self-interested calculations of an organization's immediate audiences), moral legitimacy (based on normative approval), and cognitive legitimacy (based on the taken-for-granted acceptance of an organizational form) is particularly useful here. Greenwashing is most plausibly understood as an attempt to secure pragmatic and moral legitimacy without necessarily achieving deeper, cognitive-level acceptance. Empirical support for the legitimacy mechanism comes from a recent panel study of 157 publicly listed Chinese public health firms, which found that greenwashing significantly undermined organizational legitimacy, which in turn produced measurable negative effects on financial performance, evidencing legitimacy erosion as a concrete transmission channel between greenwashing behavior and firm outcomes (Liang & Gao, 2025).

6.2 Stakeholder Theory

Stakeholder theory, associated with Freeman's (1984) foundational work, holds that firms must attend to the interests of a range of constituencies beyond shareholders, including customers, employees, regulators, environmental advocacy groups, and local communities. Applied to greenwashing, stakeholder theory explains both the pressure that motivates the practice and the risk that ultimately constrains it. On one hand, heterogeneous and vocal stakeholder groups — particularly environmentally conscious consumers and non-governmental organizations — create demand for visible environmental commitments, which can tempt firms toward symbolic rather than substantive responses when genuine compliance is costly.

On the other hand, stakeholder theory highlights the relational costs of greenwashing once it is discovered. A systematic literature review of 310 documents examining greenwashing's relationship to stakeholders found consistent evidence that perceived greenwashing damages brand image, consumer purchase intention, and business-to-business relationships (Santos et al., 2024). The reputational and relational damage associated with the Volkswagen "Dieselgate" scandal — in which the company was found to have installed defeat-device software in approximately eleven million diesel vehicles worldwide to manipulate emissions tests, resulting in a \$14.7 billion U.S. settlement and additional criminal and civil fines exceeding several billion dollars across jurisdictions, including a 1 billion euro fine from German prosecutors and a record A\$125 million penalty upheld by the High Court of Australia — is frequently cited in the literature as an illustration of how the exposure of environmental deception can produce a rapid and severe loss of stakeholder trust, extending well beyond the immediate financial penalties imposed by regulators.

6.3 Signaling Theory

Signaling Theory, introduced by Spence (1973), explains how observable information is used to communicate otherwise unobservable qualities under conditions of information asymmetry. In the context of greenwashing, firms may use environmental claims, labels, or imagery to signal superior environmental performance to stakeholders who cannot easily verify actual performance (Seele & Gatti, 2017).

The theory suggests that firms may rely on low-cost or symbolic signals that create an impression of environmental responsibility without requiring substantial environmental improvements. Signaling theory therefore predicts that greenwashing will be most prevalent in precisely the market conditions where information asymmetry between firms and stakeholders is greatest and where third-party verification mechanisms are weak or absent. This prediction is consistent with consumer-side evidence: Nyilasy, Gangadharbatla, and Paladino (2014) found

experimentally that perceived greenwashing interacts with actual corporate environmental performance to shape consumer attitudes, such that advertising a green claim without commensurate environmental performance produced more negative consumer reactions than making no green claim at all — a finding consistent with signaling theory's prediction that an uncredentialed signal can backfire once its lack of substantiation becomes apparent, suggesting that the credibility gap signaling theory identifies is a real and measurable feature of consumer cognition rather than a purely theoretical construct.

6.4 Institutional Theory and Complementary Perspectives

Institutional theory, and in particular DiMaggio and Powell's (1983) concept of institutional isomorphism, offers a complementary macro-level explanation. Organizations operating within the same institutional field face coercive pressure (from regulation and law), mimetic pressure (from the desire to imitate successful or legitimate peers under conditions of uncertainty), and normative pressure (from professional norms and standards) to adopt similar structures and practices. As sustainability disclosure becomes an institutional expectation, firms may adopt the appearance of environmental responsibility without corresponding changes in actual practices, creating a decoupling between formal commitments and operational reality.

Recent theoretical research suggests integrating legitimacy, stakeholder, signaling, and institutional perspectives into a cross-level framework that also considers firm-level characteristics and individual managerial factors (Forlano et al., 2025). This move toward theoretical integration reflects a growing recognition that no single theory fully accounts for the greenwashing phenomenon in isolation.

6.5 Consumer-Level Theoretical Perspectives

Complementing these organization-level theories, a substantial body of consumer behavior research examines greenwashing from the demand side, frequently drawing on Ajzen's (1991) theory of planned behavior, which holds that behavioral intention — including green purchase intention — is a function of attitudes, subjective norms, and perceived behavioral control. Building on this foundation, Chen and Chang (2013) introduced the influential constructs of green consumer confusion and green perceived risk, demonstrating empirically that perceived greenwashing reduces green trust by increasing both the confusion consumers experience when evaluating environmental claims and the perceived risk associated with green purchasing decisions. Subsequent studies employing structural equation modeling have consistently replicated the finding that perceived greenwashing exerts a significant negative effect on green purchase intention, mediated by green brand image, green word of mouth, and green skepticism, underscoring that the psychological mechanisms linking greenwashing exposure to consumer behavior are now reasonably well established even though firm-level detection of greenwashing itself remains methodologically difficult (Bernini et al., 2024).

7. Drivers and Consequences of Greenwashing

Building on the theoretical frameworks above, the literature identifies several recurring drivers of greenwashing at the firm level: intense competitive pressure in industries where environmental positioning has become a differentiator; weak or inconsistent regulatory enforcement that lowers the expected cost of misleading claims; poor internal environmental performance combined with strong external pressure to appear sustainable, a mismatch that Delmas and Burbano (2011) identify as the central precondition for greenwashing; and the availability of low-cost communicative tools, such as self-designed eco-labels, that can mimic the appearance of credible certification without independent verification.

The consequences of greenwashing, once exposed, are substantial and multidimensional. At the consumer level, exposure to greenwashing has been shown to increase green skepticism and perceived risk, both of which suppress green purchase intention (Chen & Chang, 2013). At the firm level, the panel-data evidence from Liang and Gao (2025) linking greenwashing to legitimacy erosion and subsequent financial underperformance is corroborated by broader stakeholder-relationship research documenting damage to brand image, consumer trust, and B2B relationships following greenwashing exposure (Santos et al., 2024). At the market level, widespread greenwashing is theorized to produce a "market for lemons" dynamic, in which the proliferation of unverifiable environmental claims makes it difficult for consumers to distinguish genuinely sustainable products from misleadingly marketed ones, potentially depressing consumer trust in green claims generally and undermining the price premium available to firms making credible environmental investments.

8. Case Illustrations Across Industries

Grounding the theoretical discussion above, several well-documented cases illustrate how greenwashing manifests across sectors and how legal systems have begun to respond.

8.1 Automotive: Volkswagen "Dieselgate"

A prominent example is Volkswagen's "Dieselgate" scandal. In September 2015, the U.S. Environmental Protection Agency (EPA) reported that certain Volkswagen and Audi diesel vehicles were equipped with software designed to detect emissions testing conditions and activate stronger emission controls during laboratory tests. During normal driving, the affected vehicles could emit nitrogen oxides at levels up to 40 times the applicable

standard (U.S. Environmental Protection Agency [EPA], 2015). The scandal ultimately affected approximately 11 million vehicles worldwide (Volkswagen Group, 2025) and resulted in substantial legal and financial consequences, including a U.S. settlement of up to \$14.7 billion (U.S. Department of Justice [DOJ], 2016), a €1 billion administrative fine in Germany (Volkswagen Group, 2018), and a further \$4.3 billion U.S. criminal and civil settlement (DOJ, 2017). In Australia, Volkswagen was ordered to pay A\$125 million for misleading representations concerning compliance with diesel emissions standards, a penalty that was subsequently upheld by the Full Federal Court and remained in force after the High Court denied Volkswagen leave to appeal (Australian Competition and Consumer Commission [ACCC], 2019, 2021). The case illustrates how environmental misrepresentation can generate interconnected legal, financial, reputational, and stakeholder consequences across multiple jurisdictions.

8.2 Aviation: KLM, Lufthansa, and Sector-Wide Scrutiny

In March 2024, the District Court of Amsterdam ruled that several of KLM's environmental advertisements were misleading and unlawful. The court found that the airline had presented an overly optimistic picture of measures such as sustainable aviation fuels and reforestation, which only marginally reduced the negative environmental effects of flying and could create the misleading impression that air travel was becoming sustainable (District Court of Amsterdam, 2024). The case, brought by Fossielvrij NL and Reclame Fossielvrij with support from ClientEarth, represented a landmark judgment concerning greenwashing in the aviation sector. In Germany, the Cologne Regional Court subsequently ruled in March 2025 against Lufthansa, prohibiting certain advertising claims concerning CO₂ compensation and sustainable aviation fuels because they could mislead consumers into believing that additional payments could make flights essentially climate-neutral (Deutsche Umwelthilfe, 2025). In the United States, Delta Air Lines faced a proposed class-action lawsuit in 2023 alleging that its claim to be the "world's first carbon-neutral airline" was misleading because it relied substantially on carbon offsets (Berrin v. Delta Air Lines, Inc., 2023). At the regulatory level, the European Commission and national consumer-protection authorities sent formal letters to 20 airlines in 2024 identifying potentially misleading green claims, particularly those suggesting that carbon offsets or sustainable aviation fuels could reduce or fully compensate for the climate impact of flights (European Commission, 2024). Collectively, these developments are consistent with signaling theory: in high-emission industries, firms may use relatively low-cost environmental claims and offset-based initiatives to signal environmental responsibility, while courts and regulators increasingly scrutinize whether such signals are adequately supported by credible evidence.

8.3 Fossil Fuels: Litigation Against Major Oil and Gas Companies

Fossil fuel companies have increasingly faced greenwashing and climate-deception litigation in the United States. In 2021, New York City sued ExxonMobil, Shell, BP, and the American Petroleum Institute, alleging that their advertising and greenwashing campaigns misled consumers about the environmental impacts of fossil fuels, including claims that ExxonMobil's Synergy fuels could reduce emissions (New York City, 2021). Similar litigation was initiated by the District of Columbia and Minnesota in 2020, alleging deceptive communications concerning fossil fuels and climate change (District of Columbia Office of the Attorney General, 2020; Minnesota Attorney General's Office, 2020). Massachusetts also sued ExxonMobil over alleged deceptive advertising and greenwashing, with the case permitted to proceed after courts rejected Exxon's efforts to dismiss it (Massachusetts Attorney General's Office, 2019, 2022). Collectively, these cases extend greenwashing research beyond individual product claims to broader corporate communication strategies and illustrate how firms may use symbolic environmental messaging to manage legitimacy pressures associated with environmentally harmful business activities.

8.4 Financial Services: ESG Fund Greenwashing

Greenwashing concerns have increasingly extended into financial markets. In 2022, German authorities searched the Frankfurt offices of DWS, Deutsche Bank's asset-management subsidiary, following allegations concerning misleading ESG disclosures. In September 2023, the U.S. Securities and Exchange Commission (SEC) charged DWS with ESG-related misstatements and other violations, resulting in \$25 million in combined penalties, including \$19 million related to ESG misstatements (SEC, 2023). Similarly, the SEC fined Goldman Sachs Asset Management \$4 million in 2022 for failing to consistently follow its own ESG investment policies (SEC, 2022). Regulatory scrutiny also increased through the SEC's 2023 amendments to the Investment Company Act Names Rule, extending the 80% investment requirement to funds whose names suggest ESG-related characteristics (SEC, 2023). In the European Union, the Sustainable Finance Disclosure Regulation (SFDR) distinguishes funds under Articles 6, 8, and 9 according to their sustainability-related disclosures and characteristics. Amid regulatory uncertainty, asset managers reclassified funds worth approximately €175 billion from Article 9 to Article 8 during the fourth quarter of 2022 (Morningstar, 2023). These developments illustrate that greenwashing is not confined to product marketing but extends into capital markets, where misleading signals about environmental characteristics can distort investment flows at a much larger scale (Yu et al., 2020).

9. Detection and Measurement of Greenwashing

A persistent methodological challenge in greenwashing research is operationalizing and measuring the phenomenon itself. A systematic methodological review of 52 quantitative empirical studies published between 1990 and 2022 found substantial heterogeneity in how researchers operationalize greenwashing — some rely on consumer or manager perception scales (typically five- to seven-point Likert instruments adapted from established scales), while others use dummy variables based on media-reported allegations or third-party greenwashing indices — and concluded that scholars remain highly uncertain about how an effective, objective greenwashing measurement instrument should be designed, with hypothetical or perception-based cases studied far more frequently than verified real-world cases (Bernini et al., 2024).

In response to this measurement gap, a growing body of computational research has applied natural language processing (NLP) and large language models to the automated detection of greenwashing in corporate sustainability reports and climate-related disclosures. A comprehensive 2025 survey identified 61 distinct NLP-based studies addressing component tasks such as climate-related statement identification, alignment with disclosure frameworks including the Task Force on Climate-related Financial Disclosures (TCFD), green-claim detection, and stance and sentiment analysis of corporate climate communication, but concluded that the field remains fragmented: several narrow subtasks now achieve near-perfect performance under controlled conditions, yet tasks requiring contextual reasoning about ambiguity or deceptive intent remain challenging, and — crucially — no dataset of independently verified real-world greenwashing cases yet exists to benchmark these systems against (Calamai et al., 2025). Related work has proposed large-language-model-driven monitoring systems for greenwashing detection using empirical data from Chinese listed companies, and other recent studies have explored aspect-level and cross-category approaches to make automated ESG-risk detection more robust against the varied linguistic strategies firms use to obscure unsubstantiated claims. Collectively, this emerging literature suggests that computational detection may eventually complement — but is unlikely soon to replace — the perception-based and disclosure-gap measurement approaches that currently dominate empirical greenwashing research

10. Global Regulatory and Legal Responses

As greenwashing has grown more visible and consequential, regulators across major jurisdictions have moved — with varying speed and stringency — to treat misleading environmental claims as a matter of consumer protection and, increasingly, financial market integrity. This section reviews the current state of regulation in seven jurisdictions, summarized comparatively in Table 1.

10.1 United States

In the United States, the primary instrument governing environmental marketing claims is the Federal Trade Commission's Guides for the Use of Environmental Marketing Claims, commonly known as the "Green Guides," first issued in 1992 and most recently substantively revised in 2012. The Green Guides are not independently enforceable regulations but interpretive guidance on how the FTC will apply its general authority under Section 5 of the FTC Act to deem environmental marketing claims "unfair or deceptive." The FTC opened a further review of the Green Guides in December 2022; as of this writing, a revised version has not been finalized, and commentators have noted that the update process has been delayed across changes in FTC leadership. Financial-market regulation has moved more decisively: the SEC's 2023 Names Rule amendments and its enforcement actions against DWS and Goldman Sachs Asset Management (discussed in Section 8.4) represent the most concrete U.S. regulatory response to date. At the state level, California's Voluntary Carbon Market Disclosures Act (2023) imposes specific disclosure obligations on companies making emissions-reduction claims tied to carbon offsets.

10.2 European Union

The European Union has pursued the most comprehensive regulatory program targeting greenwashing, built on complementary instruments. The Empowering Consumers for the Green Transition Directive (Directive (EU) 2024/825), adopted in February 2024, amends existing EU consumer protection law to prohibit generic, unsubstantiated environmental claims and self-declared sustainability labels lacking independent certification. A more ambitious complementary measure, the proposed Green Claims Directive, would have required prior, independent, third-party verification of explicit environmental claims before their use in marketing. However, the European Commission announced its intention to withdraw the Green Claims Directive proposal in June 2025 amid political disagreement — particularly concerning the proposed inclusion of small enterprises within its scope — and, as of mid-2026, its formal status remains unresolved. Notwithstanding this uncertainty, the EU's existing Unfair Commercial Practices Directive continues to serve as the basis for greenwashing enforcement and private litigation across member states — illustrated by the KLM judgment discussed in Section 8.2 — and the Ecodesign for Sustainable Products Regulation, in force since July 2024, separately introduces a digital product passport requirement intended to make environmental performance data independently verifiable. In parallel, ESMA's 2024 fund-naming guidelines restrict the use of terms such as "ESG," "sustainable," and "green" in fund names unless specific portfolio criteria are met.

10.3 United Kingdom

The UK's Competition and Markets Authority (CMA) enforces the Green Claims Code, first published in 2021, which sets out six principles requiring environmental claims to be truthful, accurate, clear, substantiated, and to compare like with like across a product's full life cycle. The CMA's investigation into fashion retailers ASOS, Boohoo, and George at Asda, concluded in March 2024 with formal undertakings from all three retailers to revise how they display and substantiate environmental claims, represents one of the most prominent enforcement actions taken under this framework and has been followed by sector-specific compliance guidance for the fashion industry. The UK's advertising regulator has also taken enforcement action in the aviation sector, including against Virgin Atlantic's use of sustainable aviation fuel claims in 2024.

10.4 Canada

Canada amended its Competition Act in June 2024 to introduce explicit anti-greenwashing provisions requiring certain environmental claims to be supported by adequate and proper testing or substantiation. The Competition Bureau issued final guidance in June 2025 following two rounds of consultation that generated more than 400 submissions. However, the legal framework subsequently changed in March 2026, when amendments removed the requirement for certain business-level environmental claims to be substantiated according to an internationally recognized methodology (Competition Bureau Canada, 2025, 2026).

10.5 India

India's Central Consumer Protection Authority (CCPA) issued the Guidelines for Prevention and Regulation of Greenwashing or Misleading Environmental Claims, 2024, on 15 October 2024, following a draft version released in February 2024. The Guidelines complement the pre-existing Guidelines for Prevention of Misleading Advertisements and Endorsements, 2022, and define greenwashing to include exaggeration, downplaying, and outright concealment of environmental impacts. They require that generic terms — including "clean," "green," "eco-friendly," "carbon-neutral," "sustainable," and "regenerative" — be accompanied by adequate qualifiers and independently verifiable substantiation, and they mandate that recyclability claims specify clearly whether they apply to an entire product or only to specific components. The Guidelines operate within the broader enforcement framework of the Consumer Protection Act, 2019, under which the CCPA can take action against misleading advertisements and impose applicable statutory penalties. India's approach is notable among the jurisdictions reviewed here for coupling detailed, example-based compliance guidance with statutory criminal penalties under the broader Consumer Protection Act, 2019 framework — a comparatively stringent enforcement posture relative to the non-binding U.S. Green Guides model, though enforcement track record and case law under the 2024 Guidelines remain nascent given their recency.

10.6 Australia and Singapore

Australia has emerged as one of the most active enforcement jurisdictions globally, principally through the Australian Competition and Consumer Commission (ACCC) and the Australian Securities and Investments Commission (ASIC), both of which have designated greenwashing an ongoing enforcement priority since 2023. Australia's courts have also upheld substantial penalties in cross-border cases, including the record A\$125 million Volkswagen fine discussed in Section 8.1. Singapore has taken a more guidance-based approach: the Competition and Consumer Commission of Singapore (CCCS) and Consumers Association of Singapore (CASE) jointly issued consumer-facing guidance in 2023, informed by a National University of Singapore Business School study finding that a substantial share of online environmental product claims were vague or used technical language that consumers could not readily verify, and the CCCS has indicated it is developing more formal business-facing guidelines.

10.7 Comparative Observations

Viewed comparatively, the seven jurisdictions reviewed here illustrate a broader global convergence around the need for environmental claims to be accurate, specific, and adequately substantiated, although the regulatory mechanisms and enforcement approaches differ considerably. The EU has pursued the most codified and prescriptive path, though political resistance has slowed its most ambitious verification requirements. The US retains a comparatively light-touch, guidance-based model for consumer marketing whose core instrument has not been substantively updated in over a decade, even as its financial-market regulator has moved assertively against greenwashing in ESG fund marketing. The UK, Canada, and Australia occupy an intermediate position, combining principles-based codes or statutory tests with active, high-profile enforcement. India's 2024 Guidelines are notable for coupling detailed, example-based compliance guidance with statutory criminal penalties, giving them comparatively sharp teeth relative to several other frameworks reviewed here, while Singapore's approach remains the most guidance-oriented and least codified among the jurisdictions surveyed.

Table 1. Comparative Overview of Anti-Greenwashing Regulatory Frameworks

Jurisdiction	Key Instrument(s)	Year	Independent Verification Required?	Penalty / Enforcement Mechanism
United States	FTC Green Guides (16 C.F.R. Part 260); SEC Names Rule; California VCMDA	1992 / rev. 2012; 2023; 2023	No (Guides); Partial (SEC)	FTC Act §5 enforcement; SEC civil penalties (e.g., DWS \$25M, 2023)
European Union	Empowering Consumers for the Green Transition Directive (2024/825); Green Claims Directive (proposed, status unresolved)	2024 (applies 2026); proposed 2023	Yes (proposed GCD); No (ECGT alone)	National consumer authority enforcement; fines up to 4% of annual turnover (proposed)
United Kingdom	CMA Green Claims Code	2021	Recommended, not mandatory	CMA investigations; formal undertakings (e.g., ASOS, Boohoo, Asda, 2024)
Canada	Competition Act ss. 74.01(1)(b.1)-(b.2)	2024 (amended)	Yes, adequate/proper substantiation required	Competition Bureau civil penalties
India	CCPA Guidelines for Prevention and Regulation of Greenwashing	2024	Yes, independent third-party substantiation	Fines up to ₹50 lakh and imprisonment up to 5 years (repeat offenders)
Australia	Australian Consumer Law; ACCC/ASIC greenwashing priorities	Ongoing enforcement priority since 2023	Case-by-case	Civil penalties (e.g., A\$125M Volkswagen fine, upheld 2022)
Singapore	Consumer Protection (Fair Trading) Act; CCCS/CASE guidance	Guidelines developed from 2023	Recommended	Consumer complaint and guidance-based approach

11. Discussion: Gaps and Challenges

Several gaps persist at the intersection of greenwashing theory, empirical measurement, and regulatory practice. First, theoretical work on greenwashing remains fragmented across disciplinary silos — management scholars emphasize legitimacy and institutional dynamics, marketing scholars emphasize signaling and consumer perception, and legal scholars emphasize doctrinal questions of deception and substantiation — with comparatively few studies attempting genuine cross-level integration, though the multi-level framework proposed by Forliano et al. (2025) represents meaningful progress in this direction.

Second, the measurement of greenwashing itself remains methodologically unresolved. As Bernini et al. (2024) document, the overwhelming majority of empirical studies rely on perception-based or hypothetical greenwashing scenarios rather than verified real-world cases, largely because no consensus measurement instrument or ground-truth dataset currently exists — a gap that recent computational NLP research has begun to address but, per Calamai et al. (2025), has not yet resolved, particularly for tasks requiring contextual judgment about deceptive intent.

Third, most empirical greenwashing research continues to focus on firms in developed economies or, increasingly, China, even though the underlying pressures that theory identifies as drivers of greenwashing — competitive differentiation, weak enforcement, and information asymmetry — may operate differently, and in some respects more acutely, in other developing-economy contexts where regulatory capacity and independent certification infrastructure are less mature, including India despite its comparatively assertive 2024 regulatory framework.

Fourth, the regulatory landscape itself remains unsettled and, in the EU case, is currently moving in a less stringent direction than initially proposed, illustrating the political economy constraints that shape how far anti-greenwashing law can go in practice, particularly regarding the costs it imposes on smaller enterprises. Fifth, emerging communicative phenomena such as greenhushing and greenwashing raise conceptual and regulatory questions that existing frameworks — largely built around the model of a false or exaggerated affirmative claim — are not yet well equipped to address, since these newer practices involve strategic silence or aspirational statements rather than straightforwardly false assertions. Finally, the extension of greenwashing concerns into financial markets (Section 8.4) raises the question of whether consumer-protection-oriented legal frameworks are institutionally well suited to police greenwashing in capital markets, where the relevant stakeholders (investors) and harms (capital misallocation) differ substantially from those in consumer product markets.

12. Practical Implications

For corporate managers, the theoretical and empirical evidence reviewed here suggests that the reputational and financial costs of exposed greenwashing — illustrated vividly by the Volkswagen, KLM, and DWS cases — generally exceed the short-term legitimacy or market-positioning benefits greenwashing is intended to secure, particularly as detection capacity (both regulatory and computational) continues to improve. Firms operating across multiple jurisdictions face a genuine compliance challenge given the divergence in verification requirements documented in Table 1, and should generally calibrate environmental claims to the most stringent applicable standard — typically the EU's substantiation requirements or India's CCPA Guidelines — rather than the most permissive one, both to reduce multi-jurisdictional legal exposure and to hedge against continuing regulatory convergence toward stricter substantiation norms.

For policymakers, the comparative regulatory review suggests that guidance-based frameworks lacking meaningful penalties (illustrated by the pre-2024 U.S. and Singaporean approaches) have historically coexisted with persistently high rates of vague or unsubstantiated claims, as documented by the European Commission's 2020 sweep and the ASCI's Indian findings; frameworks combining specific, example-based compliance guidance with meaningful statutory penalties, such as India's 2024 Guidelines, may offer a more effective — though not yet empirically validated — template for jurisdictions considering new greenwashing legislation. For consumer protection agencies and investor-facing regulators such as the SEC and ESMA, extending greenwashing oversight into financial products has proven both necessary and comparatively tractable given the more codified disclosure infrastructure already present in securities regulation.

13. Limitations

This paper is a conceptual and narrative-integrative review rather than a systematic review or empirical study, and it therefore does not follow a fully replicable, protocol-bound search and screening process; its source selection, while broad, reflects the author's judgment regarding relevance and quality rather than an exhaustive, algorithmically reproducible search. Regulatory content, in particular the status of the EU's proposed Green Claims Directive and other still-evolving instruments, may change after the time of writing and should be independently verified before being relied upon for compliance purposes. The review also draws on a mix of peer-reviewed academic literature, preprints, and regulator or legal-practitioner publications; while the latter were used judiciously and primarily for descriptive regulatory content rather than theoretical claims, they have not undergone the same peer-review process as the academic sources cited. Finally, as a theoretical synthesis, this paper does not generate new primary data on greenwashing prevalence, consumer perception, or firm performance, and its conclusions regarding drivers and consequences rest on the reliability of the underlying empirical studies it cites.

14. Conclusion and Directions for Future Research

This paper has traced greenwashing from its 1986 coinage through its establishment as a central concept in sustainability scholarship, consumer behavior research, and corporate law. Theoretically, greenwashing is best understood as the predictable product of legitimacy pressures, stakeholder demands, signaling incentives, and institutional isomorphism operating jointly on organizations that face a gap between the environmental performance stakeholders expect and the performance the organization is able or willing to deliver — a gap that consumer-level psychological research further shows translates into measurable green skepticism, perceived risk, and reduced purchase intention. Empirically, real-world cases spanning the automotive, aviation, fossil fuel, and financial services sectors demonstrate that exposed greenwashing carries substantial and multi-jurisdictional legal, financial, and reputational consequences. Regulatorily, the past three years have produced the most significant wave of anti-greenwashing law since the concept first entered public discourse, though the trajectory of that wave — particularly in the European Union — remains uncertain, and measurement science, whether perception-based or computational, has not yet caught up with the pace of regulatory and commercial change.

Future research would benefit from at least five developments: theoretical models that integrate legitimacy, stakeholder, signaling, and institutional perspectives at multiple levels of analysis rather than treating them as

competing rather than complementary explanations; the development of standardized, verifiable measurement instruments and benchmark datasets — potentially combining perception-based scales with computational NLP approaches — to address the methodological uncertainty documented by Bernini et al. (2024) and Calamai et al. (2025); comparative empirical research examining how greenwashing manifests and is regulated in developing-economy contexts such as India, where consumer protection frameworks are new and enforcement capacity is still developing; conceptual and doctrinal work extending the definitional boundaries of greenwashing to account for adjacent practices such as greenhushing and greenwishing that current law does not yet clearly address; and dedicated research into greenwashing within financial markets, where the stakeholders, harms, and regulatory institutions differ meaningfully from the consumer product context that has dominated the literature to date. As environmental claims continue to proliferate across advertising, product labeling, corporate disclosure, and investment products, the theoretical, empirical, and regulatory clarity called for in this review will only grow more consequential

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