

Green Gamification as a Driver of Green Eating Intention: The Mediating Role of Green Brand Image

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KEYWORDS

Green Gamification,
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APB framework.

ABSTRACT

This study investigates the mechanism through which green gamification influences green eating intentions, specifically regarding plant-based meat alternatives. By utilizing the affordance-psychological-behavioral (APB) framework as a theoretical lens, the research provides empirical insights into the transition from digital interaction to sustainable consumption within the Vietnamese market. Data were collected from 358 consumers in Ho Chi Minh City and analyzed using PLS-SEM. The findings reveal that green gamification affordances - specifically enjoyment, self-efficacy, and self-presentation - significantly enhance green brand image, with enjoyment emerging as the most potent driver. Furthermore, green brand image acts as a psychological mediator, effectively bridging the relationship between these gamified elements and green eating intention. These results offer empirical support for the applicability of the APB framework in the sustainable food sector, demonstrating how psychological mediators facilitate behavioral outcomes in digital contexts. Practically, the study implies that brand managers should prioritize immersive, enjoyable gamified designs to foster sustainable dietary shifts rather than relying solely on functional features.

1. Introduction

Animal-derived food production generally imposes a more significant environmental burden than plant-based meat alternatives (Kuosmanen et al., 2025). This disparity underscores the inherent unsustainability of contemporary global consumption patterns, particularly as food supply requirements are projected to escalate by 60% by 2050 to meet the needs of a growing population. Furthermore, the food system represents a critical lever in climate mitigation; it is responsible for an estimated 34% of global greenhouse gas emissions, with conventional animal protein production accounting for approximately half of this environmental footprint (Juraimi et al., 2025).

Therefore, modifying human dietary habits represents a viable strategy for effectively reducing food-related carbon emissions, thereby mitigating anthropogenic environmental impact.

Statista (2024) indicates that 86% of consumers in Vietnam have utilized plant-based food alternatives, signifying a notable shift in consumption patterns. This suggests an increasing consumer interest in healthier and more environmentally friendly food choices within the Vietnamese population. Conversely, only 10% of surveyed individuals reported never having used plant-based products, while 4% were unfamiliar with the concept of plant-based foods. Regarding the most frequently consumed plant-based food categories, plant-based milk (e.g., soy, rice, almond, or oat milk) was the

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most popular, chosen by 45% of consumers. This was followed closely by other dairy alternatives, including plant-based creams, soy yogurts, and vegan cheeses, at 44%. Plant-based meat alternatives (e.g., vegetarian burgers, mock meats, or vegan 'chicken' nuggets) were also consumed by 38% of consumers. Additionally, plant-based condiments and egg substitutes were utilized, albeit at lower rates of 29% and 3%, respectively.

Contemporary scholarship increasingly recognizes gamification as a potent mechanism for driving sustainable consumption and eco-friendly lifestyles. For instance, Bi et al. (2024) explored how gamified elements enhance user's green behaviors. This is corroborated by Du et al. (2025), who identified gamification as a significant predictor of green disposal behavior. Moreover, Zhang et al. (2024) elucidated its instrumental role in cultivating pro-environmental behaviors. However, while gamification's utility is well-documented in diverse contexts, its specific nexus with green eating intentions remains under-researched, representing a significant theoretical lacuna.

In recent years, green brand image has emerged as a focal point in sustainable consumption research. Empirical evidence increasingly confirms that green brand image serves as a critical driver of consumer behavioral intentions. Specifically, Nguyen-Viet (2022) demonstrated that green brand image functions as a vital mediating mechanism through which green marketing tools influence purchase intentions for dairy products. Similarly, a study by Nguyen-Viet et al. (2024) within the paints and coatings industry revealed that green brand image positively impacts green purchase intentions while strengthening the relationship between corporate social responsibility and consumer responses. Despite the well-established link between green brand image and the intention to purchase green products, a significant research gap persists within the food and beverage service sector. To date, empirical investigations into whether green brand image directly influences green eating intention remain scarce. In particular, the mediating role of green brand image in the relationship between green gamification and green eating intention has not been sufficiently explored. Addressing this gap is essential to enriching the theoretical framework of sustainable food consumption behavior in the digital era.

To address these research gaps, this study formulates three primary research questions:

RQ1: How are the dimensions of green gamification structured within the context of green eating?

RQ2: To what extent does green brand image influence green eating intentions?

RQ3: What is the mediating role of green brand image in the relationship between green gamification elements and green eating intentions?

To answer these questions, the affordance-psychological-behavioral framework is employed

to elucidate the transition from digital interaction to sustainable behavioral change. In this research, green gamification serves as a catalyst for promoting green eating intentions, facilitated by the mechanism of green brand image. Furthermore, this study contributes to the advancement of sustainable development through effective CO₂ emission reduction efforts - a goal that aligns with Vietnam's commitment to sustainable development goal 13 (SDG-13).

2. Theoretical foundation and hypothesis development

2.1. Theoretical foundation

2.1.1. *Affordance-psychological-behavioral (APB) framework*

Koivisto and Hamari (2019) introduced the “affordances-psychological outcomes-behavioral outcomes” framework, which elucidates the pivotal role of gamification in establishing a robust motivational system designed to steer users toward target behaviors. Rather than serving as mere entertainment, gamification seeks to facilitate behavioral transformation by constructing a system that provides incentives and experiences analogous to those found in games, thereby fostering engagement and eliciting positive change. According to this theoretical framework, the underlying mechanism operates through a specific behavioral psychological process. Specifically, gamification affordances are defined as the design elements integrated into a system that users perceive and interact with. This interaction subsequently yields psychological outcomes, wherein the user's cognitive perceptions and affective states are reshaped. These psychological shifts, in turn, serve as essential precursors that drive users toward specific behavioral outcomes. When applied to the context of green gamification within the plant-based food sector, the constituent affordances include enjoyment, self-efficacy, and self-presentation. As consumers engage with these elements, the resulting psychological outcome manifests as a green brand image, which ultimately fosters green eating intentions. The predictive validity of this framework regarding user behavior through the lens of green gamification has been substantiated by recent empirical evidence. Zhang and Anwar (2025) demonstrated that gamified experiences enable users to fulfill psychological needs, which significantly explains their green beliefs and attitudes, ultimately resulting in heightened environmentally responsible behavior. Furthermore, Du et al. (2025) posited that gamification affordances can facilitate green waste disposal behavior through the mediating role of intrinsic motivational sequences within a multi-goal framework. Similarly, Cao and Cheng (2025) indicated that competitiveness influences the efficacy

of gamification affordances and significantly alters users' psychological mechanisms, thereby stimulating their intrinsic motivation toward sustainable behaviors.

2.1.2. *Green eating*

While green purchase intention is broadly conceptualized as a consumer's predisposition to acquire products characterized by reduced ecological and social footprints (Nguyen-Viet, 2022), green eating intention represents a more specialized behavioral domain centered on sustainable dietary patterns. Green eating is defined as an individual's personal involvement in selecting and consuming sustainable food, driven by their inherent needs, values, and preferences (Zaichkowsky, 1985). Furthermore, diets rich in plant-based foods are considered more sustainable due to their lower requirements for land, water, and energy compared to diets high in animal-based foods (Xu et al., 2021). Specifically, green eating is defined by consumption trajectories that prioritize food choices with minimal environmental impact, with its core attribute being the systematic transition toward plant-based diets (Moirano & Koenigstorfer, 2025). This shift from animal-derived proteins to plant-based alternatives is increasingly recognized as a critical strategy for climate change mitigation, public health enhancement, and the advancement of animal welfare standards (Van der Meer et al., 2025). Consequently, by narrowing the focus from general pro-environmental purchasing to the nuances of dietary behavior, the present study empirically examines consumers' intentions to adopt plant-based meat alternatives.

2.1.3. *Green brand image*

Green brand image is conceptualized as the multifaceted set of brand perceptions held by consumers regarding a firm's environmental commitments and ecological concerns (Chen, 2010). Beyond mere perception, this construct serves a dual functional role, it aligns with the evolving environmental aspirations of the consumer base while simultaneously addressing broader ecological degradation. Consequently, developing a robust green brand image has become a strategic imperative for firms navigating the dual pressures of heightened consumer environmental consciousness and increasingly stringent international regulatory frameworks (Nguyen-Viet, 2022).

2.2. *Hypothesis development*

2.2.1. *Green gamification*

Gamification is defined as the application of game design elements in non-game contexts, with the aim of engaging participants and motivating them to achieve

specific objectives (Deterding, 2011). Recent research by Hsu (2025) delineates the mechanisms through which gamification enhances environmental sustainability and drives eco-friendly behaviors. Complementing these findings, Zhang et al. (2024) provide empirical evidence that the motivation stemming from engagement with online green gaming systems serves as an indirect catalyst for users' pro-environmental conduct.

This study examines the impact of green gamification through the lens of intrinsic motivation - a core determinant in shaping sustainable behaviors. According to Deci and Ryan (2008), intrinsic motivation emerges when individuals engage in an activity for inherent satisfaction, interest, or enjoyment, thereby establishing a foundation for commitment to challenging tasks. Within this context, engagement levels can be optimized by integrating enjoyable elements. Furthermore, self-presentation and self-efficacy are identified as essential intrinsic rewards. When participants perceive value and meaning derived from their individual efforts, they tend to experience deeper engagement, which subsequently fosters comprehensive involvement within the gamified system (Hsu, 2025). This study prioritizes the three dimensions of enjoyment, self-efficacy, and self-presentation, as they serve as salient indicators of intrinsic motivation (Deci & Ryan, 2008). While elements such as competition or rewards are predominantly extrinsic in nature, these three factors foster a more resilient and enduring association with the green brand image in the consumer's mindset.

Enjoyment is conceptualized as a core dimension of intrinsic motivation, suggesting that consumers are less inclined to participate unless they derive pleasure from the experience. This construct is pivotal in explaining consumer behavior within entertainment-oriented communities. In the context of this study, enjoyment is defined as the gratification derived from engaging in environmentally sustainable activities. For instance, the implementation of gamified environmental initiatives can foster enjoyment through engaging and immersive design elements. Self-efficacy refers to an individual's subjective perception of their competence regarding specific behaviors or their perceived capacity to successfully achieve goals. It represents a fundamental belief in one's ability to succeed when confronted with challenging demands and while striving to fulfill particular functions. Crucially, self-efficacy is distinct from an individual's actual skill level. As individuals accumulate experience within a specific domain, their self-efficacy is reinforced. Furthermore, self-efficacy exerts a more pronounced positive influence on engagement among environmentally conscious users compared to those with lower levels of environmental concern. Self-presentation is defined as an individual's tendency and motivation to communicate their identity and self-image to a community. Within digital contexts, individuals with a high need for self-presentation often gravitate toward online platforms that allow them to

affirm identity-related values - such as the role of an environmental advocate - thereby driving commitment and participation in specific tasks. Particularly, scoring mechanisms serve as a catalyst for this motivation by enabling users to accrue reputation and recognition from their peer social networks. Consequently, a scoring system functions not merely as a technical tool but as a key mechanism that enhances an individual's capacity for self-presentation (Hsu, 2025).

Under the APB framework, green gamification serves as a pivotal catalyst in bolstering green brand image. Empirical evidence strongly corroborates this relationship; specifically, Hollebeek et al. (2017) characterize gamification as a dynamic and increasingly prevalent strategy in modern marketing with the capacity to enhance brand equity. Furthermore, Fernández-Ruano et al. (2022) demonstrates that environmental experiences within gamified contexts significantly influence customer-based brand equity. Therefore, the following hypothesis is proposed:

H1: Enjoyment positively impacts GBI

H2: Self-efficacy positively impacts GBI

H3: Self-presentation positively impacts GBI

2.2.2. Green brand image

Green brand image aligns with consumers' environmental aspirations and mitigates ecological concerns (Khandelwal et al., 2019). Establishing a green brand image is paramount for enterprises, particularly in response to heightened consumer environmental awareness and stringent international environmental protection regulations (Delafruez & Goli, 2015). Furthermore, brand image serves as a critical determinant of purchase intentions (Kahraman & Kazançoğlu, 2019). Extant research indicates that when consumers perceive a firm as having a superior brand image, their willingness to purchase its products increases significantly (Chen et al., 2020). Consequently, a green brand image exerts a positive influence on purchase intentions (Kahraman & Kazançoğlu, 2019). Extant literature increasingly underscores the pivotal role of green brand image in driving sustainable consumption behaviors. Specifically, empirical evidence from Nguyen-Viet (2022) demonstrates that a robust green brand image significantly enhances consumer purchase intentions toward plant-based milk. This relationship is further validated by Nguyen-Viet et al. (2024) whose findings confirm the positive influence of green branding on green purchase intentions. Given this consistent empirical support, it is posited that a positive perception of a green brand image serves as a critical antecedent to sustainable purchase intention. Drawing upon the APB framework, green brand image plays a crucial role in driving green eating intentions. Accordingly, the following hypothesis is proposed:

H4: GBI positively impacts green eating intention.

Existing scholarship underscores the pivotal role of green brand image as a strategic mediator in shaping consumer behavior. Specifically, Nguyen-Viet (2022) posits that green brand image serves as a critical mediating mechanism through which green marketing tools are converted into purchase intentions, particularly within the dairy sector. This finding was further substantiated and expanded by Nguyen-Viet et al. (2024) in the context of the paint and coatings industry; their empirical evidence demonstrates that a green brand image not only directly stimulates green purchase intentions but also significantly strengthens the link between corporate social responsibility initiatives and overall consumer responses. Furthermore, green brand image has been shown to mediate the relationship between green product experience and green product purchase decisions (Bukhari et al., 2017). Similarly, green brand image mediates the impact of sustainable packaging on purchase intentions and consumers' willingness to pay (Plotkina et al., 2025). Consequently, the following research hypothesis is proposed:

H5: GBI mediates the relationship between enjoyment (H5a), self-efficacy (H5b), self-presentation (H5c), and green eating intention.

3. Methodology

3.1. Measurement

The measurement scales for the constructs in this study were adapted from established literature. The study conducted in-depth interviews with five subject matter experts - comprising three marketing academics and two food brand managers - to refine the measurement scale terminology, ensuring its linguistic appropriateness for the local context and the plant-based meat alternative (PBMA) sector. Subsequently, the final instrument was translated into Vietnamese using a rigorous back-translation procedure to maintain linguistic equivalence. The resulting survey instrument is structured into two sections: the first gathers demographic data, while the second comprises items measuring the study's focal constructs. Specifically, the scales for enjoyment (3 items), self-efficacy (3 items), and self-presentation (4 items) were adapted from (Hsu, 2025). Green brand image was assessed using 5 items from Nguyen-Viet (2022), and green eating intention was measured with a 5-item scale adapted from Chiu et al. (2025).

3.2. Sampling design and procedures

This study adopted a quantitative approach, utilizing a convenience sampling method for data collection. While this method may introduce potential sampling bias, several procedural remedies were implemented to mitigate common method bias (CMB). To minimize

questionnaire ambiguity, a focus group discussion was conducted with 10 participants representative of the target population. This session aimed to refine the instrument, enhance clarity, and eliminate potentially confusing items. Notably, the focus group discussion was facilitated to clarify the green eating construct, ensuring that participants correctly identified the concept specifically as the consumption of PBMA. Furthermore, the survey items were randomized to ensure they appeared in varying sequences for different participants. Additionally, a reverse-coded item was integrated into the questionnaire to verify respondent attentiveness and discourage arbitrary high-score patterns. Specifically, for the item BI5 (“The brand is trustworthy about environmental promises”), a corresponding reverse-coded item, BI6 (“The brand is not trustworthy about environmental promises”), was included. This design aimed to reduce potential CMB and ensure response consistency. Responses were deemed unreliable and subsequently excluded from the final dataset if participants rated both the original and reverse-coded items consistently high (e.g., 4 or 5) or consistently low (e.g., 1 or 2). Consequently, the reverse-coded item was excluded from the final statistical analysis to prevent multicollinearity issues. Moreover, multicollinearity assessments (VIF) and Harman’s single-factor test were performed, confirming that CMB did not pose a significant concern for this study (Cooper et al., 2020). Data collection took place between September and October 2025. A Google Forms link was distributed via email to students and staff at several universities in Ho Chi Minh City. The survey link was also shared across online communities (Facebook and Zalo) focused on green lifestyles, environmental protection, and eco-friendly products within the city. Offline data were gathered at selected cafes, supermarkets, and green product outlets in the same metropolitan area, with a limit of five respondents per location to enhance diversity. Screening questions were integrated to ensure participants met specific eligibility criteria, including residency in Ho Chi Minh City, recent purchasing experience or interest in green products, and prior engagement with green gamification features. A total of 358 valid responses were obtained, satisfying the sample size recommendations proposed by Hair et al. (2022). The demographic characteristics of the sample are detailed in Table 1.

3.3. Analytical technique

Data were analyzed using the PLS-SEM technique. The measurement model was assessed based on key indicators, including composite reliability, convergent validity, and discriminant validity. For the structural model, evaluation criteria encompassed the VIF, Q2, and R2 (Hair et al., 2022). These analyses were conducted using SmartPLS 4 software. Additionally,

descriptive statistics and Harman’s single-factor test were performed using SPSS 20.

Table 1. Demographic characteristics

Criteria	Group	Frequency	Percentage (%)
Gender	Male	98	27.4
	Female	260	72.6
Age	18-24	130	36.3
	25-35	143	40.0
	Older than 35	85	23.7
Education	High school	32	8.9
	University/college	208	58.1
	Postgraduate	118	33.0
Income	Less than 10 m VND	29	8.1
	10-15 m VND	57	15.9
	15-20 m VND	95	26.5
	More than 20 m VND	177	49.5
Used green gamification		358	100

4. Results

4.1. Common Method Bias (CMB)

To assess common method bias, the study employed the VIF approach. All VIF values were below 5, meeting the threshold recommended by Hair et al. (2022). Furthermore, Harman’s single-factor test indicated that the total variance explained by a single factor was 45.864%, which falls below the 50% limit suggested by Cooper et al. (2020). Consequently, it can be concluded that CMB is not a significant issue in this research.

4.2. Results regarding the measurement model

To evaluate the reliability and convergent validity of the data, we calculated the average variance extracted (AVE), Cronbach’s alpha (α), and composite reliability (CR). As shown in the Table 2, the CR values ranged from 0.843 to 0.935, which are all above the recommended threshold of 0.7, indicating satisfactory reliability. Cronbach’s alpha values ranged from 0.823 to 0.933, exceeding the 0.7 threshold, further supporting internal consistency. Convergent validity was assessed through the outer loadings and AVE values. The outer loadings ranged from 0.717 to 0.928. All remaining outer loadings exceeded the acceptable threshold of 0.7. AVE values ranged from 0.692 to 0.789, which are above the recommended value of 0.5, confirming adequate convergent validity (Hair et al., 2022).

To ensure discriminant validity, we applied the Fornell-Larcker criterion, which indicates that the square root of each construct’s AVE is greater than the

correlations between the construct and other constructs, as presented in Table 3. Additionally, the heterotrait-monotrait (HTMT) ratios of the correlations were calculated, all of which are below the recommended cut-off value of 0.90 (Hair et al., 2022), as presented in Table 4. Therefore, the results confirm the reliability, convergent validity, and discriminant validity of the measurement model, and no significant issues with multicollinearity or common method bias were identified.

Table 2. Construct reliability and convergent validity

Constructs	OL	α	CR	AVE
Enjoyment (EJ)				
EJ1	0.909			
EJ2	0.896	0.861	0.872	0.782
EJ3	0.848			
Self-efficacy (SE)				
SE1	0.850			
SE2	0.798	0.823	0.843	0.740
SE3	0.928			
Self-presentation (SP)				
SP1	0.890			
SP2	0.853	0.902	0.904	0.773
SP3	0.855			
SP4	0.917			
Green Brand Image (BI)				
BI1	0.849			
BI2	0.826			
BI3	0.887	0.887	0.890	0.692
BI4	0.869			
BI5	0.717			
Green eating intention (GE)				
GE1	0.884			
GE2	0.881			
GE3	0.836	0.933	0.935	0.789
GE4	0.917			
GE5	0.921			

Table 3. Discriminant validity (Fornell-Larcker criterion)

	BI	EJ	GE	SE	SP
BI	0.832				
EJ	0.630	0.885			
GE	0.672	0.587	0.888		
SE	0.295	0.443	0.503	0.860	
SP	0.554	0.493	0.445	0.050	0.879

Table 4. Discriminant validity (HTMT ratio)

	BI	EJ	GE	SE	SP
BI					
EJ	0.714				
GE	0.732	0.646			
SE	0.346	0.523	0.576		
SP	0.615	0.553	0.480	0.070	

4.3. Results of the structural model and hypotheses testing

The predictive relevance was confirmed, by Q^2 values of 0.324; 0.347 for BI and GE. Explanatory power was as indicated by R^2 values of 0.481; 0.452 for BI and GE. These findings collectively affirm that the structural model adequately represents the hypothesized relationships within the research framework (Hair et al., 2022).

Statistical significance was validated via the bootstrapping approach with 5,000 resamples. As indicated in Table 5 and Figure 1, the analysis of direct effects yielded the following results; EJ demonstrated a significant positive influence on BI ($\beta = 0.422$, $p < 0.01$); thus, H1 was verified. The corresponding effect size was medium ($f^2 = 0.199$). This finding aligns with the conceptualizations of Hollebeek et al. (2017) and Fernández-Ruano et al. (2022), suggesting that gamified environmental experiences significantly enhance customer-based brand equity; when individuals derive satisfaction and pleasure from an activity, they are more likely to develop sustainable engagement. Within the Vietnamese context, interaction with "green" gamified designs—such as virtual tree-planting or eco-missions—facilitates the perception of a brand as environmentally friendly and socially responsible. The results also revealed a significant positive effect of SE on BI ($\beta = 0.091$, $p < 0.1$); therefore, H2 was verified. However, its practical impact was negligible ($f^2 = 0.012$). Notably, SE exhibits a weaker influence compared to the other two antecedents. This may be attributed to the fact that selecting plant-based meat alternatives (PBMA) is often perceived as a matter of personal preference rather than a cognitively demanding task requiring specialized skills. Consequently, Vietnamese consumers may not perceive behavioral competence as a significant barrier, resulting in self-efficacy playing a secondary role in the formation of a green brand image. In the Vietnamese market, if a gamification system overemphasizes skill-based challenges at the expense of entertainment value, it may precipitate a decline in psychological brand engagement. Furthermore, the analysis indicated a significant positive relationship between SP and BI ($\beta = 0.341$, $p < 0.01$); thus, H3 was verified. The effect size for this path was categorized as medium ($f^2 = 0.162$). Consistent with Hsu (2025),

users in digital ecosystems possess a profound need to signal their personal identity and self-worth through symbolic rewards, such as badges or leaderboards. This result reflects the socio-cultural characteristics of Vietnamese consumers, particularly the younger demographic, who utilize the sharing of green achievements on social networking sites like Facebook and Zalo as a strategy to accrue social capital and affirm a civilized lifestyle. The study further explored, BI was found to have a significant positive influence on GE ($\beta = 0.672$, $p < 0.01$), supporting H4. Crucially, the effect size was exceptionally large ($f^2 = 0.825$). This is consistent with the findings of Nguyen-Viet (2022) and Nguyen-Viet et al. (2024), which demonstrate that a robust green brand image serves as a critical driver of green purchase intentions.

The examination of mediating effects, as detailed in Table 5 and Figure 1, also provided valuable insights.

BI mediated the relationship between EJ and GE ($\beta = 0.283$, $p < 0.01$); thus, H5a was verified. Similarly, BI mediated the effect of SE on GE ($\beta = 0.061$, $p < 0.1$); therefore, H5b was verified. Furthermore, the mediating role of BI between SP and GE was found to be statistically significant ($\beta = 0.229$, $p < 0.01$) supporting H5c.

5. Conclusion and implications

5.1. Conclusion

Sustainable development goal 13 (SDG 13) mandates urgent intervention to combat climate change. Amidst the escalating complexity of global climatic shifts, consumer food choices have transcended the realm of individual preference to become critical determinants of environmental sustainability. This

Table 5. Hypotheses testing

Hypotheses	Path	β	p values	f^2	Results
Direct effects					
H1	EJ→BI	0.422	0.000	0.199	Verified
H2	SE→BI	0.091	0.057	0.012	Verified
H3	SP→BI	0.341	0.000	0.162	Verified
H4	BI→GE	0.672	0.000	0.825	Verified
Specific indirect effects					
H5a	EJ→BI→GE	0.283	0.000		Verified
H5b	SE→BI→GE	0.061	0.056		Verified
H5c	SP→BI→GE	0.229	0.000		Verified

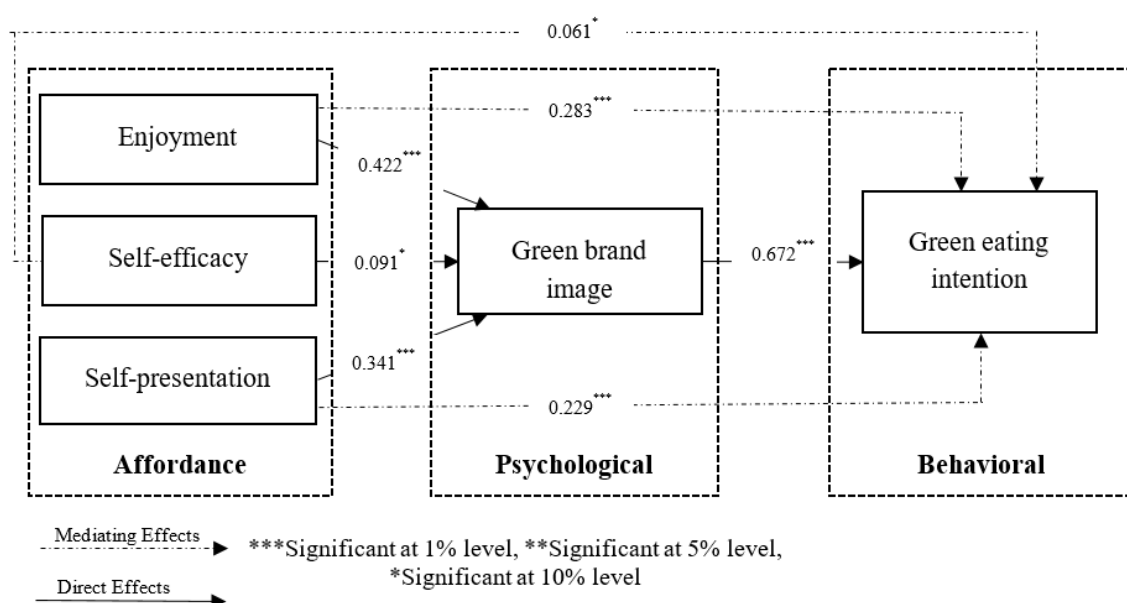


Figure 1. The structural model

reality underscores the imperative of transitioning toward consumption patterns that minimize ecological impact. Indeed, daily consumer behaviors and lifestyles constitute significant drivers of environmental degradation and climate change; notably, food-related carbon footprints account for approximately 30% of total anthropogenic emissions. Consequently, the strategic shifting of consumer dietary patterns serves as a substantive lever for reducing food-related carbon intensity, thereby mitigating the ecological externalities associated with anthropogenic activity. In practice, as gamification successfully bridges the gap between digital interaction and the intention to consume plant-based meat alternatives (PBMA), it facilitates a systematic dietary shift. Every meal replaced by a PBMA instead of conventional animal protein represents a direct reduction in methane and CO₂ emissions, given that livestock production accounts for nearly half of the food system's carbon footprint. By fostering a robust green brand image that encourages consistent plant-based choices, gamification serves as a scalable mechanism to lower individual carbon intensities, thereby providing a substantive and measurable pathway for Vietnam to meet its national commitments under SDG-13.

The findings reveal that green gamification is not merely a transient engagement tool but a substantial antecedent of brand perception. Specifically, the three dimensions of green gamification - enjoyment, self-efficacy, and self-presentation were found to positively influence green brand image. Notably, enjoyment emerged as the most potent driver, suggesting that the intrinsic hedonic value of the gamified experience is paramount in shaping a favorable ecological perception of the brand. Self-presentation also demonstrated a strong positive impact green brand image. Although self-efficacy showed a positive relationship, its influence was comparatively weaker, indicating that while competence is necessary, it is the enjoyment and self-presentation aspects that primarily drive brand image construction. Furthermore, green brand image were found to positively influence green eating intention. In addition, a pivotal finding of this study is the confirmation of green brand image as a mediator. The analysis confirms that green gamification does not only influence green brand image directly but influence green eating intention through green brand image as the psychological bridge that translates the interactive benefits of gamification into a concrete intention to adopt green eating. In summary, this research underscores that for food brands, the integration of gamified digital strategies is instrumental in cultivating a robust green image, which is essential for fostering sustainable consumption patterns in emerging economies.

5.2. Theoretical implications

This study offers several significant contributions to the extant literature on sustainable marketing, gamification, and consumer behavior, particularly within the domain of the food industry. Drawing upon the affordance-psychological-behavioral framework, this study operationalizes the research constructs as follows: affordance is represented by the constituent elements of green gamification, specifically comprising enjoyment, self-efficacy, and self-presentation. The psychological dimension is conceptualized as BI. Finally, behavioral outcomes are assessed through green eating intention.

First, this study extends the current understanding of how consumer intrinsic motivation is activated through gamified experiences oriented toward sustainable values. Specifically, it identifies intrinsic motivations - namely enjoyment, self-efficacy, and self-presentation - as the foundational components of green gamification. Furthermore, the findings demonstrate that these three factors significantly bolster green brand image.

Second, the research reveals that when consumers perceive a brand's green initiatives as having greater personal relevance, the resulting enhancement in green brand image serves as a driver for green eating intention.

Third, the results establish that green brand image plays a pivotal mediating role in the relationship between the intrinsic motivators (enjoyment, self-efficacy, and self-presentation) and consumers' green eating intention.

5.3. Practical implications

From a managerial perspective, the findings of this study offer actionable insights for marketers, brand managers in the plant-based food sector, and policymakers aiming to promote SDG-13. First, the paramount importance of enjoyment suggests that green gamification strategies must prioritize user experience design that is inherently entertaining. Managers should avoid designing gamified systems that are purely functional or educational, as these may fail to engage users emotionally. Instead, applications should incorporate immersive storytelling, visually appealing graphics, and playful interactions (e.g., growing a virtual garden based on sustainable food purchases) to make the "green" experience enjoyable. If the interaction is fun, the brand is perceived as more authentically green. Secondly, the strong influence of self-presentation indicates that consumers use these platforms to signal their green identity to others. Marketing strategies should integrate social sharing features, leaderboards, and digital badges that users can display on social media platforms (e.g., Facebook, Zalo). By enabling users to showcase their "eco-achievements," brands can leverage social proof to

enhance their green brand image. A scoring system should not just be for internal tracking but should serve as a badge of honor that enhances the user's social capital. Thirdly, managers must recognize that gamification is a branding tool, not just a sales activation tool. Since green brand image fully mediates the relationship between gamification and intention. Building a strong green image through gamification will yield sustainable long-term purchase intentions.

However, brand managers must remain vigilant regarding the novelty effect - a common phenomenon where user engagement diminishes once the initial excitement of gamification wears off. To sustain enjoyment and engagement in the long term, gamified systems should transition from static designs to dynamic, evolving ecosystems. Instead of repetitive tasks, marketers should implement 'seasonal challenges' or tiered loyalty programs that provide fresh content and increasing levels of difficulty. Furthermore, by deepening the social dimension - such as allowing users to form 'green squads' or participate in community-wide eco-competitions - brands can transform a transient digital experience into a persistent social habit. This evolution ensures that the hedonic value remains a consistent driver of the green brand image, preventing the gamification features from becoming obsolete once the novelty fades.

5.4. Limitations

Despite the rigorous methodology, this study acknowledges several limitations that pave the way for future research avenues. First, the research employed convenience sampling focused on Ho Chi Minh City. While this area represents a major economic hub with high digital literacy, the findings may not be fully generalizable to rural populations in Vietnam or consumers in Western cultural contexts where attitudes toward plant-based meat differ. Future research should employ probability sampling and conduct cross-cultural comparative studies to validate the model's global applicability. Second, the study utilized a cross-sectional design, which captures consumer intentions at a single point in time. While PLS-SEM allows for predictive analysis, it cannot definitively infer causality or long-term behavioral changes. As gamification effects can suffer from the novelty effect, future scholarship should adopt longitudinal designs to examine whether the impact of gamification on green brand image and eating habits persists over extended periods. Third, the current model focused on the drivers of green eating intention. It did not account for potential barriers such as technology anxiety, privacy concerns regarding data tracking in apps, or skepticism toward greenwashing. Future models could benefit from integrating moderating variables such as "green skepticism" or "environmental concern" to

see how different consumer segments react to green gamification. Finally, this study focused specifically on plant-based meat alternatives. Future research could expand the scope to other domains of green eating, such as organic food consumption, food waste reduction apps, or locally sourced food initiatives, to test the versatility of the APB framework in the broader sustainable food ecosystem.

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