

EXPLORING GREEN CONSUMER BEHAVIOR: THE ROLE OF TRUST AND TRANSPARENCY

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ABSTRACT

In the context of escalating environmental degradation, green consumption has emerged as a significant orientation in the behavior of modern consumers. Meanwhile, in Vietnam, there has been a considerable gap between green purchasing intention and green purchasing behavior, particularly in the Food and Beverage (F&B) sector. This study aims to identify the formation of Green Trust, examine the effects of green marketing factors and perceived greenwashing on trust, test the mediating role of Green Trust in green purchasing intention and green purchasing behavior, clarify the moderating influences of transparency, and generate managerial implications for the Vietnamese F&B industry. Based on the Theory of Planned Behavior (TPB), the Stimulus - Organism - Response (S-O-R) framework, and Signaling Theory, the proposed research model integrates green marketing tools (green advertising, eco-labels, green brand image, and CSR) and perceived greenwashing to explain how these signals establish trust among consumers and affect their green purchasing behavior. A mixed-methods approach was employed, including in-depth interviews with experts to refine measurement scales, a quantitative survey of over 400 F&B consumers in Vietnam (data were collected both online and offline), and PLS-SEM was adopted for data analysis. The findings reveal that the four green marketing tools have positive effects on Green Trust, which enhances both green purchasing intention and green purchasing behavior. Furthermore, Green Trust also mediates the negative effect of perceived greenwashing, though transparency does not significantly moderate most relationships, except in alleviating the adverse impact of greenwashing. The study makes both theoretical and practical contributions by clarifying the role of Green Trust in bridging the intention-behavior gap and by providing managerial insights to support more transparent and effective green marketing strategies in Vietnam's F&B sector.

Keywords: Green purchasing behavior, Green Trust, Greenwashing, Green Marketing, Transparency.

1. INTRODUCTION

The increasing severity of climate change and resource depletion has made the transition toward sustainable development an imperative for businesses, particularly in high-impact industries such as food and beverage (F&B) [1]. In Vietnam, this transition is further reinforced by the national commitment to achieving Net Zero emissions by 2050, placing significant pressure on firms to restructure their operations toward greener and more transparent value chains. As a key sector within consumer supply systems, the F&B industry faces growing expectations to reduce environmental impacts while ensuring accountability and sustainability across the value chain.

At the same time, consumer behavior is undergoing a significant shift toward sustainability, with increasing awareness of environmental and social responsibility. Prior studies indicate that a substantial proportion of consumers are willing to pay a premium for environmentally friendly products, reflecting the rising demand for sustainable consumption [1]. However, despite this growing demand, the development of the green F&B market remains constrained by several challenges, particularly the lack of information transparency and increasing consumer skepticism toward green marketing claims.

In this context, green marketing has emerged as a critical mechanism for shaping consumer perceptions and behavior. Elements such as green advertising, eco-labels, green brand image, and corporate social responsibility (CSR) have been shown to influence green trust and consumer behavior [2], [3], [4]. Nevertheless, existing studies have not fully clarified the mediating role of green trust in the relationship between green marketing strategies and purchase intention [3], [4].

Moreover, while green marketing tools are expected to promote sustainable consumption, the proliferation of greenwashing practices, defined as misleading or exaggerated environmental claims, has undermined consumer trust and hindered green purchasing behavior [5], [6]. In particular, according to Rahman and Nguyen-Viet, insufficient transparency in environmental communication can lead consumers to perceive green marketing efforts as greenwashing, thereby weakening trust [5].

Additionally, a persistent intention-behavior gap has been widely documented in the green consumption literature, where purchase intention does not always translate into actual behavior [7]. In this regard, green trust plays a crucial mediating role in bridging this gap, as consumers are more likely to engage in green consumption when they perceive environmental claims as credible and transparent [8], [9], [10]. However, most prior studies have primarily focused on purchase intention, with limited attention to the mechanisms that convert intention into actual behavior, particularly the joint role of psychological factors such as trust and transparency within an integrated framework [11].

In the Vietnamese F&B context, this gap between positive attitudes and actual green consumption behavior remains significant, despite growing environmental awareness among consumers. Existing studies have largely examined green marketing factors in isolation or focused primarily on purchase intention, without developing an integrated model linking green marketing, trust, intention, and actual behavior. Furthermore, the moderating role of transparency has not been sufficiently explored.

Addressing these theoretical and empirical gaps, this study aims to examine green consumer behavior in Vietnam's F&B sector by investigating the mediating role of green trust and the moderating role of transparency in the relationship between green marketing factors and consumer behavior. By doing so, the study contributes to the literature on sustainable consumption and provides managerial implications for firms to develop transparent green marketing strategies, mitigate greenwashing, and enhance sustainable brand value within global value chains.

2. LITERATURE REVIEW

2.1. Theoretical background

This study is grounded in three complementary theoretical perspectives: the Theory of Planned Behavior (TPB), the Stimulus-Organism-Response (S-O-R) framework, and Signaling Theory. These frameworks collectively provide a comprehensive explanation of green consumer behavior in the Food and Beverage (F&B) context.

2.1.1. The Theory of Planned Behavior (TPB)

The Theory of Planned Behavior (TPB) of Ajzen posits that human behavior is primarily driven by behavioral intention, which is influenced by attitudes, subjective norms, and perceived behavioral control [12]. In the context of green consumption, purchase intention has consistently been identified as a strong predictor of actual purchasing behavior [13], [14]. However, empirical evidence suggests that a significant gap often exists between intention and behavior, particularly in the domain of sustainable consumption. This intention-behavior gap may arise due to various external constraints and psychological factors, such as limited trust in environmental claims or insufficient transparency in product information [7], [15]. As a result, recent research has extended TPB by incorporating additional constructs, such as green trust and transparency, to better capture the complexity of real-world consumer decision-making.

2.1.2. The Stimulus-Organism-Response (S-O-R) framework

The Stimulus-Organism-Response (S-O-R) framework offers a complementary psychological mechanism for understanding how external marketing stimuli influence internal cognitive and emotional states, which subsequently drive behavioral responses [16], [17]. In this study, green marketing tools, including green advertising, eco-labels, green brand image, and corporate social responsibility (CSR), are conceptualized as stimuli. These stimuli affect the organism, represented by consumers' green trust, which in turn influences responses such as green purchase intention and green purchase behavior [8]. This framework is particularly relevant in the F&B sector, where many environmental attributes (organic ingredients, environmentally friendly production processes) are considered credence attributes that consumers cannot directly verify. Consequently, consumers rely heavily on external cues, such as branding and communication signals, to evaluate product quality and environmental performance.

2.1.3. The Signaling Theory

Signaling Theory further explains the role of green marketing tools under conditions of information asymmetry. Originating from Spence in 1973, the theory suggests that firms communicate unobservable product qualities through observable signals, thereby reducing uncertainty and perceived risk [18]. In green markets, eco-labels and green advertising function as signals of environmental commitment, while CSR activities and green brand image contribute to building long-term credibility and ethical reputation. However, when these signals are perceived as misleading or exaggerated commonly referred to as greenwashing, their credibility deteriorates, leading to consumer distrust and negative behavioral outcomes.

By integrating TPB and the S-O-R framework, the study captures both the formation of trust in response to marketing stimuli and the translation of intention into actual behavior. The incorporation of Signaling Theory further enriches the model by explaining how consumers interpret and evaluate green marketing signals. In this context, transparency plays a critical moderating role, as it enhances signal credibility, reduces skepticism, and mitigates the negative effects of perceived greenwashing [19]-[21].

2.1.4. Green purchase intention and Green Purchase behavior

Green purchase intention (GPI) refers to an individual's willingness or plan to purchase environmentally friendly products that minimize negative impacts on the environment. It reflects the degree to which consumers are inclined to prioritize sustainability considerations in their purchasing decisions [12], [14]. In the context of green consumption, intention is widely regarded as a key antecedent of actual behavior, capturing the motivational factors that influence consumers' readiness to act.

Green purchase behavior (GPB), in contrast, represents the actual act of purchasing environmentally friendly products. It reflects the translation of intention into real consumption actions, such as choosing organic food, eco-labeled products, or items produced through environmentally responsible processes [13]. While intention is a strong predictor of behavior, prior studies highlight that not all intentions lead to actual purchases due to barriers such as price, availability, or lack of trust in environmental claims [7].

2.1.5. Green Trust

Green trust refers to consumers' confidence in a product, brand, or company regarding its environmental performance and its ability to fulfill environmental commitments. It reflects the belief that a firm's environmental claims are credible, reliable, and not misleading [8]. In green markets, trust plays a particularly critical role because many environmental attributes are difficult for consumers to verify directly. As a result, consumers must rely on information provided by firms, such as labels, certifications, or sustainability claims. When green trust is high, consumers are more likely to form positive attitudes, develop stronger purchase intentions, and engage in actual green purchasing behavior. Conversely, low trust often caused by perceived greenwashing can significantly reduce consumers' willingness to support environmentally friendly products.

2.2. Hypotheses development and Research model

2.2.1. Green Advertisement and Green Trust

Green advertisement is defined as a form of marketing communication that emphasizes the environmental benefits of products, services or brands [22]. It serves as an important signal to convey a firm's environmental commitment and reduce information asymmetry between firms and consumers. According to Leonidou et al., green advertising helps communicate environmental values and improve consumer perceptions toward green products [23]

Previous studies indicate that credible and transparent advertising messages can enhance consumer trust, while vague or exaggerated claims may lead to skepticism and distrust [18], [22]. Nguyen-Viet also confirms that truthful green advertising positively influences brand trust in the green context [21]. In the S-O-R framework, green advertising acts as a stimulus that influences consumers' internal evaluation, particularly green trust.

H1: Green advertisement positively influences Green trust.

2.2.2. Eco-labels and Green Trust

Eco-labels are certifications granted by independent organizations to verify that products meet specific environmental standards ISO:2012 [24]. They function as credible signals that reduce information asymmetry and help consumers evaluate environmental attributes without requiring expert knowledge [25].

Delmas and Grant argue that certified eco-labels create a credibility effect, enabling consumers to distinguish between genuinely green and misleading products [26]. In emerging markets like Vietnam, eco-labels play a crucial role in strengthening consumer trust amid increasing concerns about greenwashing [21]. However, when eco-labels lack transparency or verification, consumers may develop skepticism [27].

H2: Eco-labels positively influence Green trust.

2.2.3. Green Brand Image and Green Trust

Green brand image refers to consumers' perceptions and impressions of a brand's environmental commitment [2]. It reflects the extent to which a brand is associated with sustainability, environmental responsibility and ethical practices.

A strong green brand image reduces perceived risk and enhances consumer confidence in environmental claims [2]. Empirical studies have shown that a positive green brand image significantly improves consumer trust and strengthens long-term brand relationships [28], [29]. In the S-O-R model, green brand image acts as a stimulus that shapes consumers' internal trust formation.

H3: Green brand image positively influences Green trust.

2.2.4. Corporate Social Responsibility and Green Trust

Corporate Social Responsibility (CSR) refers to voluntary actions undertaken by firms to contribute to environmental and social well-being beyond legal requirements [30], [31]. Environmental CSR (ECSR) specifically focuses on activities such as reducing emissions, conserving resources and promoting sustainability.

CSR enhances brand credibility and signals long-term commitment to environmental responsibility, which can strengthen consumer trust [10]. According to Zayyad et al. [32], environmental corporate social responsibility (ECSR) is reflected through activities such as emission reduction, energy conservation, green production, and ecosystem protection. These practices contribute to enhancing corporate image and building consumer trust, as highlighted by Hayat et al. [33]. In the S-O-R framework, CSR acts as an external stimulus that positively affects green trust.

H4: Corporate Social Responsibility positively influences Green trust.

2.2.5. Perceived Greenwashing and Green Trust

Perceived greenwashing refers to consumers' perception that a firm exaggerates or misrepresents its environmental claims [8]. Unlike actual greenwashing, perceived greenwashing focuses on consumers' interpretation and evaluation of environmental communication.

Studies show that perceived greenwashing increases skepticism and perceived risk, leading to a decline in trust [34], [35]. Chen and Chang confirm that perceived greenwashing negatively affects green trust by undermining the credibility of environmental claims [8]. Within the S-O-R framework, greenwashing perceived acts as a negative stimulus that weakens consumers' internal trust.

H5: Perceived greenwashing negatively influences Green trust.

2.2.6. Green Trust and Green Purchase Intention

Green trust is defined as the willingness of consumers to rely on a product or brand based on its environmental performance [2]. It plays a critical role in reducing uncertainty and encouraging environmentally responsible consumption.

According to Ajzen's TPB, positive beliefs and attitudes toward a behavior increase behavioral intention [12]. In the green context, higher trust leads to stronger purchase intention [9], [10]. Consumers are more likely to purchase green products when they believe that environmental claims are reliable.

H6: Green trust positively influences Green purchase intention.

2.2.7. Green Purchase Intention and Green Purchase Behavior

Green purchase intention refers to consumers' willingness to buy environmentally friendly products [8], while green purchase behavior represents actual purchasing actions.

TPB suggests that intention is the most direct predictor of behavior. Empirical studies confirm that individuals with stronger green purchase intention are more likely to engage in

actual green consumption [36]. However, this relationship may be affected by external constraints such as price and availability.

H7: Green purchase intention positively influences Green purchase behavior.

2.2.8. Moderating Role of Transparency

Transparency refers to the extent to which firms disclose clear, accurate and verifiable information about their environmental practices [37], [38]. It reduces uncertainty and enhances credibility in green communication.

Research shows that transparency strengthens the positive effects of green marketing and mitigates the negative effects of greenwashing. Prior research suggests that transparency can improve the credibility of environmental communication and mitigate the negative effects of greenwashing [34]. When information is transparent, consumers are more likely to trust environmental claims; otherwise, skepticism increases.

H8a: Transparency moderates the relationship between perceived greenwashing and green trust.

H8b: Transparency moderates the relationship between green advertisement and green trust.

H8c: Transparency moderates the relationship between eco-labels and green trust.

H8d: Transparency moderates the relationship between CSR and green trust.

H8e: Transparency moderates the relationship between green brand image and green trust.

2.2.9. Mediating Role of Green Trust

Green trust acts as a psychological mechanism that translates marketing signals into behavioral outcomes. In conditions of information asymmetry, consumers rely on trust to evaluate environmental claims [8].

Empirical evidence shows that green trust mediates the relationship between green marketing factors and purchase intention [39], [40]. Without trust, marketing signals cannot effectively influence consumer decisions.

H9a,b,c,d,e: Green trust mediates the relationship between Green advertisement, Eco-labels, CSR, Green brand image, Perceived greenwashing and Green purchase intention.

Based on the theoretical foundations discussed above, this study proposes an integrated research model to examine green consumer behavior in the Food and Beverage (F&B) sector. The model incorporates key constructs derived from the Theory of Planned Behavior (TPB), the Stimulus-Organism-Response (S-O-R) framework, and Signaling Theory to provide a comprehensive explanation of both intention formation and behavioral outcomes. Specifically, green marketing tools comprising green advertising, eco-labels, green brand image, and corporate social responsibility (CSR) are conceptualized as external stimuli that influence consumers' internal psychological state, represented by green trust. Green trust is expected to play a central role in shaping both green purchase intention and green purchase behavior, thereby helping to address the commonly observed intention-behavior gap in sustainable consumption. In addition, perceived greenwashing is introduced as a negative factor that may undermine green trust, while transparency is considered a boundary condition that can mitigate the adverse effects of misleading environmental claims. By integrating these relationships, the proposed model captures both the formation of trust and its subsequent impact on consumer decision-making.

The conceptual framework of the study is presented in Figure 1. The model integrates the Stimulus-Organism-Response (S-O-R) framework, the Theory of Planned Behavior (TPB),

and Signaling Theory to explain green consumer behavior in the Vietnamese F&B sector. In this model, green advertising, eco-labels, green brand image, and CSR are conceptualized as positive green marketing stimuli that are expected to enhance green trust, corresponding to H1-H4. In contrast, perceived greenwashing is treated as a negative stimulus that is expected to reduce green trust, corresponding to H5.

Green trust represents consumers' internal psychological state and reflects their evaluation of the credibility of firms' environmental claims. Following the S-O-R logic, green marketing signals and perceived greenwashing act as stimuli, while green trust functions as the organismic mechanism. Green trust is then expected to positively influence green purchase intention, and green purchase intention is expected to lead to green purchase behavior, corresponding to H6 and H7. This structure also reflects the TPB logic that intention is an important antecedent of actual behavior.

The model further incorporates two additional mechanisms. First, green trust is proposed as a mediating mechanism linking green advertising, eco-labels, green brand image, CSR, and perceived greenwashing to green purchase intention, corresponding to H9a,b,c,d,e. This is appropriate in the F&B context, where many green product attributes are difficult for consumers to verify directly, making trust an essential psychological bridge between marketing signals and behavioral intention. Second, transparency is introduced as a moderating variable in the relationships between the five antecedents and green trust, corresponding to H8a,b,c,d,e. Specifically, transparency is expected to shape how consumers interpret green marketing signals and perceived greenwashing by reducing information ambiguity and mitigating the harmful effect of greenwashing on green trust.

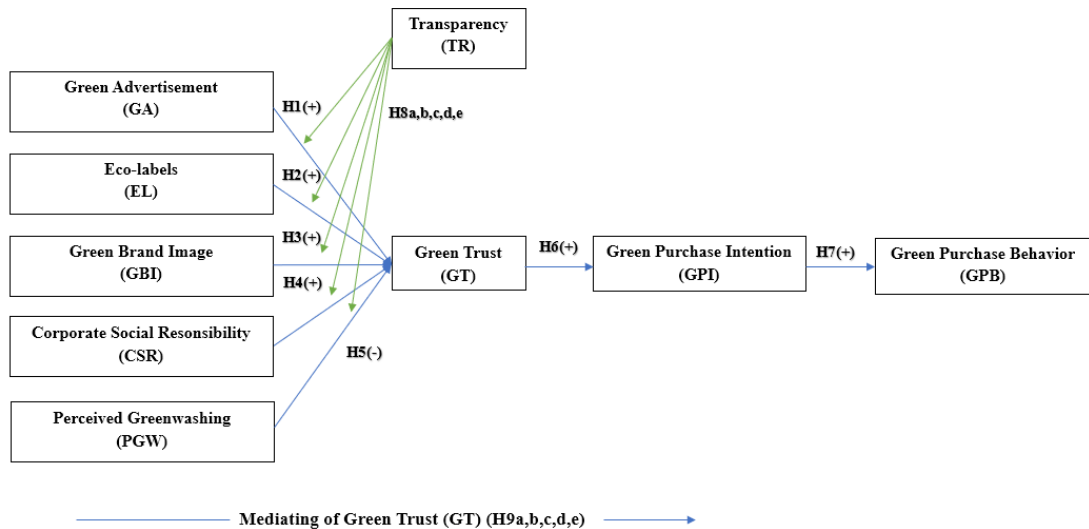


Figure 1. The conceptual framework of the study.

Source: Authors' proposed model based on TPB, S-O-R framework, and Signaling Theory.

3. METHODOLOGY

3.1. Research design and context.

The research applies a mixed-method approach. First, qualitative semi-structured interviews were conducted to refine measurement items and ensure contextual fit for Vietnam's F&B sector. This stage included interviews with 4 experts who had extensive experience in green marketing/sustainability and follow-up consumer interviews to refine

wording and clarity. Second, a quantitative cross-sectional survey was implemented to test the proposed structural relationships via PLS-SEM, consistent with S-O-R and TPB logic.

3.2. Sampling and respondents.

The quantitative phase used snowball sampling [41], combined with pragmatic field access suitable for emerging-market settings where a complete sampling frame is unavailable. Respondents met these eligibility criteria: (1) age ≥ 18 , and (2) prior purchase experience or informed awareness of “green” attributes/commitments in F&B brands/products. Data were collected through two channels: offline intercept (220 responses; 54%) and online survey distribution (187 responses; 46%). In total, 422 questionnaires were collected; after screening for incomplete or invalid responses, the final valid sample was $n = 407$.

3.3. Sample profile.

Table 1. Demographic Characteristics of the Sample (n = 407)

Demographic Characteristics (n=407)		Frequency	Percentage
Gender	Male	187	45.9%
	Female	212	52.1%
	Other	8	2.0%
Age	18-25	109	26.8%
	26-35	241	59.2%
	Above 35	57	14.0%
Occupation	Student	65	16%
	Officer	175	43.0%
	Self-employed / Business owner / Freelancer	73	17.9%
	Civil servant / Public employee	39	9.6%
	Middle manager	35	8.6%
	Other	20	4.9%
Education Level	High school	38	9.3%
	College / University	288	70.8%
	Postgraduate	80	19.7%
	Other	1	0.2%
Monthly Income (VND)	Below 5 million	43	10.6%
	5-10 million	172	42.2%
	10-20 million	123	30.2%
	Above 20 million	69	17.0%
Living Area	Ho Chi Minh City	343	84.3%
	Other	64	15.7%

Source: Authors' survey results.

The demographic profile of the sample is presented in Table 1. The sample is relatively balanced in terms of gender, with females accounting for 52.1% and males 45.9%, while a small proportion (2.0%) identified as other. In terms of age distribution, the majority of respondents fall within the 26-35 age group (59.2%), followed by those aged 18-25 (26.8%) and above 35 (14.0%), indicating a predominantly young adult sample.

Regarding occupation, office employees constitute the largest group (43.0%), followed by self-employed individuals or business owners (17.9%) and students (16.0%). Other occupational categories include civil servants (9.6%), middle managers (8.6%), and a smaller proportion of respondents in other occupations (4.9%).

In terms of educational attainment, most respondents hold a college or university degree (70.8%), while 19.7% have postgraduate qualifications and 9.3% have completed high school. Only a negligible proportion falls into other categories.

With respect to income, the largest segment of respondents earns between 5 and 10 million VND per month (42.2%), followed by those earning between 10 and 20 million VND (30.2%) and above 20 million VND (17.0%). A smaller group (10.6%) reports an income below 5 million VND.

Finally, the sample is predominantly urban, with 84.3% of respondents residing in Ho Chi Minh City, while the remaining 15.7% come from other areas. Overall, these characteristics reflect a young, educated, and urban consumer group, which is particularly relevant for studying green consumption behavior in the F&B sector.

3.4. Measures and item sources.

All constructs were measured reflectively using multi-item scales adapted from prior studies and localized through qualitative refinement. Items were rated on a 5-point Likert scale (1 = strongly disagree; 5 = strongly agree).

The measurement scales in this study were adapted from prior validated studies. Specifically, Green Advertising (GA) was adapted from Sun et al. [22]; Eco-labels (EL) from Nguyen-Viet [21]; Green Brand Image (GBI) from Doszhanov and Ahmad [42]; Perceived Greenwashing (PGW) from Rehman et al. [43]; Corporate Social Responsibility (CSR) from Anselmsson et al. [44]; Green Trust (GT) from Chen [2]; Green Purchase Intention (GPI) from Chen and Chang [8]; Green Purchase Behavior (GPB) from Wang et al. [36]; and Transparency (TR) from Lin and Zhou [4].

3.5. PLS-SEM estimation procedure.

Data analysis was conducted using SmartPLS 4.0, following established PLS-SEM procedures [45]. The analysis involved a two-step approach, including the assessment of the measurement model and the structural model. First, data were screened and descriptive statistics were examined. The measurement model was evaluated in terms of indicator reliability, internal consistency reliability (Cronbach's alpha and composite reliability), convergent validity (average variance extracted - AVE), and discriminant validity using the Fornell-Larcker criterion and HTMT ratios. Second, the structural model was assessed by examining collinearity (VIF), explanatory power (R^2), effect sizes (f^2), and predictive relevance (Q^2 predict), along with model fit indices such as SRMR and NFI. Finally, the significance of path coefficients, as well as mediation and moderation effects, was tested using bootstrapping with 5,000 resamples.

4. RESULTS AND DISCUSSION

4.1. Measurement model

All indicators loaded primarily on their intended constructs. Most outer loadings exceeded 0.70; one perceived greenwashing indicator (PGW2) loaded at 0.602, while the construct still met convergent validity and reliability thresholds at the construct level [45]. Cronbach's alpha ranged from 0.711 to 0.881, composite reliability (CR) ranged

from 0.839 to 0.913, and AVE ranged from 0.614 to 0.678, indicating adequate reliability and convergent validity (Fornell & Larcker, 1981) [45], [46].

Table 2. Measurement model results (loadings, reliability, convergent validity)

Construct	Item	Loading	Cronbach's alpha	Composite reliability (rho_a)	CR	AVE
GA	GA1	0.890	0.820	0.820	0.881	0.649
	GA2	0.822				
	GA3	0.858				
	GA4	0.872				
EL	EL1	0.734	0.791	0.793	0.864	0.614
	EL2	0.816				
	EL3	0.799				
	EL4	0.802				
GBI	GBI1	0.822	0.881	0.883	0.913	0.677
	GBI2	0.855				
	GBI3	0.813				
	GBI4	0.781				
	GBI5	0.818				
CSR	CSR1	0.878	0.832	0.835	0.888	0.665
	CSR2	0.797				
	CSR3	0.803				
	CSR4	0.836				
PGW	PGW1	0.873	0.838	0.845	0.891	0.672
	PGW2	0.602				
	PGW3	0.764				
	PGW4	0.916				
GT	GT1	0.796	0.866	0.866	0.903	0.651
	GT2	0.799				
	GT3	0.825				
	GT4	0.826				
	GT5	0.799				
GPI	GPI1	0.778	0.721	0.723	0.843	0.642
	GPI2	0.786				
	GPI3	0.832				
GPB	GPB1	0.834	0.711	0.712	0.839	0.634
	GPB2	0.778				
	GPB3	0.752				
TR	TR1	0.839	0.842	0.846	0.894	0.678
	TR2	0.866				

Construct	Item	Loading	Cronbach's alpha	Composite reliability (rho_a)	CR	AVE
	TR3	0.832				
	TR4	0.764				

Source: Authors' analysis using SmartPLS 4.0.

Discriminant validity.

Fornell-Larcker results show that the square root of AVE (diagonal) exceeds inter-construct correlations, supporting discriminant validity. HTMT ratios were all below 0.90; the maximum HTMT was 0.884 (GT-GPI), and the bootstrap CI reported in the study did not include 1.0, indicating acceptable discriminant validity [47].

Table 3. Discriminant validity (HTMT ratios; original sample values)

	GA	EL	GBI	CSR	PGW	GT	GPI	GPB	TR
GA	1.000	0.601	0.569	0.621	0.221	0.719	0.718	0.608	0.594
EL	0.601	1.000	0.556	0.599	0.323	0.753	0.661	0.542	0.433
GBI	0.569	0.556	1.000	0.640	0.298	0.803	0.775	0.650	0.528
CSR	0.621	0.599	0.640	1.000	0.277	0.699	0.740	0.625	0.546
PGW	0.221	0.323	0.298	0.277	1.000	0.411	0.353	0.271	0.272
GT	0.719	0.753	0.803	0.699	0.411	1.000	0.884	0.705	0.560
GPI	0.718	0.661	0.775	0.740	0.353	0.884	1.000	0.867	0.569
GPB	0.608	0.542	0.650	0.625	0.271	0.705	0.867	1.000	0.511
TR	0.594	0.433	0.528	0.546	0.272	0.560	0.569	0.511	1.000

Source: Authors' analysis using SmartPLS 4.0.

4.2. Structural model

Table 4. Collinearity statistics (VIF)

Endogenous Construct	Predictor	VIF
GT	GA	1.600
	EL	1.700
	GBI	1.900
	CSR	1.955
	PGW	1.300
GPI	GT	1.000
GPB	GPI	1.000

Source: Authors' analysis using SmartPLS 4.0.

All inner VIF values were low, the highest reported VIF for predictors of GT was 1.955 (CSR), indicating no multicollinearity concerns.

Table 5. Explanatory and predictive metrics

Endogenous construct	R ²	R ² adj
GT	0.681	0.672
GPI	0.489	0.488
GPB	0.387	0.385

Source: Authors' analysis using SmartPLS 4.0.

The model explained substantial variance in green trust ($R^2 = 0.681$), moderate variance in green purchase intention ($R^2 = 0.489$) and moderate variance in green purchase behavior ($R^2 = 0.387$). PLSpredict results showed positive Q^2 predict for all indicators and lower PLS-SEM RMSE than the linear benchmark (LM) for each indicator, supporting out-of-sample predictive relevance [48].

Table 6. PLSpredict results (Q^2 predict and RMSE comparison)

Indicator	Q^2 predict	PLS-SEM RMSE	LM RMSE
GT1	0.409	0.850	0.884
GT2	0.435	0.810	0.834
GT3	0.442	0.856	0.897
GT4	0.409	0.846	0.867
GT5	0.434	0.832	0.868
GPI1	0.356	0.901	0.926
GPI2	0.267	0.960	0.997
GPI3	0.310	0.944	0.956
GPB1	0.207	0.982	0.991
GPB2	0.174	0.998	1.036
GPB3	0.191	1.014	1.049

Source: Authors' analysis using SmartPLS 4.0.

The study additionally reported global fit indicators, with SRMR = 0.067 for the estimated model and NFI = 0.818, which are commonly interpreted as acceptable in PLS-SEM contexts [49], [50].

Table 7. Model fit indices

Index	Saturated model	Estimated model
SRMR	0.047	0.067
d_ ULS	1.468	2.958
d_ G	0.536	0.582
Chi-square	1289.843	1363.900
NFI	0.828	0.818

Source: Authors' analysis using SmartPLS 4.0.

The results of the structural model assessment are presented in Table 8. Overall, the findings indicate that all hypothesized relationships are statistically significant and in the expected directions. Specifically, green marketing factors including green advertising, eco-labels, green brand image, and corporate social responsibility exert positive effects on green

trust, while perceived greenwashing has a significant negative impact. In addition, green trust strongly influences green purchase intention, which in turn significantly drives green purchase behavior. The reported path coefficients, t-values, p-values, and effect sizes (f^2) further confirm the robustness and explanatory power of the proposed model.

Table 8. Structural model results (direct effects; bootstrapped)

Hypothesis	Path	β (O)	t-value	p-value	Result	f^2
H1	GA $\rightarrow$ GT	0.221	5.733	< 0.001	Supported	0.085
H2	EL $\rightarrow$ GT	0.247	5.704	< 0.001	Supported	0.119
H3	GBI $\rightarrow$ GT	0.382	9.225	< 0.001	Supported	0.255
H4	CSR $\rightarrow$ GT	0.102	2.503	0.012	Supported	0.017
H5	PGW $\rightarrow$ GT	-0.121	3.681	< 0.001	Supported	0.040
H6	GT $\rightarrow$ GPI	0.699	24.111	< 0.001	Supported	0.957
H7	GPI $\rightarrow$ GPB	0.622	19.093	< 0.001	Supported	0.631

Source: Authors' analysis using SmartPLS 4.0.

4.3. Mediation and moderation tests

4.3.1. Mediation (specific indirect effects)

Green trust significantly mediated the paths from each marketing stimulus (GA, EL, GBI, CSR) to green purchase intention and also mediated the negative influence of perceived greenwashing on intention. All indirect effects were significant and directionally consistent (positive for green marketing stimuli; negative for perceived greenwashing), supporting H9a-H9e.

4.3.2. Moderation (transparency)

Transparency moderated only the PGW $\rightarrow$ GT relationship: the positive interaction coefficient ($\beta = 0.076$) indicates that higher transparency attenuates the negative effect of perceived greenwashing on trust. Interactions between transparency and GA/EL/GBI/CSR were not significant at $p < 0.05$, rejecting H8b-H8e but supporting H8a.

Table 9. Mediation and moderation effects (bootstrapped)

Hypothesis	Effect	β (O)	t-value	p-value	Interpretation
H9a	GA $\rightarrow$ GT $\rightarrow$ GPI	0.154	5.539	< 0.001	Positive indirect effect via trust
H9b	EL $\rightarrow$ GT $\rightarrow$ GPI	0.173	5.578	< 0.001	Positive indirect effect via trust
H9c	GBI $\rightarrow$ GT $\rightarrow$ GPI	0.267	8.168	< 0.001	Strongest positive indirect effect via trust
H9d	CSR $\rightarrow$ GT $\rightarrow$ GPI	0.071	2.498	0.013	Positive indirect effect via trust
H9e	PGW $\rightarrow$ GT $\rightarrow$ GPI	-0.084	3.676	< 0.001	Negative indirect effect via trust
H8a	TR $\times$ PGW $\rightarrow$ GT	0.076	2.509	0.012	Transparency buffers greenwashing harm
H8b	TR $\times$ GA $\rightarrow$ GT	0.019	0.565	0.572	Not supported
H8c	TR $\times$ EL $\rightarrow$ GT	0.019	0.439	0.661	Not supported
H8d	TR $\times$ GBI $\rightarrow$ GT	0.075	1.822	0.069	Not supported (marginal, but > .05)
H8e	TR $\times$ CSR $\rightarrow$ GT	-0.027	0.757	0.449	Not supported

Source: Authors' analysis using SmartPLS 4.0.

This finding suggests that transparency does not act as a universal moderator in all relationships leading to green trust. Rather, it mainly functions as a boundary condition that protects trust when consumers perceive greenwashing. Specifically, the significant positive interaction indicates that transparency weakens the negative effect of perceived greenwashing on green trust. When firms provide clear, verifiable, and accessible information about product origin, ingredients, production processes, environmental certifications, and sustainability practices, consumers are better able to evaluate the credibility of green claims. As a result, the harmful effect of greenwashing perceptions on trust is reduced. This result is consistent with Chen and Chang [8], De Jong et al. [6], and Szabo and Webster [35], who showed that greenwashing increases skepticism, perceived risk, and negative consumer responses. It also aligns with Lin et al. [37] and Alyahia et al. [51], who emphasized that transparent environmental communication helps reduce uncertainty and protect green trust.

The qualitative findings of this study also support this interpretation. Experts emphasized that transparency is a key mechanism for protecting green trust in the Vietnamese F&B context, especially when consumers suspect greenwashing. Similarly, interviewed consumers viewed transparency as a foundation for trust and indicated that firms can partially restore trust by openly disclosing evidence, explaining problems, correcting mistakes, and communicating improvement roadmaps.

The non-significant moderating effects of transparency on the relationships between green advertising, eco-labels, green brand image, CSR, and green trust may be explained by the fact that these positive green marketing signals already have direct effects on trust. In ordinary situations, consumers may rely on visible cues such as labels, packaging, brand reputation, and CSR activities without actively seeking additional transparency information. Therefore, transparency may not significantly amplify these positive effects. Instead, it becomes more salient when consumers face ambiguous or suspicious green claims.

Overall, transparency in this study plays a defensive moderating role rather than an amplifying one. It does not significantly strengthen the positive effects of green marketing signals on green trust, but it helps mitigate the negative impact of perceived greenwashing. This finding contributes to the S-O-R framework and Signaling Theory by showing that transparency is an asymmetric boundary condition: it is particularly important when trust is threatened. For Vietnamese F&B firms, transparency should therefore be developed as a trust-protection mechanism through traceability systems, third-party certifications, clear environmental disclosure, and honest communication about both achievements and limitations in sustainability practices.

4.4. Discussion

This study provides empirical insights into how green marketing signals influence consumer behavior in the F&B sector, highlighting the central role of green trust and the conditional role of transparency.

First, the findings confirm that green marketing tools significantly enhance green trust, supporting both Signaling Theory and the S-O-R framework. Among these factors, green brand image emerges as the strongest predictor, suggesting that consumers rely more on consistent and long-term brand perceptions than on individual communication cues. Eco-labels and green advertising also show significant positive effects, reinforcing their role as credible signals that reduce information asymmetry. In contrast, CSR exhibits a weaker effect, indicating that consumers may perceive it as less directly related to product-level environmental performance.

Second, the study underscores the pivotal role of green trust as a mediating mechanism. In line with the S-O-R framework, trust translates external stimuli into internal evaluations, which subsequently drive behavior. The results show that green trust strongly influences green

purchase intention, which in turn leads to actual purchase behavior. This finding extends the Theory of Planned Behavior (TPB) by demonstrating that trust is a critical factor in bridging the intention-behavior gap, a well-documented issue in green consumption research.

Third, the results highlight the negative impact of perceived greenwashing. As expected, greenwashing significantly reduces green trust, thereby weakening purchase intention. The mediation analysis further indicates that this negative effect operates primarily through trust, emphasizing its central role in consumer decision-making. This finding confirms that misleading environmental claims can undermine the effectiveness of green marketing strategies.

Finally, the analysis reveals a nuanced role of transparency as a moderating factor. Transparency significantly mitigates the negative impact of greenwashing on trust, suggesting that clear and verifiable information can reduce consumer skepticism. However, it does not significantly strengthen the positive effects of green marketing tools. This implies that transparency functions more as a risk-reduction mechanism rather than a direct driver of trust.

Overall, the study contributes to the literature by integrating TPB, S-O-R, and Signaling Theory into a unified framework that explains both intention and actual behavior. It highlights green trust as a key mechanism linking marketing signals to behavioral outcomes and clarifies the role of transparency in mitigating negative perceptions.

From a managerial perspective, firms should focus on building a strong green brand image, supported by credible communication tools such as eco-labels and advertising. At the same time, avoiding greenwashing and enhancing transparency are essential to maintaining consumer trust and promoting sustainable consumption.

5. CONCLUSION

5.1. Interpretation of key findings in relation to literature.

First, the results confirm that green marketing signals significantly strengthen green trust in the F&B context, consistent with the logic that consumers rely on externally provided cues to evaluate credence attributes [18]. Among positive stimuli, green brand image emerged as the most influential driver of trust ($\text{GBI} \rightarrow \text{GT}$: $\beta = 0.382$; $f^2 = 0.255$). This suggests that consumers respond more strongly to the holistic and accumulated perception of a brand's environmental commitment than to isolated messages, aligning with the view of green brand image as a strategic asset shaping trust and value perceptions [2], [42]. Eco-labels and green advertising also showed meaningful positive effects ($\text{EL} \rightarrow \text{GT}$: $\beta = 0.247$; $\text{GA} \rightarrow \text{GT}$: $\beta = 0.221$), supporting prior evidence that credible labels and environmental messages can reduce information asymmetry and build trust [21], [22]. CSR's effect, while significant, was smaller ($\text{CSR} \rightarrow \text{GT}$: $\beta = 0.102$; $f^2 = 0.017$), implying that CSR may function as a "baseline expectation" in some consumer segments unless it is tightly connected to product-level proof and consistent delivery [44].

Second, perceived greenwashing significantly reduced green trust ($\text{PGW} \rightarrow \text{GT}$: $\beta = -0.121$), consistent with arguments that misleading environmental claims erode credibility and increase skepticism. This finding reinforces the view that in emerging markets where verification infrastructures and standardized disclosure may be uneven greenwashing perceptions can be especially damaging to trust formation.

Third, the study provides strong evidence that green trust is the central psychological mechanism translating marketing stimuli into downstream outcomes. Green trust strongly predicts green purchase intention ($\text{GT} \rightarrow \text{GPI}$: $\beta = 0.699$; $f^2 = 0.957$), and intention predicts actual behavior ($\text{GPI} \rightarrow \text{GPB}$: $\beta = 0.622$; $f^2 = 0.631$). This pattern supports TPB's intention-to-behavior logic while highlighting trust as a critical "Organism" state in the S-O-R chain

that can help explain the intention-behavior gap frequently observed in sustainable consumption contexts.

Fourth, the moderation findings refine the role of transparency in green markets. Transparency significantly moderated only the greenwashing-trust link ($TR \times PGW \rightarrow GT$: $\beta = 0.076$), indicating that transparency acts primarily as a damage-control mechanism: when firms are more transparent, the negative association between perceived greenwashing and trust becomes weaker. In contrast, transparency did not strengthen the positive trust-building effects of green advertising, eco-labels, CSR, or brand image (H8b,c,d,e rejected). This asymmetry is theoretically informative: transparency may be treated by consumers as a hygiene factor (expected baseline) rather than a differentiating enhancer, but becomes crucial when consumers suspect opportunistic “green” claims.

5.2. Theoretical contributions.

First, it operationalizes an integrated S-O-R + TPB mechanism in an emerging-market F&B setting, simultaneously modeling marketing stimuli, trust, intention, and actual behavior with high explanatory power ($R^2_{GT} = 0.681$). Second, it empirically demonstrates the dual role of transparency as a moderator specifically shielding trust from greenwashing harm, extending the transparency discourse beyond a generic “trust booster.” Third, by documenting mediation pathways (H9a - H9e) with consistent signs and significance, it clarifies how green trust functions as a central transmission channel from signals to intention, complementing signaling theory’s emphasis on credibility under information asymmetry [18].

5.3. Managerial implications for Vietnamese F&B firms and value-chain transparency.

The findings provide several practical implications for Vietnamese F&B firms. Overall, firms should prioritize system-level credibility rather than isolated promotional green claims. Since green trust plays a central role in linking green marketing signals to green purchase intention and behavior, firms need to design green marketing strategies that are credible, consistent, and verifiable [8], [10].

First, firms should invest in green brand image as the strongest trust-building factor. The results show that green brand image has the largest effect on green trust. Therefore, F&B firms should align product design, sourcing, packaging, communication, and store-level practices with a consistent sustainability narrative. A green brand image should not be built only through visual elements or promotional messages, but through repeated and consistent evidence across consumer touchpoints. This implication is consistent with prior studies showing that green brand image strengthens consumer trust and supports positive green purchase responses [2], [42].

Second, firms should strengthen the credibility and comprehension of eco-labels. Eco-labels positively influence green trust, but their effectiveness depends on credibility and consumer understanding. Firms should prioritize verifiable third-party certifications, clearly display eco-labels on packaging, and explain the meaning of certifications in simple and accessible ways. In the F&B sector, where consumers are concerned about product safety, ingredients, and origin, credible eco-labels can reduce information asymmetry and help consumers distinguish genuine green products from misleading claims [21], [24], [25], [27].

Third, green advertising should be upgraded from symbolic “green imagery” to evidence-based communication. Although green advertising positively affects green trust, vague claims such as “natural,” “eco-friendly,” or “green” may increase skepticism if they are not supported by clear evidence. Therefore, firms should provide measurable information, audited claims, certification details, and specific environmental benefits in their advertising messages. Green advertising should communicate what the firm has actually done, rather than merely creating an environmentally friendly image. This implication is consistent with previous studies emphasizing that credible and meaningful green advertising can influence consumer trust and

purchase intention, whereas misleading green claims may trigger skepticism and greenwashing perceptions [6], [21], [22].

Fourth, CSR activities should be designed for credibility rather than short-term campaigns. The relatively smaller effect of CSR on green trust suggests that superficial CSR may not strongly influence consumers. F&B firms should connect CSR with core operational practices such as sustainable sourcing, supplier standards, waste reduction, packaging improvement, emission reduction, and employee welfare. CSR is more likely to build trust when consumers perceive it as consistent with the firm's business model and long-term environmental commitment [10], [32], [33].

Fifth, transparency should be developed as a greenwashing firewall. The results show that transparency significantly mitigates the negative effect of perceived greenwashing on green trust but does not significantly amplify the positive effects of green marketing signals. This implies that transparency is especially important when consumers doubt environmental claims. Vietnamese F&B firms should implement traceability and disclosure systems, such as QR-based verification, ingredient provenance, supplier audit information, environmental certifications, and accessible sustainability reports. Firms should also communicate honestly about both achievements and current limitations, together with clear improvement roadmaps. Such practices can reduce skepticism and protect trust when green claims are questioned [5], [6], [19], [35], [38].

Finally, firms should focus on reducing the gap between green purchase intention and actual behavior. Even when consumers trust a brand and intend to buy green products, actual purchase behavior may still be constrained by price, convenience, availability, and habits. Therefore, F&B firms should make green products easier to access, reasonably priced, clearly labeled, and convenient to purchase. Building trust is necessary, but it should be combined with practical measures that help consumers translate green intention into real purchasing behavior [7], [15], [36].

Overall, Vietnamese F&B firms should view green marketing as a credibility-building system rather than a set of promotional tools. A successful green strategy requires consistent brand image, credible labels, evidence-based advertising, substantive CSR, and transparent value-chain disclosure. These actions can strengthen green trust, reduce greenwashing skepticism, and support more sustainable consumer behavior in the Vietnamese F&B sector.

5.4. Limitations and future research.

The study is limited by its cross-sectional, self-reported design and non-probability sampling in a single metropolitan context (Ho Chi Minh City), which may constrain causal inference and national generalizability. Future studies could use longitudinal or experimental designs to test causal effects of transparency cues; expand sampling across regions and rural/urban settings; and incorporate objective behavioral data (purchase records) to validate self-reported green behavior. Additional moderators (price sensitivity, perceived consumer effectiveness) and institutional factors (regulatory trust, certification regime strength) may further clarify when transparency amplifies positive signals versus when it primarily mitigates greenwashing harm.

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