



Eco-consciousness in tourism: A psychological perspective on green marketing and consumer behavior

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ABSTRACT

This research investigates the impact of eco-friendly marketing strategies on environmentally aware actions displayed by tourists in the Chinese hospitality sector. This research evaluates the relationships between green consumption value and pro-environmental self-identity and felt obligation to explain consumer behavior by applying the Stimulus-Organism-Response (S-O-R) model framework. A total of 437 hospitality consumers took part in the study, and data analysis was conducted using structural equation modeling. Result data indicates that eco-friendly marketing practices directly stimulate tourists to adopt sustainable behaviors. The relationships between these effects become stronger through the pathway influence of green consumption value and pro-environmental self-identity. Felt obligation strengthens the relationships between these variables because it increases the likelihood of people taking eco-conscious actions. The research demonstrates practical and theoretical value by showing businesses how to use green marketing effectively for sustainability promotion in hospitality operations. The study indicates that organizations must unite identity-based marketing with value-based methods to encourage environmentally sustainable actions that advance worldwide conservation programs.

1. Introduction

The world has been experiencing escalating climatic change effects, making it a critical global concern, which requires the involvement of all stakeholders in combating this problem (Ahmad, Samad, & Mahmood, 2024; Kautish et al., 2022). The increase in global temperatures, recurrent natural disasters, and changes in the weather have all pointed to the need to adopt appropriate measures to reduce the impact of climate change (Ahmad, Ahmad, & Siddique, 2024; Mehmood, Kautish, Mangla, Ali, & Kazancoglu, 2024). These phenomena resulting from excessive emission of greenhouse gases require people, organizations, and governments to change their ways and embrace sustainable practices to minimize their environmental impacts. As it has been acknowledged in the present era, each industry, organization, and person is responsible for participating in the global process of making the planet carbon neutral (Guan et al., 2023; Kautish et al., 2024).

In this regard, businesses especially play a major role in this process. Being some of the leading producers of greenhouse gases, industries globally need to adopt sustainable practices to reduce their impact (Kong et al., 2021; Shaik et al., 2025). The use of eco-friendly practices

in business not only reduces the carbon footprint of the business but also acts as a benchmark for other businesses to emulate. Some of these practices are minimization of waste, efficiency in energy consumption, and use of renewable energy sources (Jaiswal et al., 2022; Murtaza et al., 2021). However, the part of customers in enhancing and promoting such initiatives is equally important. Consumer behavior can also influence the, make organizations become more environmentally conscious (Taneja & Ali, 2021). Consumers who make a conscious decision to be environmentally friendly assist in creating awareness to organizations to practice what is known as sustainable business practices in order to meet global environmental standards.

In tourism and hospitality industries, the focus on sustainability is especially important (Rafi et al., 2024; Xu et al., 2022). In detail, the hospitality industry, which includes hotels and resorts, as well as other related services, greatly impacts the environment through energy consumption, waste production, and resource use. However, this sector also has an opportunity to become an advocate of sustainable practices (Ahmad, Ahmad, Lewandowska, & Han, 2024). By implementing environmentally friendly marketing strategies and providing eco-friendly services, hospitality organizations can greatly minimize their adverse

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effects on the environment. These efforts are beneficial to environmental conservation and are beneficial to environmental conservation and target the increasing market of eco-tourism, where people are more conscious of the impact of their actions on the environment. The hospitality industry needs sustainable consumption because environmentally conscious tourists increase, and corporate social responsibility receives worldwide attention (Ahmad, Han, & Kim, 2024; Jiang et al., 2025). The process of promoting significant behavioral alterations demands a thorough examination of psychological and motivational elements that influence eco-conscious choices made by consumers (Ahmad, Ahmad, & Siddique, 2024; Yuxiang et al., 2024). Green marketing initiatives alongside other environmental stimuli can shape human cognition and emotion which alters individual behaviors based on the Stimulus-Organism-Response (S-O-R) framework (Mehrabian & Russell, 1974). The hospitality sector has not extensively utilized this relevant theoretical approach to evaluate consumer decision patterns influenced by green marketing strategies. The majority of previous research about these relationships focused on Western populations (Majerova, 2015; Sharma, 2021) while neglecting their operational mechanisms in non-Western settings particularly China. This study seeks to contribute insights about green marketing strategies that will support academic research and practical applications in the Chinese tourism industry.

China, being one of the world's leading economies and a significant participant in international tourism, has a significant responsibility for environmental issues (Arslan et al., 2022). The Chinese government has recently sought to reduce its emissions by implementing climate change policies and sustainable development (Chen & Gong, 2021). Such measures include putting in place policies that support renewable energy, enforcing strict environmental standards, and encouraging the adoption of green technologies. The Chinese businesses in the hospitality industry are embracing sustainable features, for instance, energy conservation facilities and waste management initiatives in conformity with the national and international environmental policies.

The purpose of this research is to investigate the effect of green marketing campaigns on green consumer behavior in the Chinese hospitality industry. More precisely, we seek to explore the relationship between eco-friendly marketing initiatives and eco-conscious consumer behaviors by considering green consumption value and pro-environmental self-identity as mediators and felt obligation as a moderator. This objective is important from an environmental point of view as it focuses on the relationship between the company and the consumer in supporting sustainability. Within this context, the study aims to contribute to the understanding of these dynamics to inform the hospitality sector's contribution toward the global fight against climate change and the attainment of the carbon neutrality goal. Multiple studies have investigated green marketing effects on consumer responses within the retail and general consumer goods markets (Ahmad, Mahmood, et al., 2021; Zhang et al., 2021). Research about green marketing effect on eco-conscious consumer behavior in hospitality remains insufficient. Hospitality services require special consideration because decisions made by environmentally conscious consumers depend on their personal values (Ahmad, Ahmad, & Siddique, 2023; Ahmad, Scholz, et al., 2021) and hotel sustainability practices and marketing activities. Previous research established the impact of green marketing but failed to study the psychological mediators between this relationship, including green consumption value and pro-environmental self-identity. Systematic research in the recent past has avoided investigating the ability of felt obligation to moderate relationships between various variables. Research into these areas enables better comprehension of how green marketing measures sustainable consumer actions in hospitality settings.

Moreover, some significant research gaps still exist as follows: Firstly, there is a gap in the literature regarding the psychological processes by which green marketing initiatives affect consumer behavior, particularly within the hospitality industry, despite the extensive literature on the effects of green marketing initiatives (Chou et al., 2020;

Sharma, 2021). Similarly, prior studies have mainly examined direct associations while excluding various moderating and mediating factors that may provide more valuable information about consumers' decision-making processes (Amoako et al., 2022). Furthermore, there is a lack of research on how pro-environmental self-identity and green consumption value act as mediators in the case of eco-marketing. These variables are fundamental to personal values and self-identity in relation to environmental conservation, but the mediating function of these variables is not well understood.

As well, the literature on the role of the moderator in the hospitality industry has understudied the notion of felt obligation as a moderator. Although some earlier research has recognized moral responsibility as a factor influencing consumers' decisions (Alsaad et al., 2021), no prior research has comprehensively examined how this perceived duty plays out in relation to green marketing campaigns. This gap provides an opportunity to build on the existing literature on how internal and external factors can enhance sustainability. Moreover, most of the previous research has been conducted on Western populations (Majerova, 2015; Sharma, 2021), and therefore, the nature of such dynamics in non-Western contexts is still poorly understood. In view of this, it is necessary to compare the drivers of green marketing and green consumer behavior across cultures. It is important to note that the filling of these gaps is not only significant for academic research but also for practical applications that may contribute to the enhancement of marketing communication to encourage sustainable consumption across cultures. Our study fills these gaps in the Chinese context by examining green consumption value and pro-environmental self-identity as mediators, in tandem with felt obligation as a moderator. This study seeks to establish these mechanisms because such knowledge is still very scarce and may help enhance the contribution of the hospitality industry to sustainability globally.

To bridge these gaps, this study is guided by the following research questions:

1. How do eco-friendly marketing initiatives impact eco-conscious consumer behavior in the hospitality sector?
2. To what extent do green consumption value and pro-environmental self-identity mediate this relationship?
3. Does felt obligation strengthen the influence of eco-friendly marketing on eco-conscious consumer behavior?

This research investigates how eco-friendly marketing motives consumer conduct through the application of S-O-R model analysis. Using the S-O-R model provides an opportunity to better understand how marketing stimuli influence internal thinking and emotional processes before consumers show behavioral changes. This research incorporates green consumption value and pro-environmental self-identity as mediators in order to demonstrate both value-based and identity-based perspectives which drive eco-conscious actions. Felt obligation serves as a moderator to illustrate the importance of moral responsibility in developing sustainable behaviors. This perspective provides a comprehensive context about green marketing operations in hospitality, delivering beneficial knowledge to academic and practical domains.

2. Literature and hypotheses

Eco-friendly marketing initiatives affect several customer outcomes related to the environment (Ramli et al., 2020). Examples include promoting environmental responsibility, offering green rewards, and engaging in environmentalism that influences the consumers' perception and behavior (Dangelico & Vocalelli, 2017). The literature findings show that the communication of companies regarding their environmental activities leads to positive consumer perceptions, green consumer behavior (Kasliwal & Agarwal, 2019), and consumer's positive word of mouth (Abdelrazek & El-Bassiouny, 2023), which are all critical in combating climate change and promoting sustainability (Mandić et al., 2024).

Past studies have investigated green marketing effects on consumer responses within the retail and general consumer goods markets (Ahmad, Mahmood, et al., 2021; Zhang et al., 2021). Research about green marketing effect on eco-conscious consumer behavior in hospitality remains insufficient. Research findings show that environmentally conscious marketing practices such as sustainable hotel branding together with earth-friendly promotional promotions impact strongly how customers make their purchasing decisions (Demir et al., 2021; Uddin et al., 2024). Research into the effects of green marketing approaches on consumer conduct during Western markets exists (Majerova, 2015; Sharma, 2021), but few investigations analyze similar effects on Chinese consumers whose unique cultural and economic elements possibly generate dissimilar reactions. The growing significance of sustainability in global hospitality requires knowledge of Chinese market dynamics which strengthens academic research.

As a strategic marketing approach, green marketing involves marketing goods and services in a way that reduces their impact on the environment and supports sustainability (Ali, 2021). Consumer behavior characterized by environmental consciousness is defined as consumers' decision-making in purchasing environmentally friendly products and supporting environmentally friendly businesses (Adrita & Mohiuddin, 2020). Kasliwal and Agarwal (2019) found that green marketing strategies and consumers' green behavior correlate well. Possible measures are to support public transport, to use local organic products, and to support accommodation with environmental friendliness. These strategies target customers who are sensitive to the environment and would prefer to use services that are friendly to the environment. This understanding assists in the formulation of marketing strategies that would effectively address the needs of consumers who are concerned with the environment, hence improving the competitive edge of the business and at the same time promoting environmental conservation.

The S-O-R model can be considered as a suitable theoretical framework to explain the connection between eco-friendly marketing activities and consumer environmental consciousness. The S-O-R model serves as a theoretical mechanism which explains how marketing stimuli shape consumer decision processes. Environmental psychology created the original S-O-R model which researchers now apply across different consumer contexts throughout retail, e-commerce and service sectors (Neiba & Singh, 2024). Eco-friendly marketing messages represent external triggers within the hospitality sector which transform consumer cognitive and emotional reactions into behavioral changes. Research shows that sustainable communication in marketing generates positive mental and emotional reactions which strengthens individual dedication to consuming sustainably (Hameed et al., 2022). The research about integrating internal psychological mechanisms within the S-O-R model to explain eco-friendly marketing behavior relationships remains scarce.

As per the S-O-R model, the external environment (eco-friendly marketing initiatives) impacts the organisms and thereby brings out a particular behavior (Amaya Rivas et al., 2022). In the context of our work, stimuli are the environmentally friendly marketing activities that influence consumers' environmental beliefs and perceptions, which in turn translate into the desired green consumer behavior. This model depicts how external marketing communication leads to internal psychological changes that produce long-term behavior changes among consumers. Hence:

H1. Eco-friendly marketing initiatives positively influence eco-conscious consumer behavior in the hospitality sector.

Green consumption values, referred to by Bailey et al. (2016), are influenced by environmental marketing initiatives (Biswas & Roy, 2015). Studies have shown that individuals with higher green consumption values are more likely to engage in eco-conscious behaviors, particularly when businesses effectively communicate their environmental commitments (Tan et al., 2022). In the hospitality sector, hotels that promote sustainable practices, such as waste reduction, renewable

energy use, and eco-certifications, can enhance guests' green consumption values, thereby fostering pro-environmental behavior (Khan et al., 2024; Yan et al., 2021).

Research indicates that through the green marketing strategy, firms not only inform consumers about the benefits from the products they market but also educate them on the benefits of environmental conservation hence enhancing the green consumer value (Kar & Harichandan, 2022). Such measures as energy consumption, reduction of wastes and the use of renewable resources are more likely to be appreciated by the consumers when making their decisions.

Environmental marketing communication and green consumption value are more relevant in the hotel industry, as suggested by Han et al. (2024). Chung (2020) noted that the hotels and resorts that effectively inform the guests about the environmental measures that are in place are likely to change the perceptions of the guests. For example, the hotel that promotes solar energy, water conservation, and organic food purchasing makes a statement about being an environmentally friendly option and informs people about its benefits. This can result in the guests developing a higher appreciation and value of green consumption and, thus, patronizing businesses that practice sustainable consumption.

Efforts to promote environmental marketing are interconnected with environmentally friendly consumer behavior through green consumption value. If consumers highly regard green consumption, they will be able to exhibit behaviors that are consistent with this value (Mutum et al., 2021). Therefore, eco-friendly marketing activities can impact green behavioral intentions indirectly by increasing green consumption value (Demir et al., 2021). For instance, a hotel that markets its green certifications and sustainability measures will enhance guests' awareness and consequently, their actions like selecting environmentally friendly accommodations and participating in the hotel's recycling initiative. It is for this reason that understanding this mediation is important for businesses that seek to encourage sustainable consumer practices.

From the perspective of the S-O-R model, this mediating mechanism can be explained as follows. In this model, environmental marketing strategies serve as the external stimuli toward consumers' green consumption value, which is the internal state that, in turn, results in green consumer behavior. When the S-O-R model is applied, the mechanisms of how the eco-friendly marketing initiatives affect consumer values and behaviors can be explained, thus the indirect influence of the marketing initiatives on consumer behavior through the improvement of the green consumption value. Therefore:

H2. Eco-friendly marketing initiatives positively influence green consumption value.

H3. Green consumption value positively influences eco-conscious consumer behavior.

H4. Green consumption value mediates the relationship between eco-friendly marketing initiatives and eco-conscious consumer behavior in the hospitality sector.

Another important moderator that can explain the connection between eco-friendly marketing strategies and consumers' propensity to act sustainably is pro-environmental self-identity, which refers to how consumers define themselves as environmentally conscious buyers (Carfora et al., 2017). Such marketing can be very effective in strengthening this self-identity as it pertains to the values and behaviors consumers have regarding the environment (Lavuri et al., 2023). Therefore, when companies report about their sustainable activities and use green marketing communication, they not only promote their goods but also contribute to and reinforce the consumers' green self-identity (Carfora et al., 2017). This validation can give the consumers the impression that they are part of the environmental conservation fraternity; hence, they will be more willing to embrace and maintain environmentally friendly behaviors.

Furthermore, pro-environmental self-identity, has been identified as

a key factor in sustainable consumer behavior (Zhao et al., 2024). Consumers with a strong pro-environmental self-identity are more likely to choose eco-friendly accommodations and participate in sustainable tourism activities. While these constructs have been widely studied in general consumer contexts, their mediating roles in the hospitality industry remain under-examined. This study fills this gap by examining how green consumption value and pro-environmental self-identity act as key psychological pathways linking eco-friendly marketing to consumer behavior. In the context of the hospitality industry, the promotion of sustainable practices can be the factor that contributes to the formation of an environmental self-identity of a guest (Mahasuweerachai & Sut-tikun, 2022). For instance, when a hotel company decides to incorporate the concept of sustainability into its business by reducing waste energy, and using natural resources, it has a strong message to the guests. Therefore, this message may be appealing to those consumers who already have a positive, although not very developed, self-concept of an environmental guardian (He, 2019). When guests begin to view themselves as supporters of such sustainable practices, they will begin to behave in a manner that is consistent with their green self-identity, for instance, choosing environmentally friendly hotels and engaging in green activities promoted by the hotel (Ettinger et al., 2021).

Thus, pro-environmental self-identity as a mediator occupies a central position in linking eco-marketing strategies to environmentally friendly consumer behavior. The greater the extent of the consumers' environmental identity, the more they will act in ways that are congruent with that identity (Dermoddy et al., 2015). Marketing initiatives that are green can, therefore help enhance green consumer behavior since it enhances self-identity as being green. For example, a hotel that actively communicates its concern about the environment and practices of sustainability is likely to improve the guests' pro-environmental self (Kumar et al., 2023). Such a strengthened identity can make the guests be economical on energy used during their stay, recycle and support other measures that the hotel may be taking in the conservation of the environment. Businesses must understand this mediating role if they are to ensure that the consumers are willing to continue with sustainable behavior in the future.

In the context of this mediating mechanism, the S-O-R model can also be used. In this model, green marketing activities are considered external variables that impact the internal state of the organism, particularly the consumer's green self-identity. This internal state then leads to a specific response: eco-conscious consumer behavior. Thus, the S-O-R model helps to understand how marketing communication affects the desired self-identity and, in turn, behaviors. This approach offers a holistic view of how marketing activities can influence consumer behavior indirectly by promoting pro-environmental self-identity. Therefore:

H5. Eco-friendly marketing initiatives positively influence pro-environmental self-identity.

H6. Pro-environmental self-identity positively influences eco-conscious consumer behavior.

H7. Pro-environmental self-identity mediates the relationship between eco-friendly marketing initiatives and eco-conscious consumer behavior in the hospitality sector.

Felt obligation, which is the perceived moral responsibility to act in an environmentally friendly way (Chen, Matloob, et al., 2023) is a significant mediator (Wu et al., 2021) of the relationship between eco-friendly marketing activities and consumers' environmentally conscious behavior under a moderated mediation model. This sense of obligation can either strengthen or weaken the indirect impact of eco-friendly marketing communication through mediators such as green consumption value and pro-environmental self-identity. If consumers feel that they owe it to society to support environmentally friendly causes, the influence of these marketing strategies on the mediators should be more significant, which in turn results in higher levels of pro-

environmental behavior.

Research shows that Felt obligation stands as an important element in consumer decisions since people perceive it as their moral duty to maintain sustainable actions (Shaw & Shiu, 2002). A strong sense of obligation leads people to respond better to environmental communication while also encouraging them to practice sustainable actions according to Wu et al. (2021). Felt obligation serves to enhance green marketing effectiveness within the hospitality industry because it reinforces the ethical duty to support environmentally friendly lodgings and sustainable tourism activities (Amin & Tarun, 2019). The influence of moral responsibility in hospitality context remains a unidentified because prior research has studied this phenomenon in retail and general markets. The research aims to fill a knowledge gap by studying how felt obligation enhances indirect links between green marketing and consumer behavior that use green consumption value and pro-environmental self-identity.

In the hospitality industry, felt obligation can significantly impact the guests' reaction to the sustainability initiatives of the hotels and resorts (Han, 2021). For example, if a hotel emphasizes its certifications and environmentally friendly policies, guests with a high level of moral norms regarding environmental protection will highly appreciate green consumption and recognize themselves as responsible for the environment (Foroughi et al., 2022). This increased feeling of responsibility enhances the moderation roles of green consumption value and pro-environmental self-identity on the connection between eco-friendly marketing strategies and environmentally sustainable consumer behavior. On the other hand, if guests do not feel that they have to conform to the hotel's marketing strategies, then the green marketing strategies put in place may not bring about the right change in the values and actions of the guests. It is important for businesses to comprehend this moderated mediation effect in order to create sound marketing strategies that are appealing to consumers' moral sense.

In the context of the S-O-R model, green marketing campaigns are considered as stimuli that can affect the organism's state, in this case, through green consumption value and pro-environmental self-identity. Felt obligation, therefore, mitigates the strength of these mediating effects: how these internal states are enacted in terms of eco-conscious consumer behavior. Applying the S-O-R model will allow identifying the conditions under which the utilization of eco-friendly marketing initiatives will be most effective in encouraging sustainable behavior. Therefore:

H8. Felt obligation moderates the mediated relationship between eco-friendly marketing initiatives and eco-conscious consumer behavior through green consumption value, such that the indirect effect is more potent when felt obligation is high.

H9. Felt obligation moderates the mediated relationship between eco-friendly marketing initiatives and eco-conscious consumer behavior through pro-environmental self-identity, such that the indirect effect is more potent when felt obligation is high.

3. Methodology

3.1. Participant selection and inclusion criteria

We employed a systematic participant selection strategy to ensure a fair and representative sample of the target population while minimizing sampling bias. The study targeted individuals who had recently (within the last 12 months) stayed at hospitality establishments known for implementing eco-friendly marketing and sustainability practices. This 12-month inclusion window was chosen to ensure participants had fresh, relevant experiences with green hospitality initiatives, thereby improving the accuracy and reliability of their responses. We first compiled a list of environmentally sustainable hotels and resorts in the Chinese hospitality sector using public directories, industry listings, and professional recommendations. From this list, a purposive selection of

establishments was made to cover a variety of hospitality businesses (e.g., hotels of different sizes and locations) that engage in green marketing efforts.

At each selected establishment, the research team approached customers in person and invited them to participate in the survey. By recruiting on-site across multiple venues (rather than relying on a single location or an open online call for volunteers), we ensured a broad cross-section of participants who met the study criteria. Importantly, no additional exclusion criteria (such as restrictions on age, gender, or background) were imposed beyond the requirement of a recent eco-friendly hospitality stay. This means that anyone fitting the main criterion was eligible, which helped include a wide demographic range of travelers. This systematic multi-venue approach and the broad inclusion criteria were intended to make the sample as representative as possible of eco-conscious hospitality consumers, thereby enhancing the generalizability of the findings to the wider population of interest.

3.2. Measures to prevent sampling bias

Several deliberate measures were implemented throughout the sampling procedure to prevent common types of sampling bias. For example in order to avoid selection bias, we did not favor any particular demographic or subgroup during recruitment. Participants were approached solely based on the key inclusion criterion (a recent stay at a sustainable hospitality facility), regardless of their age, gender, or socioeconomic status. By selecting multiple hospitality sites in different areas and of varying profiles, we broadened the pool of potential respondents and avoided excluding any major segment of the target population. This strategy ensured that no particular group was over- or under-represented simply due to the sampling method, thereby increasing the applicability of the results to the wider population of eco-friendly hospitality consumers. Similarly, we minimized self-selection bias by controlling how the study was described to potential participants. At the point of recruitment, the survey was introduced in general terms (for example, as a study about “hospitality experiences”) without emphasizing the green marketing or environmental focus. By providing only limited information about the specific research objectives upfront, individuals' decisions to participate were less likely to be influenced by a strong personal interest in, or indifference to, environmental issues. In other words, guests were invited to take a short survey about their stay before knowing the exact focus on sustainability, which reduced the likelihood that only those with particular eco-conscious attitudes would volunteer. This approach helped secure a more balanced sample of participants, including those who might not self-identify as environmental enthusiasts, thus mitigating self-selection bias.

On a further note, we also took steps to address potential non-response bias and ensure a high response rate. The questionnaires were administered face-to-face on site, which tends to improve participation compared to impersonal methods, since respondents could ask questions freely and felt more engaged in the process. The personal administration of surveys allowed the research team to clarify any confusion on the spot and encourage completion, reducing the incidence of partial or dropped responses. Furthermore, we proactively over-sampled the initial pool to account for possible non-responses or drop-outs: a total of 700 questionnaires were distributed among eligible guests across the selected sites. This robust initial outreach was designed to compensate for those who might decline to participate or for surveys that might turn out unusable. As a result, 462 individuals agreed and returned completed questionnaires (approximately a 66 % response rate). After removing duplicate, incomplete, or inconsistent responses during data cleaning, 437 valid responses remained for analysis. This final sample size exceeds the minimum of 400 respondents we originally determined via a power analysis (using G*Power 3.1) as necessary for detecting medium effect sizes with 80 % power at $\alpha = 0.05$. By achieving a sample larger than the target and maintaining a substantial response rate, we minimized the risk that non-response would skew the results or

undermine the study's statistical validity.

3.3. Representativeness of the sample

The combination of the above measures resulted in a diverse and arguably representative sample of the study population. Because participants were drawn from multiple eco-friendly hospitality venues and no narrow demographic restrictions were applied, our respondent pool naturally included a wide variety of backgrounds. The final sample comprised travelers across a broad range of ages (from adolescents to seniors), with a roughly balanced gender distribution and varied educational and income levels (see Table 1 for detailed demographics). This diversity suggests that the sample reflects a broad spectrum of eco-conscious hospitality consumers rather than a narrow subset. We deliberately aligned our sampling strategy with the characteristics of the broader population of interest, enhancing the representativeness of the data. Consequently, the findings derived from this sample can be viewed with greater confidence when generalizing to similar contexts and populations, thereby strengthening the external validity of the research.

3.4. Ethical considerations

The study followed ethical standards and principles that govern human research participant involvement. The institutional ethics review board of the lead author's affiliated institution reviewed and approved the research protocol before the data collection process. Each participant received information about the study aims, procedures, and their rights to voluntary participation and response confidentiality and withdrawal privileges (Ahmad, Samad, & Han, 2023; Zhou et al., 2023).

Table 1
Demographic Information.

Demographic Variable	Frequency	Percentage
Age		
Under 18	23	5.3 %
18–24	95	21.7 %
25–34	127	29.1 %
35–44	102	23.3 %
45–54	48	11.0 %
55–64	32	7.3 %
65 and above	10	2.3 %
Gender		
Male	208	47.6 %
Female	215	49.2 %
Other	6	1.4 %
Prefer not to say	8	1.8 %
Education Level		
High school or lower	45	10.3 %
Associate degree	87	19.9 %
Bachelor's degree	189	43.2 %
Master's degree	88	20.1 %
Doctoral degree	28	6.4 %
Monthly Income (RMB)		
<5000	67	15.3 %
5000–10,000	115	26.3 %
10,001–15,000	108	24.7 %
15,001–20,000	82	18.8 %
20,001–25,000	38	8.7 %
>25,000	27	6.2 %
Frequency of Staying at Green Hospitality Services		
Never	37	8.5 %
Rarely (1–2 times a year)	142	32.5 %
Sometimes (3–5 times a year)	151	34.5 %
Often (6–10 times a year)	81	18.5 %
Very often (>10 times a year)	26	6.0 %

All respondents provided their informed consent to participate prior to participating. The study collected no identifying personal data that would reveal participants while following ethical requirements for research. Each participant received a brief explanation of the research purpose and participant rights and an understanding of voluntary participation before starting. The research study included a consent form that explained the study goals and estimated time commitment and participant rights to withdraw for any reason with no negative impact. The participants received strong guarantees about both the research purpose anonymity and the exclusive use of their responses for research reasons. The research team implemented confidentiality practices by collecting data without personal identifiers such as names or contact information (Ahmad, Ullah, AlDhaen, & Siddique, 2023; Han et al., 2022). An encrypted database served as the data storage system accessible to the research team members only who performed aggregation analysis to protect the anonymity of individual participants. The research followed ethical standards that protected participant privacy and required the study to be performed with integrity toward human subjects (Ahmad, Ullah, et al., 2021).

3.5. Sample size estimation and demographic

The researchers used G*Power 3.1 software to estimate their study sample size because this tool is a common power analysis tool in behavioral research studies. The required minimum participant count for this study reached 400 to achieve statistical power of 0.80 for medium effect sizes ($f^2 = 0.15$) with $\alpha = 0.05$ significance. A total of 700 questionnaires were distributed to deal with potential non-responses and incomplete survey responses. The research received 462 responses, leading to 437 valid responses remaining for analysis following data cleaning to ensure an adequate sample for structural equation modeling. Our sample demographics are shown in Table 1.

3.6. Measures

In our research, we employed established scales to measure the variables using a five-point Likert scale. The independent variable, the eco-friendly marketing initiative, was assessed with six items adapted from Cheng et al. (2022), who modified the scale of Rahbar and Wahid (2011). A sample item is "This green hotel has set up environmental notices to promote eco-friendly practices (such as saving water, recycling paper, saving electricity), which I find to be a good green marketing practice." Green consumption value, acting as a mediator, was measured with six items based on the work of Alagarsamy et al. (2021). An example statement is "I consider the potential environmental impact of my actions when making many of my decisions related to hotel stays." The moderator, felt obligation, included seven items derived from Chen, Matloob, et al. (2023). One of the items is, "I have an obligation to support green hospitality services to help them achieve their sustainability goals."

The dependent variable, Eco-conscious Consumer Behavior, was evaluated with five items from the study of Kautish and Sharma (2020), originally based on the work of Roberts and Bacon (1997). A representative item is "When there is a choice, I always choose the accommodation that contributes to the least amount of pollution." Lastly, Pro-environmental self-identity, another mediator, was measured with four items taken from the study of Dermody et al. (2018), originally based on Whitmarsh and O'Neill (2010). A sample item is "I think of myself as a consumer who prefers eco-friendly hospitality services."

Participants were informed that their responses would remain anonymous and confidential so as to reduce social desirability bias (Ahmad, Ullah, Ryu, et al., 2023; Li et al., 2024). Using Harman's single-factor test, the common method variance was controlled empirically (Liu et al., 2023). A large proportion of the variance in this study comes from no one variable, implying that there is little likelihood of method variance.

4. Results

The study utilized Partial Least Squares Structural Equation Modeling (PLS-SEM) through Smart-PLS, a robust, variance-based technique ideal for analyzing complex models with latent constructs (Ahmad, Samad, & Han, 2024; Liu et al., 2024). This method was selected because of its capacity to manage non-normal data distributions, accommodate small-to-moderate sample sizes, and address intricate mediation and moderation effects, characteristics particularly advantageous in behavioral and marketing research (Hair et al., 2019). Unlike covariance-based SEM, which emphasizes overall model fit, PLS-SEM is designed to maximize the explained variance in dependent variables, making it especially suited for predictive and exploratory studies (Sarstedt et al., 2019; Wang et al., 2024).

The study results validate the proposed model and the relationships among variables. The factor loadings of items on their constructs show high reliability and validity. Eco-conscious consumer behavior (ECCB) items had loadings from 0.886 to 0.935, indicating strong consistency. Eco-friendly marketing initiative (EFMI) items had loadings between 0.820 and 0.888. Felt obligation (FO) items showed loadings from 0.685 to 0.848. Green consumption value (GCV) items had loadings from 0.650 to 0.752, while pro-environmental self-identity (PESI) items ranged from 0.859 to 0.951, both indicating strong validity.

To ensure the reliability and validity of the measurement model, the study employed several established criteria. Internal consistency was measured using Cronbach's alpha (Nunnally & Bernstein, 1994) and composite reliability (CR) (Hair et al., 2019), with acceptable values set above 0.70 (Ahmad et al., 2022; Chen et al., 2022). Convergent validity was assessed through average variance extracted (AVE), ensuring that each construct accounted for at least 50 % of the variance in its indicators (Fornell & Larcker, 1981). The validity and reliability of the constructs are supported by composite reliability and AVE. An AVE of 0.826 indicates excellent reliability for ECCB, with a composite reliability of 0.960. A composite reliability was 0.944 for EFMI and an AVE of 0.736 for EFMI. Based on the composite reliability of 0.878 and the AVE of 0.530, FO has an acceptable level of reliability. PESI and GCV had composite reliability values of 0.861 and 0.942, respectively, with AVE values of 0.509 and 0.801, which indicates good reliability. The R^2 value served as a measure of the explanatory power of the independent variables, where values of 0.26, 0.13, and 0.02 were interpreted as indicating substantial, moderate, and weak effects, respectively (Cohen, 1992). Using R-square values, we can determine the explanatory power of the variables. With an R-square of 0.464, ECCB explains 46.4 % of the variance in eco-conscious consumer behavior. GRCV has an R-square of 0.376, which means that 37.6 % of the variance can be explained by the predictors. An R-square of 0.432 was found for the PESI, meaning that 43.2 % of the variance in pro-environmental self-identity can be accounted for by the model. Fig. 1 illustrates our measurement model, and Table 2 summarizes our results.

Discriminant validity was verified by applying the Fornell-Larcker criterion, which requires the square root of each construct's AVE to exceed its correlations with other constructs, and further supported by ensuring that the Heterotrait-Monotrait (HTMT) ratio remained below 0.90 (Henseler et al., 2015). The correlation and square root of AVEs, in conjunction with the HTMT ratios (Table 3), provide insight into the relationship between constructs and the discriminant validity of the measurement model. Discriminant validity is demonstrated by the square root of the AVE for every construct being higher than the correlation between constructs. A correlation of 0.179 to 0.652 exists between EFMI and PESI and 0.07 between EFMI and FO. Additionally, all of the HTMT ratios below 0.85 support discriminant validity. A high HTMT ratio is found between PESI and EFMI, confirming discriminant validity. Additionally, the table includes f-square values measuring the effect size of constructs on one another. For instance, the f-square value of 0.071 for EFMI on ECCB indicates a small effect size, while 0.322 for EFMI on GCV suggests a medium effect size. The largest effect size is

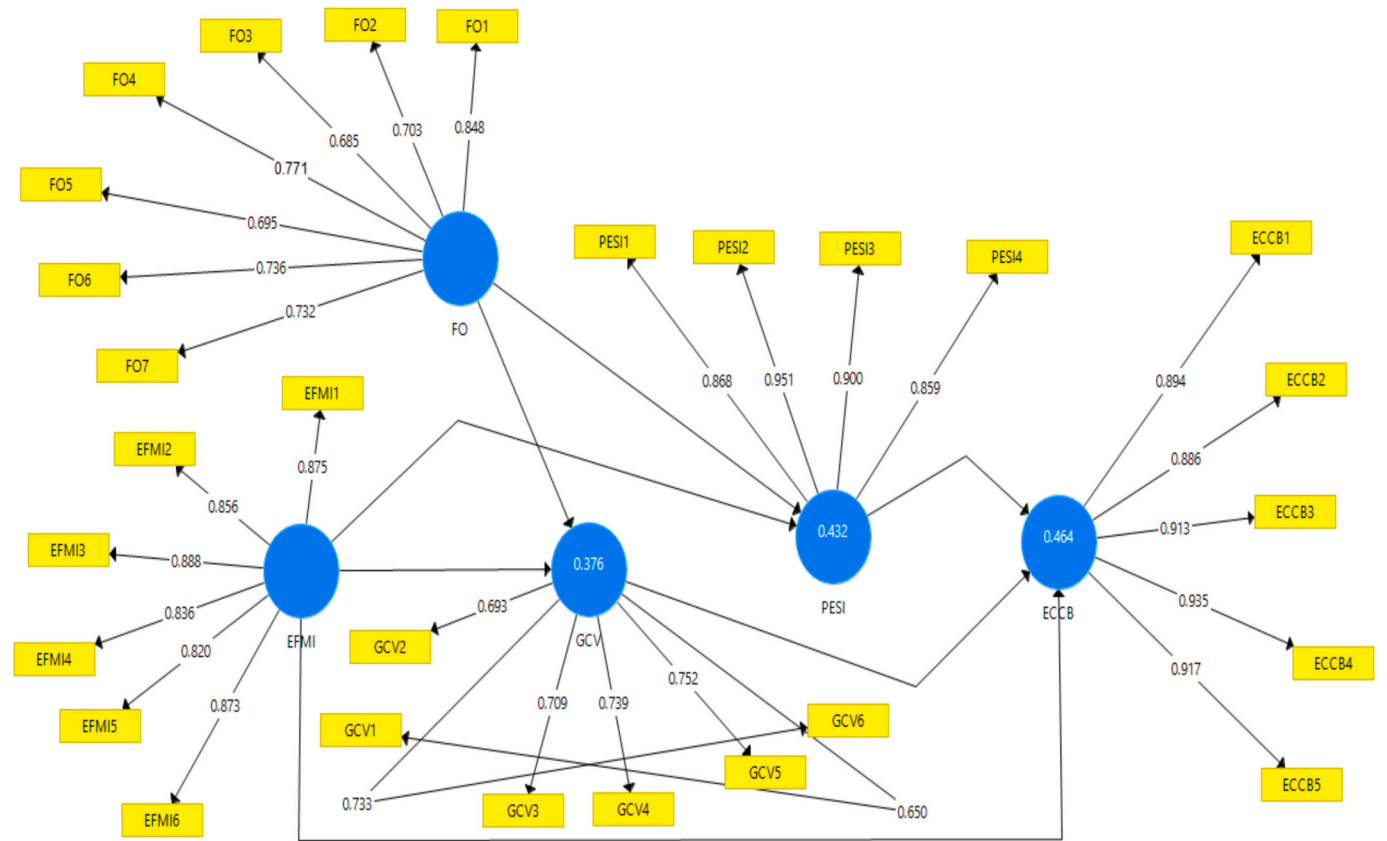


Fig. 1. The measurement model.

Table 2
Quality statistics of measurement model.

Construct	Item	Factor Loading	Composite Reliability	AVE	R-square	Mean	Mode	Min	Max
ECCB	ECCB1	0.894	0.96	0.826	0.464	2.8	3	1	5
	ECCB2	0.886				3.1	3	1	5
	ECCB3	0.913				2.9	3	1	5
	ECCB4	0.935				3.2	3	2	5
	ECCB5	0.917				2.7	2	1	4
EFMI	EFMI1	0.875	0.944	0.736		3	3	2	5
	EFMI2	0.856				2.8	3	1	5
	EFMI3	0.888				2.9	3	2	4
	EFMI4	0.836				3.1	3	1	5
	EFMI5	0.82				2.6	2	1	4
	EFMI6	0.873				3.2	3	1	5
FO	FO1	0.848	0.878	0.53		2.7	3	1	4
	FO2	0.703				2.9	3	2	5
	FO3	0.685				2.5	2	1	4
	FO4	0.771				3	3	2	5
	FO5	0.695				2.8	3	1	4
	FO6	0.736				2.6	2	1	4
	FO7	0.732				2.9	3	2	5
GCV	GCV1	0.65	0.861	0.509	0.376	2.7	3	1	4
	GCV2	0.693				2.8	3	2	5
	GCV3	0.709				2.6	2	1	4
	GCV4	0.739				2.9	3	2	5
	GCV5	0.752				2.5	2	1	4
	GCV6	0.733				3	3	2	5
PESI	PESI1	0.868	0.942	0.801	0.432	2.8	3	1	4
	PESI2	0.951				3.1	3	2	5
	PESI3	0.9				2.7	2	1	4
	PESI4	0.859				3	3	2	5

between EFMI and PESI (0.728), indicating a substantial impact. For more details, see Table 3.

5. Results

We tested our hypotheses using Partial Least Squares Structural Equation Modeling (PLS-SEM) with 5000-sample bootstrapping for

Table 3
Correlations and discriminant validity.

Construct	ECCB	EFMI	FO	GCV	PESI
ECCB	0.909	0.56 (0.581) 0.071	0.203 (0.227)	0.593 (0.334)	0.516 (0.545)
EFMI		0.858	0.179 (0.111)	0.48 (0.334) 0.322	0.652 (0.697) 0.728
FO			0.714	0.419 (0.515) 0.234	0.139 (0.166) 0.141
GCV				0.713	0.461 (0.366)
PESI					0.895
f-square					

Note: For each construct, the diagonal values represent the square root of AVE. Correlations between constructs are represented by off-diagonal values. Parentheses indicate HTMT ratios, which show discriminant validity between constructs. After the HTMT ratios are the f-squares, which represent the effects of the constructs on one another.

significance testing. The analysis provided a strong overall model fit, with the key outcome variable eco-conscious consumer behavior (ECCB) showing an R^2 value of 0.464 (indicating that 46.4 % of the variance in ECCB is explained by the model). The predictors also explained substantial variance in the mediators green consumption value (37.6 %) and pro-environmental self-identity (43.2 %). All hypothesized paths were supported by the data. Below, we present each hypothesis result with its statistical evidence and interpretation, aligned with prior research.

5.1. Hypothesis 1: Eco-friendly marketing → eco-conscious behavior (H1)

H1 proposed that eco-friendly marketing initiatives (EFMI) positively influence eco-conscious consumer behavior (ECCB). This hypothesis was **supported**. EFMI showed a significant positive direct effect on ECCB ($\beta = 0.267$, $t = 4.613$, $p < 0.001$, 95 % CI [0.131, 0.350]). This result indicates that stronger eco-friendly marketing efforts lead to higher levels of sustainable consumer behavior. The effect size is moderate, suggesting that green marketing campaigns have a meaningful impact on tourists' eco-conscious actions. This finding aligns with prior studies showing that green marketing strategies improve consumers' pro-environmental attitudes and behaviors. For example, (Kasliwal & Agarwal, 2019) observed that hotel green marketing programs correlate with customers' sustainable practices, and Kar and Harichandan (2022) likewise reported that consumers' attitudes toward green consumption are enhanced by green marketing. Our result is also consistent with evidence from emerging markets indicating that eco-friendly marketing boosts consumer preference for sustainable offerings, reinforcing the general conclusion that effective green marketing directly encourages eco-conscious behavior in the hospitality context.

5.2. Hypothesis 2: Eco-friendly marketing → green consumption value (H2)

H2 posited that EFMI increases consumers' green consumption value (GCV). The analysis **supported** this hypothesis, with EFMI exhibiting a strong positive effect on GCV ($\beta = 0.440$, $t = 8.367$, $p < 0.001$, 95 % CI [0.336, 0.540]). This indicates that participants exposed to robust eco-friendly marketing develop higher internal values regarding green consumption. In practical terms, effective green marketing campaigns appear to elevate how much consumers prioritize and value environmentally friendly products and practices. The effect size for this relationship was one of the largest in our model; highlighting that corporate sustainability initiative can **shape consumers' core values**. This result addresses a gap in the literature by identifying a significant antecedent of green consumption values. To our knowledge, few prior studies have empirically demonstrated that marketing strategies can directly **strengthen consumers' pro-environmental values**. Our finding extends the S-O-R framework in a novel way, showing that marketing (an external stimulus) can substantially influence the organism's internal value system, which is a noteworthy contribution to green marketing research.

5.3. Hypothesis 3: Green consumption value → eco-conscious behavior (H3)

H3 stated that consumers' green consumption value positively affects their eco-conscious consumer behavior. This hypothesis was **supported**, as GCV had a significant positive impact on ECCB ($\beta = 0.389$, $t = 4.769$, $p < 0.001$, 95 % CI [0.282, 0.581]). Consumers with stronger pro-environmental values were more likely to engage in eco-friendly behaviors during their hospitality experience. The magnitude of this effect was relatively substantial – indicating that personal values toward green consumption are a key driver of actual sustainable actions. This result is consistent with prior findings that individual environmental values translate into eco-conscious practices. For instance, Chung (2020) found that when hotels successfully communicate environmental measures, they can **change guests' perceptions and values**, which in turn leads to more eco-friendly guest behaviors. Our data corroborate that **holding strong green values is directly associated with acting in an environmentally conscious way**, in line with the value-belief-norm theory's assertion that personal values are crucial motivators of pro-environmental behavior. This underscores the importance of fostering green values in consumers as a pathway to encourage sustainable tourism behavior.

5.4. Hypothesis 4: Mediation by green consumption value (EFMI → GCV → ECCB)

H4 predicted that green consumption value mediates the relationship between eco-friendly marketing and eco-conscious behavior. The results **supported** this mediating effect. The indirect path EFMI → GCV → ECCB was positive and significant ($\beta = 0.171$, $t = 3.142$, $p = 0.002$, 95 % CI [0.114, 0.322]). This indicates that part of the influence of green marketing on consumer behavior occurs **through** its effect on consumers' values. In our model, EFMI not only had a direct impact on behavior (H1) but also a sizeable indirect impact via GCV, confirming a **partial mediation**. The direct effect of EFMI on ECCB remained significant, implying that green marketing affects behavior both directly and indirectly. The mediation by GCV means that eco-friendly marketing drives up consumers' environmental values, which in turn lead those consumers to act in eco-conscious ways. This mechanism provides deeper insight into *how* green marketing works: it suggests that companies can increase the effectiveness of their sustainability campaigns by targeting consumers' value systems. Our findings echo the recommendation that **marketers should communicate messages that resonate with consumers' values**, as doing so strengthens the chain from marketing stimulus to value internalization to sustainable response. In sum, Hypothesis 4's confirmation reinforces the idea that fostering green values is a crucial intermediary step for translating marketing efforts into actual pro-environmental consumer behaviors.

5.5. Hypothesis 5: Eco-friendly marketing → pro-environmental self-identity (H5)

H5 proposed that eco-friendly marketing initiatives positively

influence consumers' pro-environmental self-identity (PESI). This hypothesis was **strongly supported**, with EFMI showing a very large effect on PESI ($\beta = 0.638$, $t = 18.908$, $p < 0.001$, 95 % CI [0.567, 0.700]). This was the highest path coefficient in our model, indicating that exposure to green marketing has a **pronounced impact on how consumers see themselves** in terms of environmental friendliness. In other words, effective sustainability marketing campaigns in hospitality venues significantly enhanced participants' self-identification as "green consumers." This finding is in concordance with prior research suggesting that environmental marketing campaigns can help **create or strengthen a consumer's green identity**, thereby influencing behavior. Mahasuweerachai and Suttikun (2022) similarly noted that when hotels incorporate visible sustainability practices (e.g. reducing waste, using renewable resources), it sends a strong message that can shape guests' environmental self-identity. Our result provides empirical confirmation that hospitality marketing efforts not only inform or persuade consumers, but can actually change how consumers **perceive themselves** in relation to sustainability. This is a critical insight for theory and practice: it indicates that building a pro-environmental self-identity in consumers could be a powerful leverage point for encouraging long-term green consumer behavior.

5.6. Hypothesis 6: Pro-environmental self-identity → eco-conscious behavior (H6)

H6 stated that pro-environmental self-identity would positively affect eco-conscious consumer behavior. The data **supported** this hypothesis: PESI had a significant positive effect on ECCB ($\beta = 0.163$, $t = 4.107$, $p < 0.001$, 95 % CI [0.086, 0.238]). Consumers who strongly identify themselves as "eco-friendly" were indeed more likely to perform eco-conscious behaviors during their tourism/hospitality activities. Although the effect size ($\beta \sim 0.16$) was smaller than that of green consumption value ($\beta \sim 0.39$ from H3), it is still a meaningful contribution to explaining behavior. This finding is in line with a broad body of evidence that individuals' self-perception as an environmentally responsible person is associated with greater engagement in sustainable actions. Ettinger et al. (2021), for example, observed that people with a strong environmental self-identity tend to engage more in eco-friendly practices. Likewise, recent studies have documented that consumers who see themselves as "green" are more inclined to choose green products and services. Our results reinforce these conclusions, confirming that **how consumers view themselves (as pro-environmental or not)** plays a significant role in determining their actual behavior. Notably, in our study the influence of self-identity, while significant, was somewhat smaller than the influence of personal values on behavior (H3). This suggests that in the Chinese hospitality context, **value-driven motivations might outweigh identity alone** in driving eco-conscious actions – a point we return to in the Discussion.

5.7. Hypothesis 7: Mediation by pro-environmental self-identity (EFMI → PESI → ECCB)

H7 tested whether pro-environmental self-identity mediates the effect of eco-friendly marketing on behavior. The results **supported** this mediation. We found a significant indirect path EFMI → PESI → ECCB ($\beta = 0.104$, $t = 4.152$, $p < 0.001$, 95 % CI [0.057, 0.155]). This indicates that EFMI influences ECCB in part by **strengthening consumers' green self-identity**, which then leads to more eco-conscious behavior. In combination with H5 and H6, this mediated effect implies a partial mediation: EFMI has both a direct impact on behavior (H1) and an indirect impact through identity. The significance of the indirect path confirms that consumers' self-identity is an important **psychological conduit** for marketing effects. Eco-friendly marketing efforts appear to translate into action not only by persuading consumers directly, but by getting consumers to internalize an eco-friendly identity, which then **drives them to behave consistently with that identity**. This finding

resonates with the observations of Dermody et al. (2015), who noted that developing a green self-identity is a major factor in promoting pro-environmental behavior. It also aligns with self-congruity theory, where consumers strive to act in accordance with their self-concept. By confirming H7, our study provides empirical support for the idea that **identity-based interventions** (like branding a hotel as sustainably-minded and encouraging guests to see themselves as "sustainable travelers") can effectively channel marketing stimuli into actual sustainable consumer behaviors. The mediation through identity complements the mediation through values (H4), together illustrating two parallel mechanisms (value-based and identity-based) through which green marketing influences consumer behavior.

5.8. Hypothesis 8: Moderation by felt obligation in the GCV → ECCB relationship (H8)

H8 examined whether **felt obligation (FO)**, the consumer's sense of moral obligation to act sustainably – moderates the impact of green consumption value on behavior. We found **support** for this hypothesis. The interaction of GCV and FO on ECCB was significant ($\beta = 0.083$, $t = 2.524$, $p = 0.012$, 95 % CI [0.052, 0.185]). The positive coefficient for the interaction term indicates that the relationship between green values and eco-conscious behavior becomes stronger as felt obligation increases. In other words, consumers who feel a strong moral duty toward sustainability are more likely to act on their pro-environment values. Conversely, for those with low felt obligation, having green values translates to behavior somewhat less strongly. Although the moderation effect size is relatively modest, it is statistically significant and theoretically important. This result highlights the role of personal moral norms in the value-behavior linkage. It aligns with prior research suggesting that a sense of moral responsibility can **amplify the translation of environmental attitudes or values into action**. For instance, Chen, Chen, and Schminke (2023) found that individuals who feel morally obliged toward the environment show a tighter attitude-behavior consistency in eco-friendly contexts. Our finding for H8 is consistent with this pattern: **when consumers feel them "ought" to behave sustainably, their pro-environmental values are more fully realized in their behavior**. This moderated effect reinforces the notion from norm-activation theory that personal norms (like felt obligation) are a critical catalyst that can turn general environmental values into concrete behaviors.

5.9. Hypothesis 9: Moderation by felt obligation in the PESI → ECCB relationship (H9)

H9 proposed that felt obligation also moderates the effect of pro-environmental self-identity on behavior. This hypothesis was **supported**, though the effect was smaller in magnitude. The interaction between PESI and FO on ECCB was positive and significant ($\beta = 0.023$, $t = 2.481$, $p \approx 0.013$, 95 % CI [0.009, 0.045]). This indicates that even for consumers who strongly identify as environmentally friendly, having a higher sense of obligation increases the likelihood that they will act in line with that identity. When felt obligation is high, an eco-friendly self-identity more readily translates into eco-conscious actions; when obligation is low, an environmentally-focused identity might not fully manifest in behavior. The effect size here is quite small ($\beta = 0.023$), suggesting that the moderating influence of moral obligation on identity-driven behavior, while real, is subtle. Nonetheless, detecting a significant effect is noteworthy because it uncovers an additional nuance in how personal factors interact. This result extends existing knowledge by showing that **moral obligation can enhance the impact of even deeply held identities on behavior**. To our knowledge, prior studies have rarely examined this specific interaction, making our finding somewhat novel. It complements H8's result to paint a consistent picture: personal moral norms (felt duty) strengthen the influence of internal predispositions (values and identity) on outward behavior. This is

in line with recent arguments that consumers who feel a moral **duty** toward sustainability respond more strongly to green initiatives. In practical terms, **H9's** outcome suggests that even committed “green” consumers are more likely to follow through on their ecological self-image when they also feel a sense of obligation or guilt regarding environmental issues.

In sum, all hypotheses were supported, reinforcing the proposed Stimulus-Organism-Response model of eco-conscious behavior. The direct effects (**H1**, **H2**, **H3**, **H5**, **H6**) were all positive and significant, the mediation hypotheses (**H4**, **H7**) revealed that both green values and green identity serve as important mediators, and the moderation hypotheses (**H8**, **H9**) demonstrated that felt obligation adds an additional conditional influence by bolstering the value-behavior and identity-behavior links. The overall explanatory power of the model was substantial (accounting for about 46 % of variance in consumers' eco-conscious behavior), indicating a strong model fit for a behavioral study. These results provide a structured, hypothesis-by-hypothesis validation of our theoretical framework, laying the groundwork for a nuanced discussion of each finding in light of existing literature.

Further details can be found in **Table 4**, and the structural model is depicted in **Fig. 2**.

Figs. 3 and 4 represent the simple slope analysis for moderation effects. In **Fig. 3**, the slopes depict the relationship between EFMI and GCV at different levels of FO. The green line represents FO at +1 standard deviation (SD), the red line represents FO at the mean, and the blue line represents FO at -1 SD. The positive slope indicates that as EFMI increases, GCV also increases, and this relationship is stronger when FO is higher (green line). This suggests that individuals with a higher sense of felt obligation are more likely to develop stronger green consumption values in response to eco-friendly marketing initiatives.

In **Fig. 4**, the slopes show the relationship between EFMI and PESI at different levels of FO. Similarly, the green line represents FO at +1 SD, the red line represents FO at the mean, and the blue line represents FO at -1 SD. The positive slope indicates that as EFMI increases, PESI also increases, and this relationship is more pronounced when FO is higher (green line). This suggests that individuals with a higher sense of felt obligation are more likely to strengthen their pro-environmental self-identity in response to eco-friendly marketing initiatives.

6. Discussion

6.1. Green Marketing's direct impact on consumer behavior (**H1**)

The first notable finding is that eco-friendly marketing initiatives have a **significant direct impact on eco-conscious consumer behavior** (supporting **H1**). This outcome cements the idea that when hospitality businesses implement and promote sustainable practices, consumers respond with more environmentally friendly behavior. Our result reinforces a growing body of literature on green marketing effectiveness in tourism. It aligns closely with prior studies that reported positive correlations between green marketing and consumer pro-environmental action. For example, **Kasliwal and Agarwal (2019)** found that green marketing efforts in hotels improved guests' attitudes

and willingness to engage in eco-friendly practices, and **Kar and Harichandan (2022)** similarly observed that consumers exposed to green promotions developed more favorable dispositions toward sustainable consumption. Our contribution confirms these relationships in the context of Chinese hospitality, providing evidence from an emerging market that complements earlier findings largely from Western settings. In fact, our data showed that Chinese consumers are highly receptive to green marketing messages, which is consistent with **Kautish et al. (2022)**'s observation that emerging market consumers increasingly prefer brands with strong sustainability credentials. By validating **H1**, we not only replicate previous results but also extend them geographically. This direct influence of green marketing on behavior underscores the **practical importance of sustainability-oriented marketing strategies**: it suggests that hotels and tourism operators can actively drive greener customer behaviors (such as saving energy, reducing waste, or choosing eco-friendly services) through well-designed marketing communications. It also confirms fundamental marketing theories in a sustainability context, for instance, the basic Stimulus-Response link in the S-O-R framework, wherein the “stimulus” of green marketing triggers a favorable “response” in consumer behavior.

6.2. Mediating role of green consumption values (**H2**, **H3**, **H4**)

Beyond the direct effect, our study illuminates the **mediating role of consumers' environmental values** in shaping behavior. We found that eco-friendly marketing significantly boosts consumers' green consumption values (**H2**), and those values in turn strongly predict eco-conscious behavior (**H3**), with a significant mediation effect (**H4**). This set of results integrates well with existing research and theory, shedding light on *why* green marketing works. The link between green values and behavior (**H3**) confirms a core proposition of environmental psychology: individuals who internalize pro-environmental values are more likely to act in accordance with those values. **Chung (2020)** provides a parallel example in the hotel industry, showing that educating guests about a hotel's sustainability measures can positively change guests' values and lead to greener behaviors. Our findings contribute additional evidence that **values are a proximal driver of ecological behavior**, a result that is in line with the Value-Belief Norm (VBN) theory, which positions personal values as a precursor to pro-environmental norms and actions. More novel is our demonstration that **green marketing can elevate those pro-environmental values in the first place (**H2**)**. By confirming that EFMI increases green consumption value, we address a previously under-explored link. Past literature had established that consumers' values influence their green purchasing and travel decisions, but there was scant evidence about whether companies can actively shape or strengthen these values through marketing. Our study fills this gap. We show that when hotels and resorts communicate sustainability effectively (for example, through eco-labels, green advertisements, or on-site educational messages), they can instill stronger environmental values in their customers. This finding extends prior work on marketing's psychological impacts by revealing **value-based mechanisms**: the marketing stimulus changes the “organism” (consumer) by enriching their internal value system, which then affects the “response”

Table 4
Hypothesis testing results.

Relationship	Beta Coefficient	Sd	t-values	p-values	Confidence Interval (2.5 % - 97.5 %)	Hypothesis
EFMI - > ECCB (H1)	0.267	0.058	4.613	0	0.131–0.35	Accepted
EFMI - > GCV (H2)	0.44	0.053	8.367	0	0.336–0.54	Accepted
EFMI - > PESI (H5)	0.638	0.034	18.908	0	0.567–0.7	Accepted
GCV - > ECCB (H3)	0.389	0.082	4.769	0	0.282–0.581	Accepted
PESI - > ECCB (H6)	0.163	0.04	4.107	0	0.086–0.238	Accepted
EFMI - > GCV - > ECCB (H4)	0.171	0.055	3.142	0.002	0.114–0.322	Accepted
Moderating Effect 1 - > GCV - > ECCB (H8)	0.083	0.033	2.524	0.012	0.052–0.185	Accepted
EFMI - > PESI - > ECCB (H7)	0.104	0.025	4.152	0	0.057–0.155	Accepted
Moderating Effect 2 - > PESI - > ECCB (H9)	0.023	0.009	2.481	0.013	0.009–0.045	Accepted

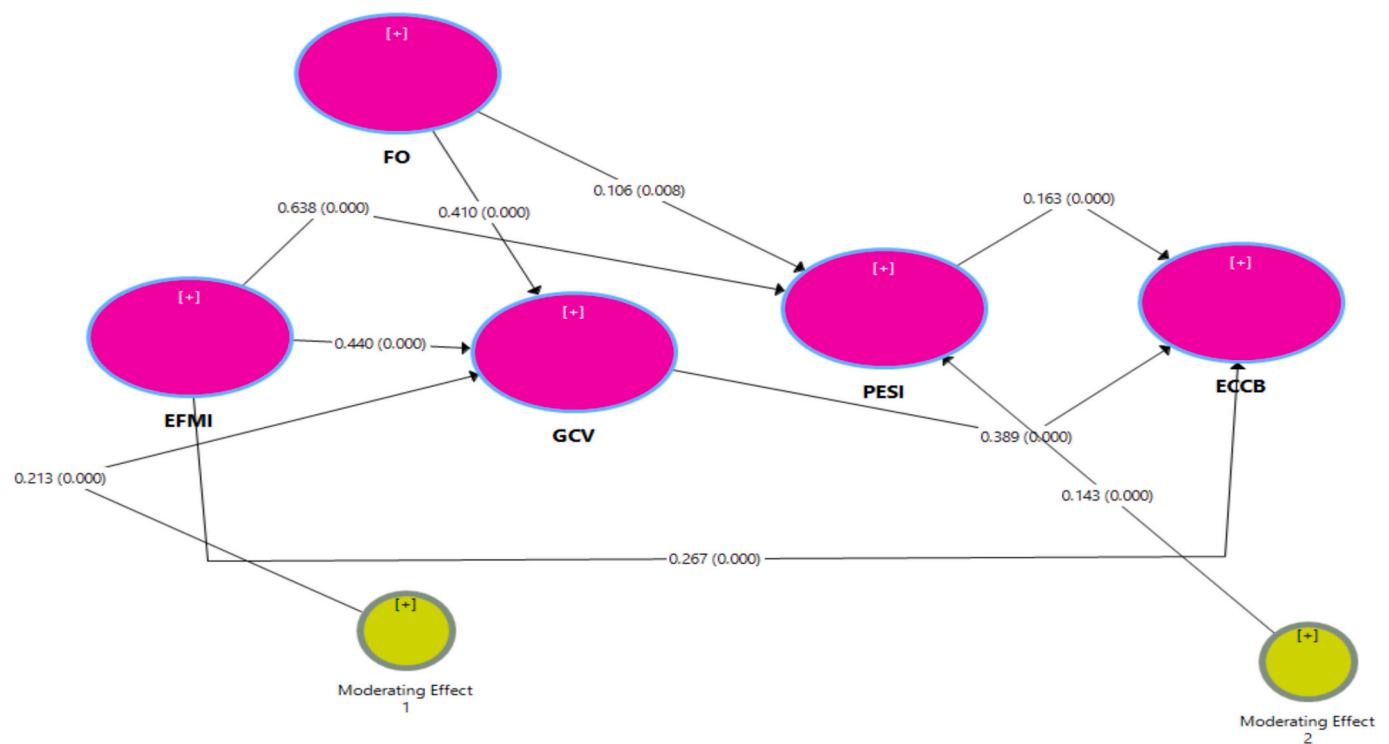


Fig. 2. The structural model.

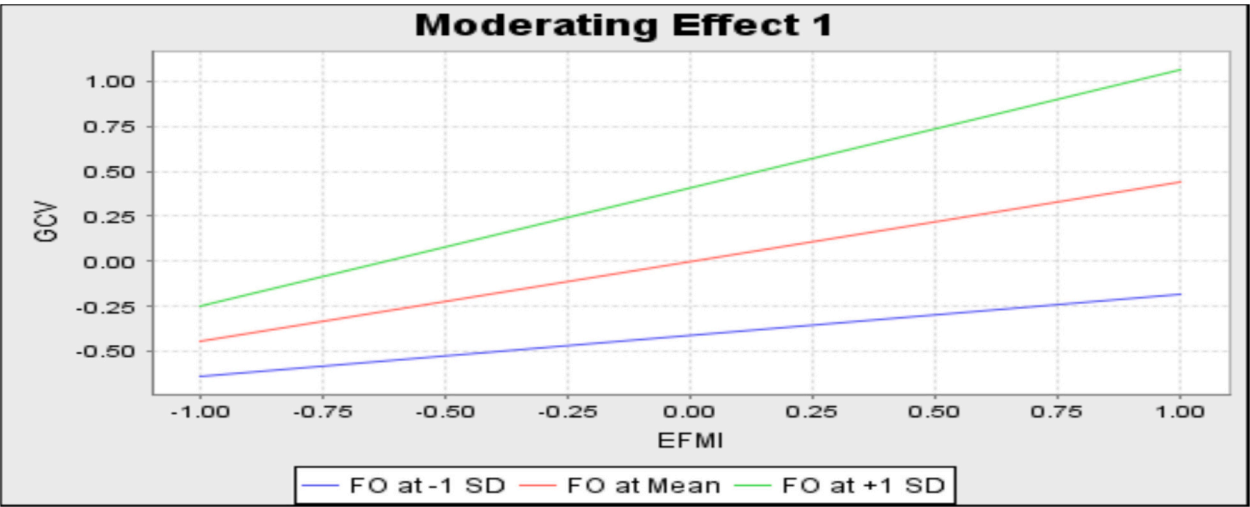


Fig. 3. The Moderation effect of FO between EFMI and GCV.

(behavior). In theoretical terms, this supports the Stimulus-Organism-Response model in a new way, illustrating that the “Organism” component can include value changes, not just emotional or cognitive states. It also complements theories like VBN by showing that external interventions (marketing appeals) can move the needle on personal norms and values that were once thought to be relatively stable.

The mediation via green consumption value (H4) underscores an important implication: **consumers' eco-friendly values serve as a conduit for marketing influence**. Our mediated effect was significant, indicating that part of the reason green marketing drives behavior is that it first activates or strengthens green values, which then motivate the behavior. This result echoes suggestions from earlier studies that marketing messages resonate more when they tap into consumers' core values. In practice, this means that hospitality marketers should craft campaigns that appeal to guests' environmental values, for instance,

emphasizing how the hotel's initiatives align with protecting nature or benefiting the community, thereby invoking those values and encouraging guests to behave consistently (such as reusing towels, conserving water, etc.). The H4 finding is consistent with recent calls in the literature for value-driven marketing strategies. It also provides empirical backing for the idea that **changing hearts and minds (values) is a route to changing behavior** in the sustainability domain. By highlighting the mediating role of values, our study extends previous research and offers a deeper explanatory insight: green marketing is not just about informing or reminding consumers, it can fundamentally **reshape what consumers care about**, which in turn leads to greener choices.

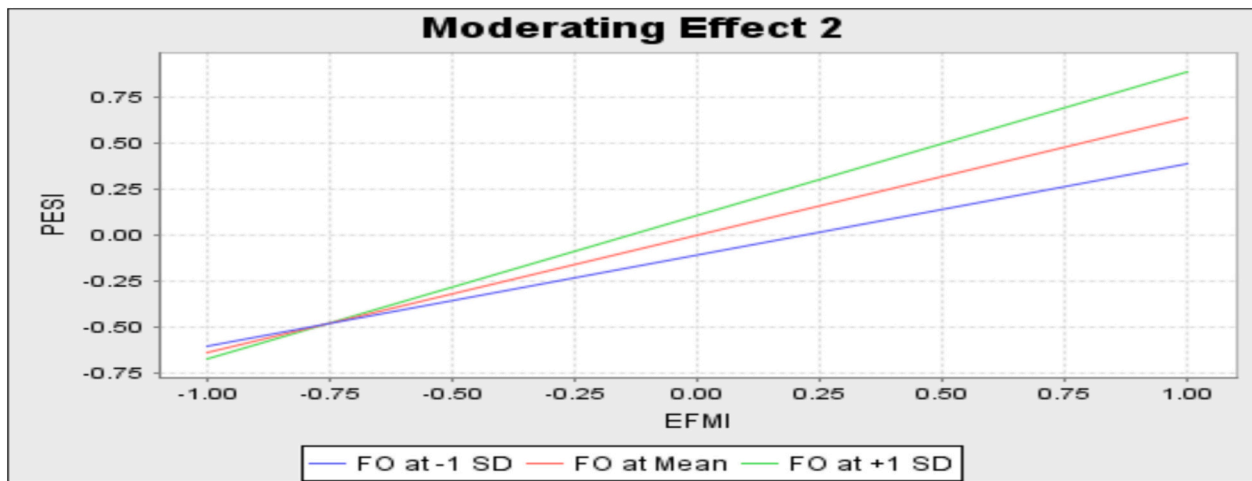


Fig. 4. The Moderation effect of FO between EFMI and PESI.

6.3. Mediating role of pro-environmental self-identity (H5, H6, H7)

Our results also emphasize the crucial **role of pro-environmental self-identity** in the efficacy of green marketing, aligning with hypotheses H5, H6, and H7. We found that eco-friendly marketing initiatives greatly enhanced consumers' self-identity as "green" (H5), and that this self-identity was a significant predictor of eco-conscious behavior (H6). Moreover, a portion of green marketing's overall effect on behavior was carried through this self-identity pathway (partial mediation, H7). These findings integrate our work with recent literature focusing on identity in sustainable consumer behavior.

The strong effect of EFMI on pro-environmental self-identity (H5) suggests that marketing efforts in hospitality do more than just educate or persuade – **they can shape how consumers see themselves**. This aligns with the notion that when companies engage in visible green practices (such as a hotel advertising its zero-waste program or a resort showcasing its use of solar energy), customers may internalize those signals and incorporate them into their self-concept. Mahasuweerachai and Suttikun (2022) provide supporting evidence: they observed that exposure to green restaurant campaigns led young consumers to develop a greener self-image, which in turn influenced their purchase intentions. Likewise, our study in the hotel context finds that guests who encountered strong eco-friendly marketing felt a higher identification with environmentalism. Theoretically, this supports extensions of marketing theory into identity formation; it demonstrates that the "Organism" in S-O-R includes identity shifts. It also ties into Self-Identity Theory, confirming that identity can be dynamic and responsive to external cues (in this case, marketing stimuli). Our contribution here is significant because it empirically validates that **identity-based marketing** is effective: by crafting messages that allow consumers to see themselves as part of a sustainability movement, marketers can trigger an internalization process that makes green behavior more self-relevant to consumers.

The influence of pro-environmental self-identity on behavior (H6) in our results reinforces a well-documented pattern in sustainability research: people tend to act in congruence with their identities. If a traveler thinks of themselves as an environmentally conscious person, they are likely to behave in ways that uphold that identity (such as recycling, choosing eco-certified hotels, etc.). This finding is in agreement with numerous studies across contexts – for instance, Ettinger et al. (2021) reported that hospitality customers with a strong eco-friendly identity prefer companies that engage in Corporate Social Responsibility and are more likely to support such companies through their patronage. Similarly, Khan et al. (2024) found that **those who strongly identify as "environmentally friendly" tend to perform more green**

behaviors in their daily lives, supporting the idea that identity guides action. Our contribution is to confirm this relationship within our model and sample, showing that it holds true in the Chinese hospitality sector as well. Interestingly, we observed that the magnitude of identity's direct effect on behavior, while significant, was smaller than that of green values. This could suggest that for our respondents, **values played a slightly more dominant role than identity** in driving behavior. One possible interpretation is that in collectivist cultures or certain contexts; shared values (like concern for the environment) might be a more salient motivator than individual identity labels – a nuance that future research could explore. Nonetheless, H6's support adds weight to identity-based theories of consumer behavior and confirms that cultivating a pro-environmental identity in consumers is a valid strategy for encouraging sustainable actions.

With both H5 and H6 confirmed, the mediation via self-identity (H7) provides a cohesive story: eco-friendly marketing fosters a green identity in consumers, which then leads to eco-conscious behavior. This mediated pathway is conceptually similar to the value-mediated pathway discussed earlier, and indeed our results show that **both identity and values serve as parallel mediators**. The identification of pro-environmental self-identity as a mediator is consistent with findings from Dermody et al. (2015), who in a cross-cultural study (UK and China) found that pro-environmental self-identity mediated the relationship between environmental concern and sustainable consumption behaviors. Our study extends Dermody et al. (2015) insight by positioning identity as the mediator between a marketing stimulus and behavior, rather than between two internal psychological variables. This extension is important: it demonstrates that identity can mediate not just intrinsic effects but also the influence of extrinsic interventions (like marketing campaigns). In doing so, we support theoretical integration between marketing and psychology, confirming that **self-identity is a central mechanism in the S-O-R process for green marketing**. From a practical perspective, this suggests that hospitality firms should design marketing communications that **speak to the consumer's identity**. For example, campaigns might include messages like "Join the community of eco-conscious travelers" or provide badges/rewards for "green guests," which could strengthen a guest's self-identification with sustainability. By doing so, businesses leverage the H7 mechanism: as consumers adopt the identity of a "sustainable tourist," they are more inclined to follow through with actions that affirm that identity (e.g., participating in hotel recycling programs, opting for linen reuse). In summary, our findings regarding H5–H7 highlight that **identity-based and value-based processes work in tandem** to translate green marketing into green behavior, offering a richer understanding of consumer psychology in sustainability marketing.

6.4. Moderating influence of moral obligation (H8, H9)

A key contribution of our study is the incorporation of **felt obligation (moral obligation)** as a moderating variable, which provided insight into conditional effects (H8 and H9). Our results revealed that felt obligation intensified the impact of both green consumption values and pro-environmental identity on behavior. In other words, the more a consumer felt a moral **duty** to support environmental sustainability, the more effective their values and identities were in driving actual eco-conscious behaviors. This finding connects our work with literature on moral norms and norm activation theory, and it addresses a gap where prior research had called for understanding how personal moral obligations might interact with other determinants of green behavior.

For the value-behavior link (H8), we found that consumers' eco-friendly values translated into action much more strongly when accompanied by a high sense of obligation. This result is consistent with the notion that **personal norms can activate or amplify one's values**. Chen, Chen, and Schminke (2023) provide parallel evidence by noting that when individuals feel morally responsible for the environment, their attitudes are more likely to lead to corresponding behaviors. Similarly, classical work by Schwartz and contemporaries (Shaw & Shiu, 2002) has long suggested that moral norms (like a felt obligation) are often the missing link that turns general beliefs into ethical action. Our study empirically corroborates this in a green marketing context: even if a tourist values sustainability, it may take a personal sense of obligation or "oughtness" to strongly drive behaviors such as conserving water or reducing waste during a hotel stay. We saw that at low levels of felt obligation, the effect of values on behavior was present but weaker; at high levels of obligation, it was much more pronounced. This moderated relationship underscores the importance of **moral engagement** in sustainable consumer behavior. It suggests that interventions aiming to promote green actions should not only instill values but also appeal to consumers' personal moral principles. For instance, hospitality marketers might include messaging that invokes responsibility (e.g., "We each have a duty to protect our planet for future generations") to elevate the audience's sense of obligation. By doing so, they could activate those consumers' existing environmental values more powerfully, resulting in behavior change. Our H8 finding contributes to the literature by empirically validating that **felt obligation serves as a catalyst that boosts the conversion of environmental values into practical action**, a dynamic that had been theorized but rarely demonstrated in prior hospitality studies.

Regarding the identity-behavior link (H9), our results showed a similar pattern: pro-environmental self-identity had a stronger influence on behavior among consumers who felt a high moral obligation toward sustainability. Although the moderation effect for H9 was smaller, it was statistically significant. This nuance suggests that even identity-driven behaviors are subject to reinforcement by moral norms. When someone strongly identifies as an eco-friendly person, a concurrent strong sense that "I should live up to this identity because it's the right thing to do" pushes them to act consistently. If that sense of obligation is absent, an individual might intellectually see themselves as "green" yet occasionally fail to act accordingly (for instance, a guest might identify as eco-conscious but still use single-use plastics on a trip if they don't feel a personal moral imperative at that moment). Our finding on H9 extends the current literature by highlighting an interaction effect that had not been widely explored: the synergy between **self-identity and personal norms**. Recent research by Kautish et al. (2024) and Mandić et al. (2024) touches on related ideas, suggesting that consumers who feel moral duties toward the environment respond more favorably to green messages and are more consistent in their eco-friendly actions. We build on this by specifically quantifying how moral obligation can intensify the impact of one's environmental self-concept on one's behavior. Essentially, our data indicate that **moral obligation provides an extra motivational push to live out one's green identity**.

From a theoretical standpoint, incorporating felt obligation (a

personal norm) as a moderator contributes to a more holistic understanding of sustainable consumer behavior models. It bridges the gap between rational/cognitive drivers (values, identity) and the normative driver (moral obligation). By showing that all these factors interact, our study supports an integrated perspective consistent with theories like the Norm Activation Model and recent integrative models of ethical consumption (which often call for inclusion of personal norms alongside attitudes and identity). In fact, a recent study by Kumar and Pandey (2023) modeled environmentally conscious purchase behavior and found that **ethical obligation and green self-identity are both crucial factors**. Our results complement their findings by demonstrating how these factors interrelate: we find that ethical obligation (felt duty) can enhance the influence of self-identity on behavior, adding nuance to Kumar et al.'s conclusions. In practical terms, the moderation by felt obligation suggests that marketers and policy makers might want to **invoke consumers' sense of moral responsibility** as part of sustainability campaigns. For example, campaigns that include pledges or moral appeals (e.g., "Do the right thing for the planet") could strengthen consumers' resolve to act in line with their green values and identities. However, one must tread carefully: overemphasizing moral obligation can sometimes backfire or induce guilt. The takeaway from H8 and H9 is that a balanced approach, one that nurtures environmental values and identity, while also reminding consumers of the moral stakes, could yield the strongest engagement in pro-environmental behavior.

6.5. Theoretical implications

The following are the theoretical implications of this study that enrich the existing literature on eco-friendly marketing and consumer behavior: First, this research enriches the literature by adopting the S-O-R model in the context of eco-friendly marketing within the hospitality industry. Thus, this work contributes to the literature by showing that green marketing initiatives are external stimuli that affect internal states like green consumption value and pro-environmental self-identity, eventually leading to green consumer behavior.

Secondly, the study also supports the role of value-based and identity-based mechanisms in motivating consumers to engage in eco-conscious behavior. The analysis of the mediation model shows that green consumption value and pro-environmental self-identity are significant mediators through which the company's eco-friendly marketing strategies influence consumer actions. This finding supports and extends previous theories, including the Value-Belief-Norm (VBN) theory and the Self-Identity theory, by providing a theoretical model that explains how marketing interventions can affect individuals' values and identities related to the environment to encourage sustainable behavior.

Thirdly, it extends the research on the conditional effects in the context of green marketing by incorporating the concept of felt obligation as a moderator. The findings of this study also show that perceived moral responsibility has a strong moderating influence on the effectiveness of green marketing strategies. This finding enriches the existing literature by showing how moral norms can enhance the strength of the relationships between the attitudes and intentions of consumers with regard to environmental behavior.

Furthermore, this research contributes to the existing literature by offering findings from a non-Western country, namely China. Previous research on the concept of green marketing and consumer behavior has been mainly conducted in Western countries; thus, the findings of the current research may not be generalizable to other cultures. Thus, this study extends the cultural coverage of the existing theories and shows their relevance in different cultural contexts by targeting Chinese consumers. This cross-cultural validation is important for formulating global marketing strategies that can be used in marketing sustainability across different cultures.

In addition, the study's implications can be useful for hospitality organizations that are interested in improving sustainability practices. Thus, by adopting green consumption values and pro-environmental

self-identity in their marketing mix, companies can better target consumers and promote the culture of green consumerism. This approach also has the added advantage of improving the image and competitiveness of the hospitality firms that are interested in the sustainability agenda.

6.6. Practical implications

The research results from this study create a substantial impact for hospitality sustainability policies. Policymakers should establish regulatory frameworks to support standard green marketing practices since eco-friendly marketing initiatives significantly affect green consumer behavior. Eco-labeling guidelines, together with sustainability claims and green certification standards, need to be established as they guarantee transparent information and stop greenwashing advertising practices, which develop trust between consumers and sustainable hospitality services. Industry and governmental organizations need to establish programs that provide incentives to hospitality businesses that embrace sustainable practices. Sustainable transition speeds up when businesses acquire financial incentives through environmental performance-based benchmark rewards or, tax relief programs or project funding. Public-private alliances should work together to develop education programs that teach consumers about sustainable choices while running public awareness initiatives.

The integration of sustainability principles within consumer protection policies by policymakers will help businesses maintain their ethical marketing practices. Transparent environmental disclosure requirements together with strengthened sustainability standards, enable consumers to select products based on genuine information. The implementation of education programs about sustainability should become part of sustainability policies to train hospitality professionals about responsible marketing and sustainable operations. A sustainable industry culture will develop when these practices become established, which will strengthen green consumer actions. Through policy implementation, regulatory bodies can establish a sustainable environment that stimulates standardized practices while effectively conveying them to consumers for both environmental and economic benefits. Future policies need to study inter-sectoral collaborative efforts and develop international sustainability protocols that will make hospitality marketing practices compliant with worldwide environmental objectives.

6.7. Limitations and suggestions for future

The study delivers important findings yet faces some important limitations that suggest future research directions. The research design as a cross-section creates restrictions for showing cause-and-effect relationships. Further research needs to utilize longitudinal research methods that study the timing impact of eco-friendly marketing initiatives on the development of eco-conscious consumer behavior. The research concentrates on China's hospitality sector which restricts the application of findings to different cultural settings and industrial environments. Future research must conduct duplicate studies in different geographic zones together with various industries to boost external validity and confirm the patterns across diverse contexts.

This study evaluates green consumption value, pro-environmental self-identity, and felt obligation, but additional potential mediators like environmental knowledge would enhance research quality. Research into additional variables would help establish psychological and contextual patterns forming eco-conscious consumer behavior. The research method utilizes self-reported data that might introduce social desirability bias to the results. Future research should adopt experimental design methods to confirm consumers' subjective responses while using objective measurement tools to strengthen result reliability. Future research needs to tackle these identified weaknesses to improve the comprehension of the hospitality sector's sustainable consumer conduct and related sustainable practices.

7. Conclusion

The study provides clear evidence that eco-friendly marketing initiatives can significantly encourage eco-conscious consumer behavior in the hospitality sector. In the Chinese hotel context, we found that green marketing efforts directly promote tourists' engagement in sustainable actions, echoing similar patterns observed in recent hospitality studies. These results bolster the growing consensus that well-designed sustainability campaigns positively shape consumer intentions and behaviors in tourism settings (Cheng et al., 2022; Foroughi et al., 2022). Notably, our context-specific findings extend this knowledge by confirming the effectiveness of green marketing in an emerging market (China), thereby adding geographic and industry nuance to the literature on green consumer behavior. Furthermore, the influence of eco-friendly marketing is shown to operate through key psychological pathways, green consumption value and pro-environmental self-identity, which serve as mediators. In other words, sustainability messages are effective because they instill stronger eco-centric values in consumers and reinforce consumers' self-concept as environmentally responsible individuals. This mechanism aligns with prior findings that highlight consumption value as an important mediator between environmental awareness and eco-friendly intentions, and it underscores the pivotal role of a "green" self-identity in driving sustainable consumption decisions. Our simultaneous examination of value-based and identity-based mediators offers a more comprehensive perspective than many earlier studies that examined these factors in isolation. By integrating both aspects, we answer recent calls to combine personal values, ethical norms, and identity in predicting green consumer behavior (Kumar, 2023). It is worth noting that some research has reported non-significant direct effects of green marketing on consumers' environmental identity, suggesting that this relationship may depend on context or execution. In contrast, our positive finding in a hospitality setting indicates that well-crafted sustainable marketing initiatives (e.g. in hotels) can indeed strengthen consumers' green self-identity, perhaps due to the immersive and experiential nature of hospitality services where identity alignment is more salient.

In addition, our results underscore the moderating role of felt obligation (i.e. a sense of moral responsibility) in strengthening the impact of green marketing on behavior. Individuals who feel a strong moral duty to protect the environment responded more positively to green marketing messages and were more likely to translate sustainable intentions into action. This outcome is in line with observations from other recent studies that consumers with pronounced moral obligations (for example, Gen Z tourists with high sustainability ethics) exhibit greater receptiveness to green advertising. Together, these findings reinforce the view of personal norms as powerful motivators of pro-environmental choices. Our work extends prior research by demonstrating this effect in the hospitality domain, where such psychological moderators have been relatively under-examined. By highlighting felt obligation's amplifying influence, we contribute new insights into how moral and ethical considerations can enhance the efficacy of green marketing strategies. By framing these relationships within the S-O-R model, this research also contributes to theoretical advancements in green marketing and consumer behavior. The S-O-R framework was useful for explaining how marketing stimuli (eco-friendly initiatives) trigger internal cognitive and emotional states (values, identities, and moral norms), which in turn lead to observable sustainable responses. Our findings empirically validate this chain of effects, aligning with recent S-O-R based models of green consumer adoption that link marketing cues to consumer attitudes, personal norms, and behaviors. This confirmation of the S-O-R model's applicability in an eco-conscious decision-making context extends current knowledge and illustrates a holistic view of the psychological process underlying green consumption behavior.

From a practical standpoint, the study's insights highlight how hospitality firms can foster sustainability through integrated green marketing approaches. Managers should craft campaigns that

simultaneously appeal to consumers' environmental values and affirm their eco-friendly self-identity. Such value-driven and identity-focused marketing communication can encourage customers to participate in green programs (e.g. choosing eco-certified hotels, conserving resources during their stay) while also enhancing the brand's image and loyalty. Indeed, openly promoting sustainability efforts, rather than “green-hushing”, aligns positively with customers and can differentiate firms in the competitive hospitality market. This dual benefit of green marketing is evident in our findings: well-designed initiatives attracted consumers to sustainable practices and improved corporate reputation, a result that mirrors the competitive advantages noted for hospitality companies adopting visible green strategies. Ultimately, implementing holistic green marketing strategies provides shared value by driving pro-environmental consumer behavior and contributing to broader sustainability goals in the tourism and hospitality industry. Our study thereby adds to the evolving discourse on green marketing, consumer behavior, and sustainability by offering up-to-date empirical evidence that is both consistent with recent literature and illustrative of new dimensions (like felt obligation) in the pursuit of sustainable consumer engagement. The findings not only reinforce existing knowledge but also pave the way for more comparable studies across contexts, underscoring the importance of combining value-oriented appeals with identity and moral considerations to effectively promote green consumption behavior in hospitality.

CRedit authorship contribution statement

Yuxi Zhang: Writing – review & editing, Writing – original draft, Visualization, Validation, Software, Resources, Methodology, Investigation, Funding acquisition, Data curation, Conceptualization. **Hua Zhao:** Writing – review & editing, Writing – original draft, Visualization, Validation, Software, Resources, Methodology, Investigation, Funding acquisition, Data curation, Conceptualization. **Umer Zaman:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization.

Author contribution statement

The first author conceptualized the research, collected and analyzed data, and drafted the manuscript. The second author supervised the study and revised the manuscript. The third author contributed to the theoretical framework, literature review, and finalization of the manuscript. All authors approved the final version.

Informed consent statement

Informed consent was obtained from all participants after providing them details about the study's objectives, procedures, confidentiality, and their rights to withdraw. Only those who agreed voluntarily were included.

Ethical statement

This study was conducted in accordance with ethical guidelines set by the Ethics Committee of Shandong Xiehe University (Approval No. SXU/EC/2023/1025, dated 25th October 2023).

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this manuscript. All authors confirm that the research was conducted independently and objectively, with no involvement from external parties that could present a conflict of

interest.

Data availability

Data will be made available on a reasonable request by contacting the corresponding author.

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