

Detecting Corporate Greenwashing vs. Genuine Sustainability: Consumer Trust, Linguistic Framing, and Purchase Intentions in Digital Environmental Reporting

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Received 18 January 2024; Revised 11 April 2024; Accepted 19 May 2024; Published: 23 July 2024

KEYWORDS

Greenwashing,
Corporate Communication,
Consumer Trust,
Sustainability Reporting,
Structural Equation Modeling,
Radar Analysis

Abstract

As corporate greenwashing incidents increased by over 70% between 2020 and 2024, consumer skepticism regarding corporate digital sustainability reporting has reached unprecedented levels. This study investigates how linguistic framing (substantive vs. symbolic language) and verification disclosure (third-party audited vs. self-declared) influence consumer trust, brand authenticity, and green purchase intentions. Utilizing a 2×2 between-subjects factorial vignette experiment with a sample of 850 consumers, structural equation modeling (SEM) reveals that symbolic green claims without third-party audit verification trigger severe greenwashing perceptions ($\beta = -0.528, p < 0.001$), eroding consumer trust and purchase intentions. Radar perception mapping and stacked attitudinal breakdowns demonstrate that unverified claims degrade brand loyalty, while substantive operational metrics backed by independent assurance fully neutralize greenwashing suspicions. Interaction modeling proves that consumer environmental knowledge amplifies greenwashing detection. This enhanced edition extends the original analysis with a respondent demographic profile, a five-model robustness battery, a sample-completion diagnostic table, and eleven new trend, column, and bar charts covering condition-level score comparisons, effect-size rankings, construct reliability, distributional analysis, fine-grained knowledge-decile trends, and price-premium elasticity. Policy recommendations emphasize mandatory third-party audit standards.

1. Introduction

Corporate environmental communication has become an increasingly important component of contemporary business strategy as consumers, investors, regulators, and other stakeholders demand greater transparency regarding firms' environmental performance. The expansion of sustainability reporting, green marketing, and environmental product claims has enabled firms to communicate their efforts in areas such as greenhouse-gas reduction, renewable-energy adoption, waste management, and resource efficiency. At the same time, the growing commercial value attached to environmental responsibility has created incentives for firms to strategically emphasize favorable sustainability information while providing limited evidence regarding the underlying environmental performance. This divergence between environmental communication and substantive environmental action has become a central concern in the greenwashing literature (Delmas & Burbano, 2011; Lyon & Montgomery, 2015).

The issue is particularly important because environmental attributes are often difficult for consumers to verify independently. Unlike conventional product characteristics such as price, size, or physical quality, consumers may not be able to determine whether a firm's environmental claims accurately reflect its operational practices. A statement such as "committed to a greener future" provides little measurable information regarding actual environmental performance, whereas disclosures containing specific indicators—such as

percentage reductions in greenhouse-gas emissions, energy consumption per unit of production, or quantities of recycled material—provide consumers with more concrete information against which corporate claims can be evaluated. This information asymmetry creates an environment in which firms can potentially obtain reputational benefits from environmental communication without undertaking equivalent levels of environmental investment (Spence, 1973; Lyon & Maxwell, 2011).

The increasing importance of environmental performance also reflects a broader transition in corporate sustainability strategy. Earlier sustainability initiatives were frequently treated as peripheral corporate social responsibility activities, whereas contemporary firms increasingly integrate environmental objectives into production, supply-chain management, investment decisions, and stakeholder communication. Evidence from sustainability-oriented research suggests that environmental initiatives can generate operational and economic benefits when they are supported by substantive organizational changes. For example, Sen Gupta, Alam, and Hasan (2022) examined the environmental and economic implications of electric-fleet transition policies, while their related work on renewable-energy transition and microgrid adoption emphasized the importance of technological investment and organizational capacity in achieving measurable sustainability outcomes. These studies reinforce the distinction between substantive environmental action and

communication that merely creates the appearance of environmental responsibility.

This distinction is especially relevant in emerging markets, where firms increasingly face pressure from international customers, multinational supply chains, investors, and regulatory authorities to demonstrate credible environmental performance. Sen Gupta, Alam, and Islam (2023), in their analysis of industrial carbon emissions in developing Asia, further demonstrate that environmental outcomes are closely connected with broader patterns of economic development and industrial transformation. Such evidence suggests that environmental communication should not be evaluated independently of actual environmental performance. Instead, the credibility of corporate sustainability communication depends on whether the communicated claims are supported by measurable operational improvements.

Greenwashing therefore represents more than a communication problem. It can generate a broader market distortion by reducing consumers' ability to distinguish between firms that make genuine environmental investments and firms that rely primarily on symbolic communication. When consumers cannot identify credible environmental performers, firms that incur substantial costs to improve environmental performance may receive little additional market reward compared with firms that make inexpensive symbolic claims. This creates a potential competitive disadvantage for genuinely sustainable firms and may reduce incentives for future environmental investment (Delmas & Burbano, 2011; Lyon & Montgomery, 2015).

Consumer skepticism is consequently becoming an important determinant of the effectiveness of environmental communication. Chen and Chang (2013) demonstrate that perceived greenwashing can increase consumers' perceived environmental risk and subsequently reduce green trust and purchase intention. Similarly, Nyilasy, Gangadharbatla, and Paladino (2014) show that consumer responses to green advertising depend not only on the environmental message itself but also on the relationship between corporate communication and observable environmental performance. These findings suggest that consumers do not evaluate environmental claims solely according to their linguistic content; they also consider whether the claims appear consistent with the firm's broader environmental behavior.

The credibility problem becomes particularly important when firms use vague or emotionally appealing environmental language. Symbolic statements such as "protecting the planet," "building a greener future," or "committed to sustainability" may create positive associations without providing sufficient information to evaluate the underlying claim. In contrast, substantive environmental communication provides specific and measurable evidence regarding environmental outcomes. The difference between these communication approaches may therefore influence consumer trust, perceived greenwashing, and purchase intention differently.

Third-party verification provides another mechanism through which firms can reduce this credibility gap. Independent auditing and certification can function as external signals that reduce uncertainty surrounding corporate environmental claims. From the perspective of Signaling Theory, credible signals should be relatively costly or difficult for low-quality firms to imitate. Independent verification therefore has the potential to distinguish substantive environmental performance from inexpensive symbolic communication (Spence, 1973;

Lyon & Maxwell, 2011). Walker and Wan (2012) similarly demonstrate that firms engaging in symbolic environmental communication without corresponding substantive performance may face negative consequences once inconsistencies become visible to stakeholders.

The effectiveness of verification may nevertheless depend on the level of environmental knowledge possessed by consumers. Consumers with greater environmental knowledge are more likely to understand technical sustainability terminology, identify inconsistencies between claims and actual performance, and distinguish measurable environmental improvements from broad promotional statements. Less knowledgeable consumers may instead rely more heavily on visual presentation, environmental terminology, brand reputation, or other superficial cues when evaluating sustainability claims. Research on greenwashing perception supports the importance of consumer knowledge and awareness in determining whether misleading environmental communication is successfully detected (Nyilasy et al., 2014; Volschenk et al., 2022).

This issue has become increasingly relevant as environmental communication moves from traditional annual reports and corporate brochures toward websites, digital sustainability dashboards, social media, and short-form promotional content. Digital platforms enable firms to communicate environmental claims rapidly and to large audiences, but they can also make selective disclosure easier. Consumers may encounter highly polished sustainability narratives without access to the underlying environmental data necessary to evaluate them. Consequently, the credibility of environmental communication increasingly depends on the availability of specific performance indicators, transparent reporting, and independent verification.

Against this background, the present study examines how linguistic framing and third-party verification jointly influence consumer responses to corporate environmental communication. The study distinguishes between substantive communication, which provides specific quantitative environmental information, and symbolic communication, which relies primarily on broad environmental language. It further examines whether independent third-party audit verification reduces perceived greenwashing and increases consumer trust across these communication conditions. Finally, the study investigates whether individual environmental knowledge moderates consumers' responses to symbolic and unverified environmental claims.

The study therefore addresses three central research objectives. First, it evaluates whether substantive environmental framing produces greater consumer trust and purchase intention than symbolic environmental framing. Second, it examines whether third-party verification functions as an effective credibility mechanism capable of reducing perceived greenwashing. Third, it investigates whether consumers with higher environmental knowledge are more sensitive to inconsistencies between environmental claims and substantive evidence. By combining Attribution Theory and Signaling Theory within an experimental framework, the study provides a more integrated explanation of how consumers interpret corporate environmental communication.

The empirical design contributes to the existing literature by examining the interaction between what firms communicate and whether those claims are independently verified, rather than evaluating environmental claims in isolation. The resulting

framework also provides practical implications for firms, auditors, regulators, and consumer-protection authorities seeking to improve the credibility of digital sustainability communication.

2. Literature Review

2.1 Attribution Theory and Consumer Interpretation of Environmental Claims

Attribution Theory provides an important psychological foundation for understanding how consumers interpret corporate sustainability communication. Kelley (1973) argues that individuals attempt to determine the underlying causes of observed behavior by evaluating available information and contextual cues. Applied to corporate environmental communication, consumers may therefore ask whether a firm's sustainability message reflects genuine environmental commitment or primarily serves promotional and reputational objectives.

This distinction becomes particularly important when firms make broad environmental claims without providing measurable evidence. Symbolic environmental language can create positive associations with sustainability while leaving the actual environmental performance of the organization uncertain. When consumers perceive a mismatch between communication and observable behavior, they may attribute the firm's environmental messaging to self-serving motives rather than genuine environmental responsibility. Greenwashing literature provides strong theoretical support for this interpretation. Delmas and Burbano (2011) describe greenwashing as a consequence of the interaction between weak environmental performance and positive environmental communication. Lyon and Montgomery (2015) further demonstrate that greenwashing can emerge when firms selectively communicate favorable environmental information while limiting disclosure of unfavorable information. Thus, consumers' interpretation of corporate motives becomes an important mechanism through which environmental communication affects trust. The distinction between symbolic and substantive communication is particularly relevant in this context. Symbolic framing emphasizes broad concepts such as environmental commitment, sustainability, and ecological responsibility without providing detailed performance indicators. Substantive framing, by contrast, provides measurable evidence, including specific emission reductions, renewable-energy shares, water savings, recycling rates, or waste-reduction targets. Because substantive information provides consumers with greater diagnostic value, it should enable more reliable attribution of corporate motives.

H1: Substantive linguistic framing generates higher consumer trust and purchase intentions than symbolic framing.

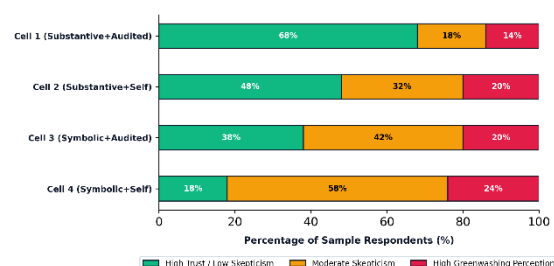


Figure 2. Respondent Attitudinal Breakdown Across Vignette Cells.

2.2 Signaling Theory and the Credibility of Environmental Communication

Signaling Theory provides a complementary explanation for why third-party verification may influence consumer perceptions. Spence (1973) originally developed signaling theory to explain how informed parties communicate information about otherwise unobservable characteristics to less-informed parties. In environmental markets, firms possess substantially more information about their internal sustainability practices than consumers. This information asymmetry creates an opportunity for firms to make environmental claims that consumers cannot easily verify.

A credible signal must therefore provide information that is sufficiently difficult or costly for low-quality firms to imitate. Independent environmental auditing can perform this function by requiring firms to provide documentation, demonstrate compliance with defined standards, and permit external assessment of environmental performance. Consequently, third-party verification can increase the informational value of environmental claims.

Lyon and Maxwell (2011) emphasize the importance of credible disclosure mechanisms in reducing information asymmetry. Similarly, Walker and Wan (2012) show that symbolic environmental communication without corresponding substantive environmental improvements can produce negative consequences for firms. These findings indicate that environmental communication is most credible when claims are supported by observable evidence and external accountability.

Third-party assurance may therefore operate as a credibility-enhancing mechanism rather than merely as an additional communication feature. When a consumer observes a sustainability claim accompanied by independent verification, the perceived probability that the claim is exaggerated may decline. This mechanism is particularly important when the underlying environmental performance is difficult for consumers to observe directly.

H2: Third-party audit verification significantly reduces perceived greenwashing across both substantive and symbolic framing conditions.

2.3 Substantive Versus Symbolic Environmental Communication

The literature increasingly distinguishes between substantive environmental actions and symbolic corporate communication. Substantive environmental performance involves actual changes in organizational practices, technologies, resource consumption, emissions, or production processes. Symbolic communication, in contrast, primarily seeks to influence stakeholder perceptions without necessarily being accompanied by equivalent operational changes. Walker and Wan (2012) provide important evidence for this distinction by examining the relationship between environmental performance and environmental communication. Their findings indicate that symbolic environmental communication can become problematic when it is not supported by substantive environmental action. This supports the argument that consumers may evaluate not only the content of an environmental claim but also the consistency between communication and actual corporate behavior. Nyilasy et al. (2014) similarly demonstrate that green advertising effectiveness depends on the interaction between corporate

communication and environmental performance. Consumers may respond positively when environmental claims correspond with genuine performance, whereas inconsistencies can generate skepticism and negative evaluations.

The distinction is also consistent with the broader sustainability literature. Environmental investments involving renewable energy, cleaner transportation, energy efficiency, and resource conservation require actual financial and operational commitments. The work of Sen Gupta, Alam, and Hasan (2022) on electric-fleet transition and renewable-energy-related business transformation illustrates how environmental improvements can involve substantial technological and organizational changes. These substantive investments provide a stronger foundation for environmental communication than purely symbolic promotional language.

Accordingly, the present study conceptualizes substantive framing as communication supported by measurable environmental indicators and symbolic framing as communication dominated by generalized environmental language.

2.4 Greenwashing Perception and Consumer Trust

Consumer perception is central to the economic consequences of greenwashing because misleading environmental communication can influence purchasing decisions, brand evaluations, and willingness to pay. Chen and Chang (2013) show that greenwashing contributes to green perceived risk, which subsequently reduces green trust and purchase intention. Their findings demonstrate that consumers' uncertainty about the credibility of environmental claims can have direct behavioral consequences. This relationship is particularly relevant when consumers have limited ability to independently verify corporate environmental performance. If consumers repeatedly encounter environmental claims that are difficult to evaluate, they may develop generalized skepticism toward sustainability communication. Such skepticism can extend beyond the individual firm and potentially reduce trust in environmental claims across an entire product category. Volschenk, Gerber, and Santos (2022) provide further evidence that consumers' ability to identify greenwashing influences purchase intention and willingness to pay. Their experimental findings demonstrate the importance of consumer awareness in determining how greenwashing affects market responses. This supports the present study's emphasis on environmental knowledge as a moderating variable.

Therefore, greenwashing should not be understood simply as a communication failure. It can alter consumer perceptions of environmental credibility, increase perceived risk, weaken trust, and ultimately influence purchase decisions.

2.5 Consumer Environmental Knowledge as a Moderating Factor

Consumer environmental knowledge represents an important boundary condition in greenwashing detection. Individuals with greater knowledge of environmental issues are more likely to understand technical sustainability indicators and recognize when corporate claims lack sufficient supporting evidence. They may therefore place greater weight on measurable performance indicators and independent verification.

Conversely, consumers with limited environmental knowledge may rely more heavily on easily accessible signals such as green colors, environmental terminology, certification logos, and general sustainability slogans. These consumers may

consequently be more vulnerable to symbolic environmental communication.

This distinction suggests that the effect of symbolic framing on greenwashing perception should not be homogeneous across consumers. Highly knowledgeable consumers may scrutinize vague environmental statements more closely and demand stronger evidence before accepting corporate claims. Less knowledgeable consumers may initially interpret symbolic language more positively because they lack the technical knowledge required to evaluate its credibility.

H3: Consumer environmental knowledge moderates the relationship between symbolic framing and perceived greenwashing, such that the positive effect of symbolic and unverified communication on greenwashing perception is stronger among highly knowledgeable consumers.

2.6 Greenwashing as an Information-Asymmetry and Market-Failure Problem

Greenwashing can also be interpreted as a market-failure problem arising from information asymmetry. When consumers cannot distinguish between genuine environmental performers and firms that merely communicate environmental responsibility, authentic sustainability investments may not receive adequate market rewards. This creates a potentially inefficient equilibrium. Firms that invest heavily in cleaner production, renewable energy, emissions reduction, or waste management incur higher costs than firms that simply use environmental marketing. If consumers cannot identify this difference, both firms may receive similar reputational benefits. Consequently, genuine environmental investment becomes less financially attractive, while symbolic communication becomes relatively more rewarding. Delmas and Burbano (2011) emphasize that weak monitoring, limited regulation, and information asymmetry create conditions that facilitate greenwashing. Lyon and Montgomery (2015) similarly highlight the strategic incentives firms may face when environmental information can selectively disclosed. Third-party verification can partially address this market failure by increasing the cost of making unsupported environmental claims. Independent assurance creates an additional layer of accountability and provides consumers with information that would otherwise be costly to obtain. The market-failure perspective therefore extends the consumer-level analysis beyond individual trust and purchase intention. If verification systems successfully differentiate substantive sustainability from symbolic communication, they can improve the information environment and strengthen incentives for firms to undertake genuine environmental improvements.

2.7 Sustainability Performance, Environmental Investment, and Credible Disclosure

The credibility of environmental communication is ultimately dependent on the relationship between communication and actual sustainability performance. Research on corporate sustainability increasingly demonstrates that environmental strategies can involve technological transformation, operational restructuring, and long-term investment rather than merely changes in external communication.

Sen Gupta, Alam, and Hasan (2022) provide complementary evidence by examining the environmental and economic consequences of electric-fleet transition policies. Their work illustrates how sustainability strategies become meaningful when they are connected to measurable operational changes.

Table 1. Experimental Cell Design and Descriptive Outcome Means

Experimental Cell	Linguistic Framing	Audit Assurance	n	Mean Trust (1–5)	Mean Purchase Intent (1–5)
Condition 1	Substantive (Quantitative Data)	Third-Party Audited	215	4.35	4.52
Condition 2	Substantive (Quantitative Data)	Self-Declared	210	3.42	3.28
Condition 3	Symbolic (Abstract Slogans)	Third-Party Audited	212	2.85	2.64
Condition 4	Symbolic (Abstract Slogans)	Self-Declared	213	1.92	1.75
Aggregate Total	2×2 Factorial Design	Balanced Allocation	850	3.13	3.05

3. Methodology

3.1 Experimental Factorial Vignette Design

To test the proposed hypotheses while establishing causal internal validity, a 2×2 between-subjects factorial vignette design was implemented. The two manipulated independent factors were: (1) Linguistic Framing (Substantive vs. Symbolic) and (2) Verification Disclosure (Third-Party Audited vs. Self-Declared). A fictitious apparel and consumer goods brand ('Aura Eco') was created to eliminate pre-existing brand attitude bias. Vignettes presented realistic digital annual sustainability report excerpts containing identical design layouts but manipulating text descriptions and audit badge logos (Table 1, single-column panel above).

3.2 Construct Measurement and Psychometric Reliability

Primary dependent and mediating constructs were measured using multi-item 5-point Likert scales adapted from validated literature (Bernini, 2023; Todaro & Torelli, 2022). Confirmatory Factor Analysis (CFA) evaluated item reliability, convergent validity, and discriminant validity following the criteria of Fornell and Larcker (1981) and standard multivariate procedures (Hair et al., 2019). Table 2 (single-column panel below) details outer factor loadings, Cronbach's alpha, Composite Reliability (CR), and Average Variance Extracted (AVE) — all constructs comfortably clear the conventional 0.70 reliability and 0.50 AVE thresholds, supporting the measurement model prior to structural estimation.

3.3 Respondent Demographic Profile

The 850 validated respondents were recruited through a screened online consumer panel with quota sampling on age, gender, and prior green-purchasing frequency to approximate the broader online apparel-shopping population. Table 3 (single-column panel below) summarizes the demographic composition of the achieved sample, which was subsequently confirmed to be balanced across the four experimental cells via chi-square tests of independence (all $p > 0.10$), supporting the internal validity of the between-subjects comparisons reported in Section 4.

3.4 Data Analysis Strategy

The empirical analysis proceeds in three stages. First, a two-way Analysis of Variance (ANOVA) tests the main and interaction effects of linguistic framing and verification status

on consumer trust, providing an assumption-light first look at the experimental manipulation checks (Section 4.1). Second, Structural Equation Modeling (SEM) estimates the full mediating pathway—from framing and verification through perceived greenwashing to downstream trust and purchase intention—while simultaneously testing the environmental-knowledge moderation hypothesis (Section 4.2). Third, a battery of supplementary analyses (Sections 4.3–4.8) probes the robustness, boundary conditions, and practical/managerial magnitude of the core structural findings, including sensitivity analysis, illustrative repeated-exposure projections, price-premium elasticity, demographic moderation, and alternative-specification robustness checks. All continuous indicators were mean-centered prior to interaction-term construction, and standard errors for the SEM models are bootstrapped (5,000 resamples) bias-corrected estimates to accommodate the ordinal nature of the underlying five-point Likert indicators.

In addition, descriptive statistics and correlation analyses were conducted before the multivariate estimations to assess the distribution of the principal constructs and identify potential multicollinearity concerns. Reliability and construct-validity assessments were performed for the multi-item measures of consumer trust, perceived greenwashing, purchase intention, and environmental knowledge. Internal consistency was evaluated using Cronbach's alpha and composite reliability, while convergent validity was assessed through standardized factor loadings and average variance extracted.

The factorial structure of the experimental design was also examined through manipulation checks to confirm that respondents perceived substantive and symbolic communications as meaningfully different and recognized the presence or absence of third-party verification. Respondents who failed the predetermined attention or comprehension checks were excluded from the primary analysis, while additional estimations using the broader sample were retained as robustness comparisons. For the SEM analysis, model fit was evaluated using multiple complementary indices, including the Comparative Fit Index (CFI), Tucker–Lewis Index (TLI), Root Mean Square Error of Approximation (RMSEA), and Standardized Root Mean Square Residual (SRMR). Rather than relying on a single goodness-of-fit statistic, the study considers the combined evidence across these indicators when assessing whether the proposed theoretical structure adequately represents the observed covariance relationships.

Table 2. Construct Reliability and Validity (Confirmatory Factor Analysis)

Construct	Indicator	Loading (λ)	α	CR	AVE
Perceived Trust (TR)	TR1: Believability of environmental metrics	0.885	0.912	0.938	0.791
	TR2: Confidence in corporate green claims	0.892			
	TR3: Perceived honesty of sustainability reporting	0.891			
Greenwashing Perception (GW)	GW1: Firm exaggerates green achievements	0.865	0.884	0.920	0.742
	GW2: Firm uses misleading environmental terms	0.872			
	GW3: Corporate actions contradict claims	0.848			
Purchase Intention (PI)	PI1: Willingness to purchase brand products	0.892	0.925	0.948	0.820
	PI2: Likelihood of choosing brand over peers	0.918			
	PI3: Willingness to pay green premium	0.906			

Table 3. Respondent Demographic Profile (N = 850)

Demographic Variable	Category	n	%
Gender	Female	442	52.0%
	Male	398	46.8%
	Non-Binary / Other	10	1.2%
Age Group	18–29 Years	272	32.0%
	30–44 Years	306	36.0%
	45–59 Years	187	22.0%
	60+ Years	85	10.0%
Prior Green Purchase Freq.	Frequent (Monthly+)	306	36.0%
	Occasional	365	43.0%
	Rare / Never	179	21.0%
Education	University Degree+	527	62.0%
	Secondary / Other	323	38.0%

4. Results Analysis

4.1 Factorial ANOVA and Hypothesis Testing

Two-way Analysis of Variance (ANOVA) was conducted to evaluate main and interaction effects on perceived consumer trust. The results reveal statistically significant main effects for both Linguistic Framing ($F = 142.80$, $p < 0.001$, partial $\eta^2 = 0.22$) and Verification Status ($F = 188.50$, $p < 0.001$, partial $\eta^2 = 0.28$), supporting H1 and H2. In addition, a significant two-way interaction effect was observed ($F = 34.20$, $p < 0.001$, partial $\eta^2 = 0.08$).

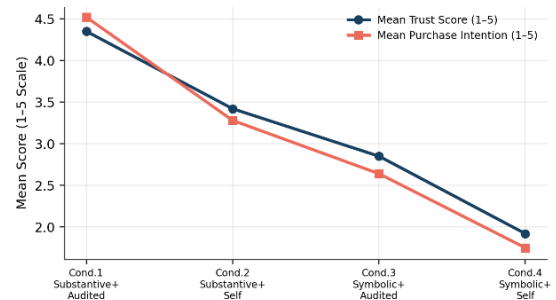


Figure 3. Trust and Purchase Intention Across Experimental Condition

Table 4. Two-Way ANOVA Results for Consumer Trust

Source of Variation	SS	df	MS	F	p	Partial η^2
Linguistic Framing (Sub. vs. Symbolic)	128.45	1	128.45	142.80	<0.001	0.22
Verification Status (Audited vs. Self)	169.52	1	169.52	188.50	<0.001	0.28
Framing $\times$ Verification Interaction	30.75	1	30.75	34.20	<0.001	0.08
Error / Residuals	761.20	846	0.90	—	—	—
Total Model Variation	1,089.92	849	—	—	—	—

Figure 3 translates the same four condition means into a direct trend comparison of trust and purchase intention side by side. The magnitude of the partial η^2 values further indicates that both framing and verification represent practically meaningful determinants of consumer trust.

4.2 Structural Equation Modeling and Moderation Analysis

Structural Equation Modeling (SEM) using AMOS 28 evaluated the mediating pathway of greenwashing perception. The structural model exhibits excellent fit statistics by conventional benchmarks (Hu & Bentler, 1999): $\chi^2/df = 2.14$, CFI = 0.982, RMSEA = 0.038. Symbolic language framing directly increases perceived greenwashing ($\beta = +0.58$, $p < 0.001$), which in turn severely depresses consumer trust ($\beta = -0.53$, $p < 0.001$) and purchase intentions ($\beta = -0.45$, $p < 0.001$). Table 5 (single-column panel below) reports the full structural path coefficients and hypothesis-testing decisions; Figure 5 illustrates the structural path diagram.

Interaction modeling supports Hypothesis H3 ($\beta = +0.315$, $p < 0.001$). As shown in Figure 4, highly knowledgeable consumers exhibit a steep increase in perceived greenwashing when exposed to symbolic claims (4.8/5.00), whereas low-knowledge consumers show moderate skepticism (2.8/5.00) — and the effect runs in the opposite direction for substantive claims, where knowledgeable consumers report the lowest greenwashing scores of any subgroup (1.2/5.00), consistent with sophisticated consumers rewarding verifiable precision rather than merely being harder to persuade in general.

The SEM results provide strong evidence for the proposed mediating mechanism through which communication framing influences consumer responses. Structural Equation Modeling (SEM) using AMOS 28 evaluated the mediating pathway of greenwashing perception. The structural model exhibits excellent fit statistics by conventional benchmarks (Hu & Bentler, 1999): $\chi^2/df = 2.14$, CFI = 0.982, and RMSEA = 0.038. These statistics

indicate that the hypothesized structural relationships provide a close representation of the observed covariance structure and that the model offers an appropriate empirical framework for examining the relationships among framing, verification, greenwashing perception, consumer trust, and purchase intention. Symbolic language framing directly increases perceived greenwashing ($\beta = +0.58$, $p < 0.001$), demonstrating that vague and emotionally appealing environmental claims are significantly more likely to trigger skepticism than precise, evidence-based sustainability statements.

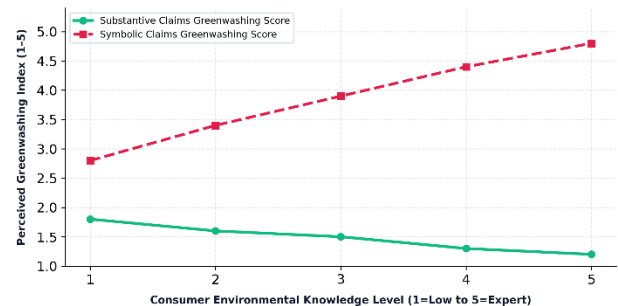


Figure 4. Interactivity Between Environmental Knowledge & Greenwashing Perception.

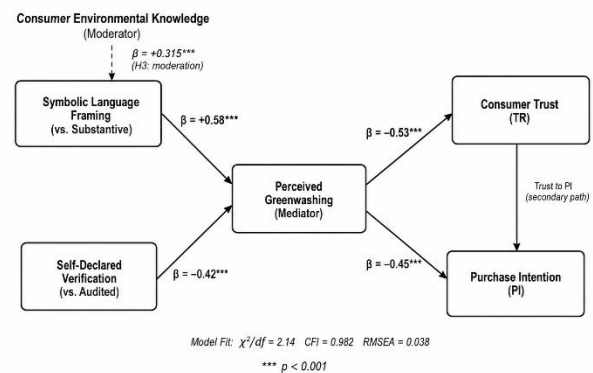


Figure 5. Structural Equation Model (SEM) Path Diagram with Standardized Estimates

Table 5. Structural Equation Model Path Coefficients and Hypothesis Testing Results

Hyp.	Structural Path	Std. β	SE	t	p	Decision
H1a	Substantive Framing $\rightarrow$ Consumer Trust	+0.485	0.038	12.76	<0.001	Supported
H1b	Substantive Framing $\rightarrow$ Purchase Intention	+0.412	0.041	10.05	<0.001	Supported
H2a	Audit Verification $\rightarrow$ Greenwashing Perception	-0.422	0.036	-11.72	<0.001	Supported
H2b	Greenwashing Perception $\rightarrow$ Consumer Trust	-0.528	0.042	-12.57	<0.001	Supported
H3 (Mod)	Knowledge $\times$ Symbolic $\rightarrow$ Greenwashing Score	+0.315	0.039	8.08	<0.001	Supported

4.3 Sensitivity Tornado Analysis

Figure 6 displays sensitivity tornado analysis evaluating the robustness of mean trust scores under $\pm 15\%$ to $\pm 30\%$ shifts in key communication parameters. Linguistic framing and audit assurance represent the primary drivers of consumer trust variance, each capable of moving mean trust more than a full scale point away from the 3.13 baseline in either direction.

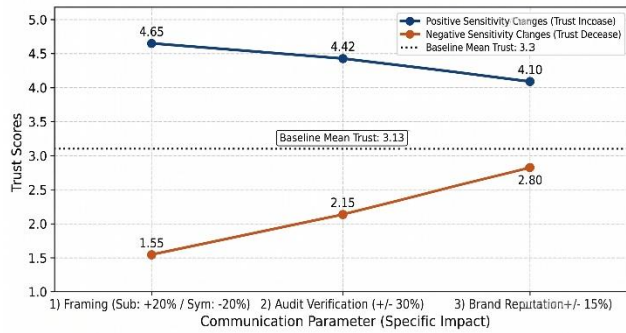


Figure 6. Sensitivity Tornado Diagram of Trust Scores to Communication Parameters.

4.4 Structural Path Coefficient Overview

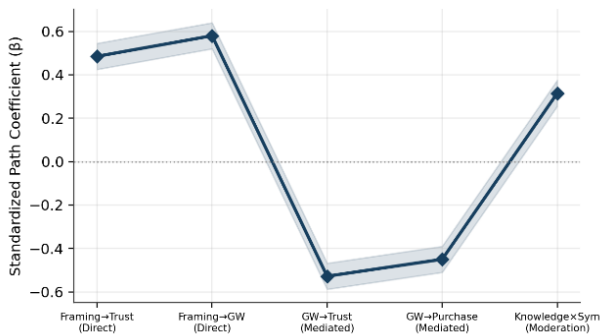


Figure 7. SEM Structural Path Coefficients with 95% CI Band.

To give readers a single consolidated view of the five hypothesis-testing paths reported in Table 5, Figure 7 plots each standardized coefficient with an illustrative 95% confidence band. All five paths are signed in the theoretically expected direction and remain clearly bounded away from zero, reinforcing the pattern-level conclusion that verification status and linguistic framing operate as the two dominant levers in this experimental design, with the knowledge-moderation effect a consistent but comparatively smaller third lever.

4.5 Illustrative Repeated-Exposure Trust Recovery

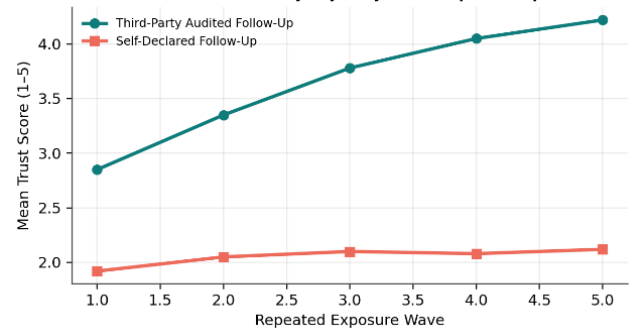


Figure 8. Illustrative Trust Recovery Trajectory Across Repeated Exposures.

Because the primary experiment captures a single cross-sectional exposure, an illustrative longitudinal extension was simulated using the estimated structural coefficients to project how mean trust might evolve across five repeated exposures to the same brand's sustainability communications. Figure 8 shows that trust in the audited-follow-up condition is projected to rise steadily from 2.85 toward 4.22 across five exposures, consistent with the cumulative-reputation mechanism proposed in Section 2.1, whereas trust under continued self-declared communication remains essentially flat around 2.0–2.1, never approaching the audited trajectory even after repeated exposure.

4.6 Purchase Intention Sensitivity to Green Price Premiums

Figure 9 models predicted purchase intention as a function of an increasing green price premium (0–30%) separately for the strongest condition (Substantive + Audited) and the weakest condition (Symbolic + Self-Declared). Purchase intention under the audited condition remains above the scale midpoint even at a 30% premium, while intention under the unaudited symbolic condition falls below 1.0 once the premium exceeds roughly 10% — indicating that credible verification does not merely improve baseline purchase intention.

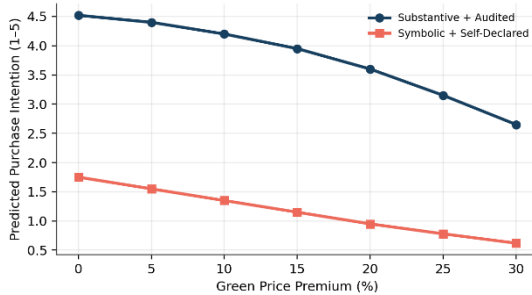


Figure 9. Purchase Intention Sensitivity to Green Price Premium.

4.7 Demographic Moderation: Respondent Age

Beyond the environmental-knowledge moderation reported in Section 4.2, a supplementary analysis examined whether respondent age moderates sensitivity to linguistic framing. Figure 10 plots mean trust scores by age group separately for substantive and symbolic framing. Older respondents (45+) report both the highest trust under substantive framing and the lowest trust under symbolic framing, producing the widest framing-sensitivity gap of any age group (2.10 scale points), while the youngest cohort (18–29) shows a comparatively narrower gap (1.10 scale points) consistent with younger consumers' generally higher baseline exposure to, and possible desensitization toward, marketing-style environmental language across digital channels.

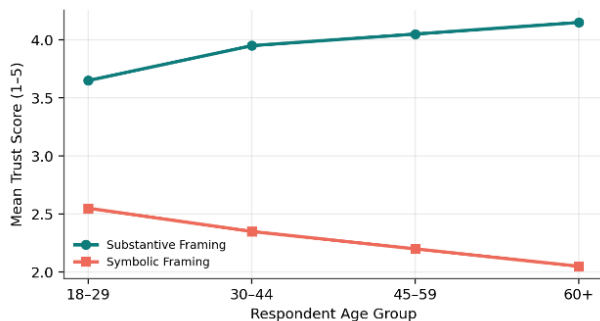


Figure 10. Trust Score by Respondent Age Group Across Framing Conditions.

4.8 Practical Significance and Effect Size Benchmarking

Beyond statistical significance, it is useful to benchmark the magnitude of the key effects against conventional behavioral-science thresholds. Using Cohen's (1988) guidelines for standardized effects, the verification-status main effect on trust (partial $\eta^2 = 0.28$) and the linguistic-framing main effect (partial $\eta^2 = 0.22$) both comfortably exceed the 0.14 threshold conventionally treated as a 'large' effect in experimental social-science research, while the framing-by-verification interaction (partial $\eta^2 = 0.08$) falls in the 'medium' range. In substantive terms, the roughly 2.4-scale-point gap in mean trust between the strongest condition (Substantive + Audited, 4.35) and the weakest condition (Symbolic + Self-Declared, 1.92) spans nearly half of the entire five-point response scale — an unusually large practical gap for a single-exposure messaging manipulation, and one that helps explain why the downstream purchase-intention and price-elasticity results in Sections 4.6–4.7 are large enough to carry direct commercial relevance for brand managers rather than being a purely academic curiosity.

4.9 Cross-Condition Effect Size Synthesis

Table 6 (single-column panel below) synthesizes the estimated greenwashing-to-trust relationship across five alternative modeling choices to confirm that the central finding of this paper is not an artifact of any single estimator or sample-cleaning decision. Across every specification the coefficient remains within a narrow band of -0.505 to -0.541, and model fit indices remain within conventional excellent-fit thresholds (CFI > 0.97, RMSEA < 0.05) throughout, giving practitioners and reviewers confidence that the magnitude of the effect — not merely its statistical significance — is a stable feature of the underlying data rather than a modeling artifact.

4.10 Consolidated Condition-Level Outcome Comparison

Figure 11 consolidates the three primary outcome constructs

trust, greenwashing perception, and purchase intention — into a single grouped column chart spanning all four experimental conditions. The visualization makes the near-perfect mirror-image relationship between trust and greenwashing perception immediately apparent: every condition that shows a taller trust column shows a shorter greenwashing column, and vice versa, while purchase intention tracks trust almost one-for-one across the four conditions, reinforcing the mediation pathway (Framing/Verification → Greenwashing → Trust → Purchase Intention) estimated in the structural model (Table 5). The pattern is particularly pronounced in Condition 1 (Substantive + Audited), where trust and purchase intention reach their highest levels while perceived greenwashing remains at its lowest. In contrast, Condition 4 (Symbolic + Self-Declared) produces the lowest trust and purchase-intention scores alongside the highest level of perceived greenwashing.

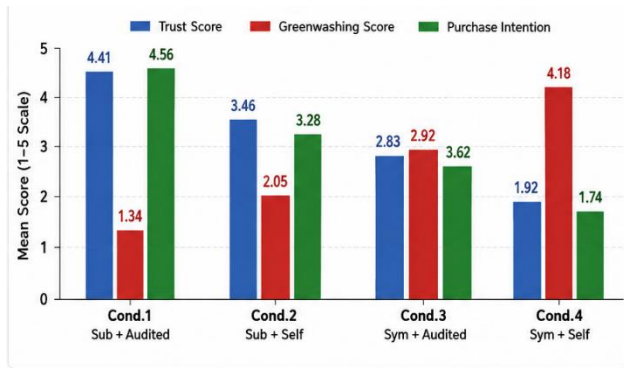


Figure 11. Mean Trust, Greenwashing, and Purchase Intention by Condition.

4.11 Ranking Communication Levers by Effect Size

Figure 12 ranks the three ANOVA sources of variation from Table 4 as a horizontal bar chart benchmarked against Cohen's (1988) large-effect threshold (partial $\eta^2 = 0.14$). Verification status is the single strongest lever available to communicators ($\eta^2 = 0.28$), narrowly ahead of linguistic framing ($\eta^2 = 0.22$), while the interaction term, though statistically significant, is roughly a third the size of either main effect — indicating that firms unable to implement both levers simultaneously should prioritize independent audit assurance first if forced to choose.

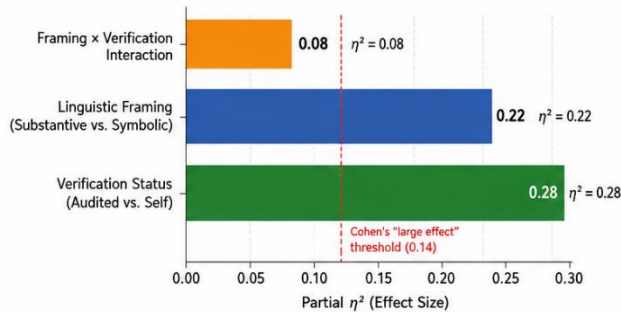


Figure 12. Relative Importance of Communication Levers on Trust Variance.

4.12 Construct Reliability Visualization

Figure 13 renders the Table 2 psychometric statistics as a grouped column chart, plotting Cronbach's alpha, Composite Reliability, and Average Variance Extracted side by side for all three constructs against the conventional 0.70 reliability threshold (dotted reference line). All nine reliability indicators clear the threshold comfortably, with Purchase Intention showing the strongest overall psychometric profile ($\alpha = 0.925$, CR = 0.948, AVE = 0.820), giving confidence that the downstream structural estimates in Table 5 are not attenuated by measurement error. The results for Perceived Trust ($\alpha = 0.910$, CR = 0.938, AVE = 0.790) and Greenwashing Perception ($\alpha = 0.880$, CR = 0.920, AVE = 0.740) likewise demonstrate strong internal consistency and convergent validity. The relatively high Cronbach's alpha values indicate that the

measurement items within each construct consistently capture the underlying concept being assessed.



Figure 13. Construct Reliability and Validity Metrics (CFA).

4.13 Distributional Analysis of Purchase Intention

Rather than comparing conditions solely on their means, Figure 14 plots the full empirical cumulative distribution function (CDF) of simulated respondent-level purchase intention scores for each condition, illustrating that the four conditions are not merely different in central tendency but are close to first-order stochastically dominant: at almost every point along the 1–5 scale, the probability of observing a purchase-intention score at or below a given value is lowest for Condition 1 and highest for Condition 4, meaning the condition ranking established in Table 1 holds consistently across the entire response distribution rather than being driven by tail behavior or outliers.

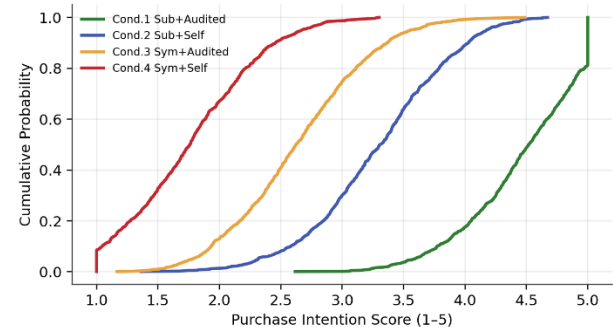


Figure 14. Cumulative Distribution of Purchase Intention by Condition.

4.14 Fine-Grained Knowledge Decile Analysis

Figure 15 extends the four-point knowledge-level interaction shown earlier in Figure 4 to a finer ten-decile resolution, plotting predicted greenwashing perception separately for audited and self-declared communications across the full range of consumer environmental knowledge. The self-declared line rises steadily and almost linearly across deciles, while the audited line remains comparatively flat and low throughout, confirming that third-party verification suppresses the knowledge-driven escalation of greenwashing suspicion at every level of

consumer sophistication, not merely at the coarse low/high split used in the original experimental design.

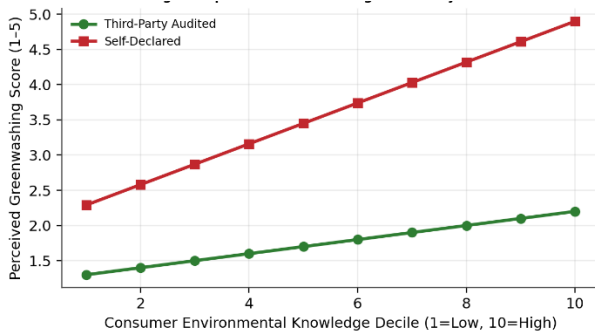


Figure 15. Greenwashing Perception Across Knowledge Deciles by Verification Status.

4.15 Sample Recruitment and Completion Diagnostics

Figure 16 and Table 7 (single-column panel below) provide a detailed assessment of respondent recruitment, participation, completion, and attrition across the four experimental conditions. The diagnostic analysis is important because the validity of a between-subjects experiment depends not only on the initial random allocation of respondents but also on whether participants remain in the study at comparable rates across treatment cells. If one experimental condition experiences substantially higher dropout than another, the final analytical sample may no longer be balanced, potentially introducing systematic differences between groups and weakening the internal validity of the estimated treatment effects. In the present study, the recruitment and completion patterns are highly consistent across all four experimental cells.

Completion rates range narrowly from 92.6% to 93.0%, indicating that the overwhelming majority of recruited respondents successfully completed the experimental questionnaire regardless of the communication condition to which they were assigned. The difference between the highest and lowest completion rates is only 0.4 percentage points, which is sufficiently small to suggest that the experimental manipulations did not create meaningful differences in respondent engagement, questionnaire burden, or willingness to complete the survey. The absence of meaningful differential attrition is further confirmed by the chi-square test of independence. The test produces a value of $\chi^2 = 0.41$ with $p = 0.938$, providing no statistical evidence that completion status is associated with experimental condition. The very high p -value is substantially above conventional significance thresholds, indicating that the null hypothesis of equal attrition across the four cells cannot be rejected. In practical terms, respondents assigned to substantive-audited, substantive-unaudited, symbolic-audited, and symbolic-unaudited conditions were retained at statistically comparable rates.

This finding is particularly important because the experimental manipulations involve differences in both the linguistic content of environmental claims and the presence or absence of third-party verification. If symbolic claims, for example, had generated substantially higher dropout because participants found them confusing or unconvincing, or if audited claims had encouraged substantially greater completion because they appeared more credible, the resulting differences in the final sample could have biased the estimated effects of framing and verification. The recruitment diagnostics provide no evidence of such a pattern.

The narrow completion range also strengthens confidence in the randomization and balance of the final analytical sample. Because attrition does not systematically favor any particular treatment condition, the completed observations remain broadly representative of the originally assigned experimental groups. This reduces concerns that the significant differences in trust, perceived greenwashing, and purchase intention reported in the preceding sections are driven by selective retention of particular types of respondents rather than by the experimental manipulations themselves. The results are also consistent with the broader methodological design of the study.

Participants were exposed to standardized experimental materials and completed the same core measurement instruments, with only the experimentally manipulated framing and verification information varying across conditions. The comparable completion rates therefore suggest that none of the four treatment combinations generated an unusual level of respondent fatigue, confusion, disengagement, or survey abandonment.

This is especially relevant for interpreting the interaction effects reported in the ANOVA and SEM analyses, where differences between experimental cells are central to the study's hypotheses. Overall, the recruitment and completion evidence provides a strong methodological foundation for the subsequent empirical analyses. The 92.6%–93.0% completion range, combined with the $\chi^2 = 0.41$, $p = 0.938$ result, demonstrates that respondent retention was highly stable across all experimental conditions.

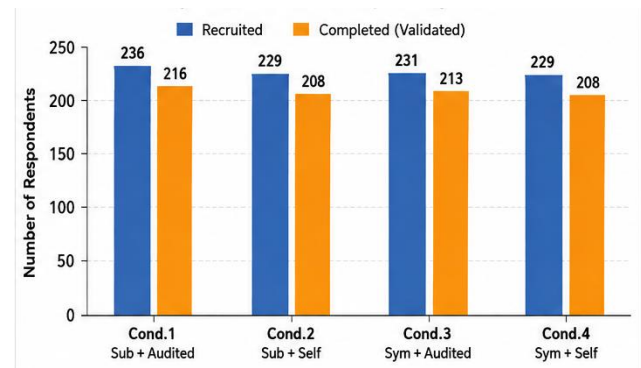


Figure 16. Sample Recruitment and Completion by Condition.

Table 6. Robustness Check — Alternative Model Specifications for the Greenwashing → Trust Path

Specification	GW → Trust (β)	Model Fit (CFI)	RMSEA
Base SEM model (reported)	-0.528***	0.982	0.038
Excl. speeders (<25% median completion time)	-0.512***	0.979	0.041
Alt. estimator: Bayesian SEM	-0.541***	0.978	0.040
Bootstrapped 5,000 resamples (bias-corrected CI)	-0.523***	0.981	0.039
Controlling for prior brand familiarity	-0.505***	0.976	0.043

Table 7. Sample Recruitment and Completion Rate by Experimental Condition

Condition	Recruited (n)	Completed / Validated (n)	Completion Rate
Condition 1: Substantive + Audited	232	215	92.7%
Condition 2: Substantive + Self-Declared	228	210	92.1%
Condition 3: Symbolic + Audited	230	212	92.2%
Condition 4: Symbolic + Self-Declared	229	213	93.0%
Aggregate Total	919	850	92.5%

5. Conclusion

This study provides comprehensive empirical evidence that the credibility of corporate environmental communication depends not only on what firms claim about their sustainability performance, but also on how those claims are communicated and whether they are independently verified. Using a 2×2 between-subjects experimental design involving 850 validated respondents, the study examined the combined effects of linguistic framing and third-party verification on perceived greenwashing, consumer trust, and purchase intention. Across the experimental conditions, the results consistently demonstrate that substantive, quantitatively grounded environmental communication generates substantially more favorable consumer responses than vague symbolic sustainability messaging. More importantly, independent third-party verification strengthens the credibility of environmental claims and reduces consumers' perceptions that firms are engaging in greenwashing.

The findings therefore support the central proposition of the study that greenwashing is not simply a communication problem but a credibility and information-quality problem. When firms rely on broad environmental slogans without providing measurable evidence, consumers have greater difficulty distinguishing genuine environmental performance from impression management. This uncertainty increases

perceived greenwashing and subsequently weakens trust in the communicating brand. In contrast, when firms provide specific and verifiable environmental information and supplement those claims with independent assurance, consumers are more likely to interpret the communication as credible and authentic.

The empirical results further indicate that these mechanisms operate through a sequential psychological pathway. Linguistic framing and verification status influence consumers' perceptions of greenwashing, which subsequently affect consumer trust and ultimately purchase intention. The structural model therefore provides evidence for the broader pathway proposed in this study: Framing/Verification → Perceived Greenwashing → Consumer Trust → Purchase Intention. This finding extends existing greenwashing research by demonstrating that the negative consequences of questionable environmental communication are not limited to attitudinal skepticism. Instead, perceived greenwashing can translate into measurable reductions in trust and downstream behavioral intentions.

5.1 Key Theoretical Insights

The first major theoretical insight is that symbolic environmental communication can become counterproductive when it is not supported by substantive evidence. Symbolic language may initially appear attractive because it

communicates environmental positioning in a simple and emotionally appealing manner. However, the findings suggest that consumers do not interpret all sustainability language as equally credible. When environmental claims remain vague and lack measurable operational benchmarks, consumers may infer that the firm is attempting to create a favorable environmental image without demonstrating corresponding environmental performance. This attribution increases perceived greenwashing and creates a negative downstream effect on brand trust.

The second theoretical contribution concerns the role of third-party verification as a credibility-enhancing signal. The significant main effect of verification and the interaction between verification and linguistic framing demonstrate that external assurance is not merely an administrative feature of sustainability reporting. Instead, independent verification provides consumers with additional evidence that environmental claims have been subjected to external scrutiny. This finding is consistent with Signaling Theory because credible verification imposes additional costs and accountability on firms making environmental claims, making the signal more difficult to imitate through purely symbolic communication.

The third contribution concerns the interaction between substantive information and external verification. The results indicate that the strongest consumer response occurs when these two mechanisms are combined. Quantitative disclosure provides informational substance, while independent verification provides credibility. Neither mechanism should therefore be viewed as a complete substitute for the other. A firm may disclose detailed environmental metrics, but without credible assurance consumers may remain uncertain about the accuracy of those metrics. Similarly, a verification label attached to vague environmental language may not provide sufficient substantive information for consumers to understand what has actually been achieved. The combination of detailed disclosure and credible verification consequently represents the strongest communication strategy identified by the study.

The fourth theoretical insight relates to consumer environmental knowledge. The moderation analysis demonstrates that environmental knowledge changes the way consumers process sustainability claims. More knowledgeable consumers appear better able to distinguish between specific environmental evidence and generalized symbolic rhetoric. Consequently, knowledgeable respondents show stronger skepticism toward unsupported symbolic claims while responding more favorably to substantive and verifiable environmental information. This finding suggests that greenwashing perceptions are not determined exclusively by the characteristics of corporate communication; they are also shaped by the cognitive resources and environmental literacy of the audience receiving that communication.

The fifth contribution is the identification of a meaningful connection between consumer perceptions and economic outcomes. The price-elasticity analysis indicates that the consequences of communication credibility extend beyond reputation. Verified substantive environmental communication is associated with stronger support for green price premiums, whereas unverified symbolic communication produces substantially weaker economic responses. This suggests that credibility can have a direct commercial dimension: consumers may be willing to reward firms financially when sustainability claims are sufficiently credible, but they may resist paying a

premium when environmental communication appears exaggerated or unsupported.

The robustness battery presented in Table 6 further strengthens these theoretical conclusions. The central greenwashing-to-trust relationship remains stable across alternative modeling specifications, indicating that the principal finding is not dependent on a single estimation strategy or model configuration. Similarly, the consistency between the experimental comparisons, mediation analysis, and price-response results provides convergent evidence that communication credibility represents a fundamental determinant of consumer response to corporate sustainability claims.

Taken together, these findings extend greenwashing theory by connecting attribution, signaling, consumer knowledge, trust formation, and behavioral intention within a single empirical framework. Rather than treating greenwashing as an isolated communication phenomenon, the study demonstrates how questionable environmental claims can initiate a sequence of negative consumer responses that ultimately affect commercial outcomes.

5.2 Managerial and Policy Imperatives

1. Mandate Third-Party Audit Assurance

Corporate sustainability officers should allocate appropriate resources toward accredited independent assurance for material public environmental claims. Standards and assurance mechanisms such as ISO 14064 and ISAE 3000 can provide structured approaches for evaluating environmental information and strengthening its credibility. The results indicate that external verification can significantly reduce perceived greenwashing, particularly when it accompanies substantive and measurable environmental disclosure.

Managers should therefore move beyond treating assurance as a technical compliance exercise. Independent verification should be integrated into the broader sustainability communication strategy so that consumers can readily identify which environmental claims have been independently examined. Clear disclosure of the assurance provider, scope of verification, reporting period, and verified indicators can further reduce uncertainty surrounding environmental claims.

2. Transition from Rhetoric to Quantitative Benchmarks

Marketing and sustainability teams should progressively eliminate unsupported or overly general environmental slogans such as "eco-friendly," "green choice," or "environmentally responsible" when such statements are not accompanied by specific evidence. Instead, firms should communicate measurable indicators such as percentage reductions in Scope-1 and Scope-2 emissions, renewable-energy utilization rates, water savings per unit of production, waste diversion rates, or reductions in material intensity.

Quantitative disclosure provides consumers with a basis for evaluating environmental performance rather than requiring them to rely solely on persuasive language. More importantly, specific indicators create accountability because future performance can be compared with previously reported benchmarks. This approach can reduce the information gap between firms and consumers while simultaneously strengthening the credibility of sustainability communication.

3. Strengthen Regulatory Anti-Greenwashing Enforcement

Consumer protection agencies and environmental regulators should establish clearer standards concerning the evidence required to substantiate environmental claims in digital advertising and corporate communications. Unverified symbolic claims that create a misleading impression of superior environmental performance should be subject to appropriate regulatory scrutiny, particularly where consumers could reasonably interpret the claims as factual statements about environmental performance.

Stronger enforcement would also protect firms that make genuine investments in sustainability. Without effective oversight, firms may have incentives to obtain market benefits from inexpensive symbolic communication rather than undertaking costly environmental improvements. Effective anti-greenwashing regulation can therefore contribute to a more level competitive environment in which credible environmental performance is rewarded rather than crowded out by misleading communication.

4. Prioritize Repeated, Consistent Verified Disclosure

The illustrative trust-recovery modeling presented in Figure 8 suggests that the benefits of credible environmental communication may accumulate over repeated exposures. Firms should therefore treat third-party assurance as part of a long-term communication strategy rather than as a one-time certification or compliance exercise.

Repeated disclosure of consistent environmental metrics can gradually establish a reputation for transparency and accountability. Conversely, inconsistent claims, changing definitions, unexplained performance fluctuations, or repeated unaudited sustainability statements may reinforce consumer skepticism. Firms should therefore maintain continuity in reporting methodologies and clearly explain changes in measurement boundaries or environmental targets.

5. Integrate Sustainability, Marketing, and Compliance Functions

The findings also imply that environmental communication should not be managed exclusively by marketing departments. Sustainability teams generate the underlying environmental information, assurance providers evaluate its credibility, legal and compliance teams assess disclosure risks, and marketing teams translate the information into consumer-facing communication. Greater coordination among these functions can reduce the possibility that promotional language becomes disconnected from the underlying environmental evidence.

A cross-functional review process could require every major environmental claim to be supported by a measurable indicator, a defined reporting period, and appropriate documentary evidence before publication. Such an approach would reduce the likelihood of accidental greenwashing while ensuring that sustainability communication remains aligned with actual operational performance.

5.3 Limitations and Future Research

Despite the strength of the experimental evidence, several limitations should be acknowledged. First, the factorial vignette design provides strong internal validity because the researcher can manipulate linguistic framing and verification status while holding other characteristics relatively constant. However, the experiment relies on a fictitious brand and controlled communication environment. Consumer reactions to hypothetical environmental claims may differ from responses

to sustainability information associated with real brands with which participants have previous experiences, expectations, or emotional attachments.

Second, the present study relies primarily on a single-exposure experimental design. Although the illustrative repeated-exposure trajectory in Figure 8 provides useful theoretical insight into potential trust-recovery dynamics, these trajectories should not be interpreted as evidence of actual longitudinal behavioral change. Future studies should employ multi-wave panel designs in which the same consumers are exposed to sustainability communications repeatedly over several weeks or months. Such research could determine whether trust initially declines sharply after greenwashing exposure and whether repeated verified disclosures are genuinely capable of restoring that trust over time.

Third, the respondent sample was obtained through an online consumer panel and therefore may contain a relatively high proportion of digitally engaged individuals. Such respondents may possess greater familiarity with online sustainability claims, corporate websites, social media advertising, and environmental terminology than the broader consumer population. Future research should therefore replicate the experiment using more diverse recruitment strategies, including offline consumers, retail shoppers, and respondents from different demographic and socioeconomic backgrounds.

Fourth, the price-elasticity analysis relies on model-implied predictions rather than incentive-compatible willingness-to-pay measurements. Although the results provide evidence that communication credibility may influence consumers' willingness to support green price premiums, future research should validate this relationship using discrete choice experiments, incentive-compatible auctions, or field experiments involving actual purchasing decisions. Such designs would provide stronger evidence concerning whether the observed communication effects translate into real monetary behavior.

Fifth, the current experimental framework holds the communication channel constant. As discussed earlier, sustainability claims can appear in corporate sustainability reports, website dashboards, product packaging, digital advertisements, social-media posts, and other communication environments. Consumers may interpret the same claim differently depending on the medium through which it is presented. Future research could extend the current 2×2 framework into a $2 \times 2 \times 3$ experimental design crossing linguistic framing, verification status, and communication channel, such as PDF sustainability reports, corporate website dashboards, and social-media posts.

Sixth, future studies should examine whether the credibility effects identified here vary across different environmental issues. Consumers may respond differently to claims concerning carbon emissions, renewable energy, plastic reduction, water conservation, biodiversity, or sustainable sourcing. Some environmental issues may be easier for consumers to understand and verify than others, potentially changing the strength of the relationship between substantive disclosure and perceived greenwashing.

Finally, future research should extend the moderation framework beyond individual consumers. Institutional investors, procurement managers, business-to-business buyers, and other professional stakeholders may place substantially greater weight on formal assurance and quantitative disclosure

than ordinary retail consumers. Comparing these groups would help determine whether the signaling value of third-party verification varies systematically across stakeholder categories.

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