

Full Length Article

Promoting responsible visitor behavior through green tourism initiatives: Willingness to pay for support scenarios in Labuan Bajo and Komodo National Park, Indonesia

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ARTICLE INFO

ABSTRACT

Keywords:

Sustainable tourism
Visitor preferences
Willingness to pay (WTP)
Choice experiment
Komodo National Park (KNP)

Rapid growth in nature-based and super-premium tourism has increased environmental pressures on protected destinations such as Labuan Bajo and Komodo National Park (KNP) in Indonesia, raising concerns about biodiversity conservation and responsible visitor behavior. Understanding how visitors value and support green tourism initiatives is therefore essential for designing effective and acceptable sustainability policies. This study explores visitor preferences and willingness to pay (WTP) for green tourism initiatives in Labuan Bajo and KNP, a renowned super-premium tourism destination in Indonesia. A choice experiment was employed to ascertain which green tourism options visitors prioritize. A total of 600 visitors completed surveys presenting different tourism scenarios. The data were then analyzed using statistical models to estimate to what extent visitors are willing to pay for each option. The study's primary focus was on five key aspects: green hotels, sustainable transportation, locally sourced products, environmental footprint reduction, and communication with locals. Three hypothetical scenarios were developed: Scenario 1 with a focus on eco-friendly accommodations; Scenario 2 with an emphasis on sustainable transportation and local engagement; and Scenario 3 with comprehensive green tourism initiatives. The findings showed robust support from visitors and clear WTP for programs such as green hotels, public transport, local food, and improved waste management. The findings also highlighted the significance of enhancing awareness regarding the protection of Komodo dragons and marine ecosystems as part of sustainable tourism. This study significantly contributes to the literature by quantifying visitor preferences within a United Nations Educational, Scientific and Cultural Organization (UNESCO) world heritage site and shows the potential for policies that support environmentally and socially responsible tourism in biodiversity-rich areas.

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<https://cstr.cn/32279.14.REGSUS.20250041>

<https://doi.org/10.1016/j.regfus.2025.100279>

Received 22 January 2025; Received in revised form 28 August 2025; Accepted 12 December 2025

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1. Introduction

The rapid growth of tourism in Labuan Bajo of Indonesia has precipitated numerous environmental concerns (Tussadiah et al., 2021; Fatina et al., 2023). The conventional reliance on private vehicles for transportation has been identified as a major contributor to air pollution and greenhouse gas emissions (Mun Ng et al., 2024). Moreover, the lack of comprehensive waste management systems has been demonstrated to exacerbate littering and pollution, thereby posing a threat to both terrestrial and marine ecosystems (Bhat et al., 2022; Mihai et al., 2022). There is often a lack of the implementation of sustainable practices in hotels and other accommodations (Sakshi et al., 2020; Salehi et al., 2021; Kasavan et al., 2022), leading to excessive water and energy consumption and insufficient waste recycling. Acknowledging these challenges, the Indonesian government has initiated several policies aimed at promoting sustainable tourism in Labuan Bajo. Green hotels, sustainable transportation, locally sourced products, environmental footprint reduction, and communication with locals are deemed crucial to green tourism as they collectively enhance the sustainability and appeal of tourism destinations (Ministry of Tourism Republic of Indonesia, 2023). Green hotels play a pivotal role by implementing comprehensive eco-friendly programs and obtaining the Cleanliness, Health, Safety, and Environment Sustainability (CHSE) certification (Damaianti et al., 2023). These initiatives ensure high standards of environmental sustainability, rendering these hotels more attractive to eco-conscious tourists and significantly reducing resource consumption. The CHSE certification further validates these efforts, thereby offering tourists a sense of assurance regarding the hotel's commitment to sustainability (Hakim et al., 2023). The adoption of sustainable transportation options is essential to reduce the carbon footprint associated with tourism (Zientara et al., 2024). The introduction of public buses to tourist destinations enables to reduce the need for private vehicle use, thereby lessening emissions (Obaid et al., 2021). Moreover, the rental of electric scooters provides tourists with flexible, eco-friendly transportation options (Longo et al., 2021). Collectively, these measures have the potential to mitigate the environmental impact of tourist transportation and align with broader sustainability goals.

The promotion of locally sourced products constitutes an additional critical attribute of green tourism (Bilynets et al., 2023; García-Milon and Juaneda-Ayensa, 2024). Currently, the national branding of local products in Labuan Bajo remains underdeveloped. The promotion of the local food consumption has been demonstrated to support the local economy and to reduce the carbon footprint associated with the transportation of food from distant locations (Vargas et al., 2021; Stein and Santini, 2022). Moreover, the promotion of eco-friendly local souvenirs has been demonstrated to support local artisans and businesses while encouraging sustainable production practices (Olszewski-Strzyżowski, 2022; Rahman et al., 2024). This approach has the dual benefits of promoting economic development and enhancing the overall sustainability of the tourism supply chain. Environmental footprint reduction initiatives are designed to address the need for more sustainable practices among tourists. The status quo reveals the limited options for utility reduction that are currently available. Supporting sustainable waste management practices, such as reducing, reusing, and recycling initiatives, is instrumental in enhancing the effectiveness of waste management and mitigating its environmental impact. Furthermore, encouraging tourists to opt for eco-friendly transportation modes, such as walking, cycling, or using electric vehicles, has been demonstrated to further reduce their carbon footprint (Shah et al., 2021; Campos et al., 2022). These practices are imperative for mitigating the environmental impact of tourism activities and conserving the natural beauty and biodiversity of the region (Baloch et al., 2023). Effective communication with locals is also vital for enhancing tourists' understanding and appreciation of the local environment and culture (Jiang and Zhang, 2024). The current level of information about the protection of Komodo dragons and marine ecosystems is found inadequate. The enhancement of knowledge concerning the protection of Komodo dragons facilitates the comprehension of tourists about the importance of conservation efforts for this unique species. Additionally, educating tourists about marine protection highlights the significance of marine biodiversity and the actions necessary to preserve it (Pearson and Thompson, 2023). This enhanced communication fosters a deeper connection and commitment to conservation efforts among tourists, promoting responsible tourism behavior. Collectively, these attributes form a comprehensive approach to promoting green tourism, thereby ensuring that tourism development is both economically beneficial and environmentally sustainable. By aligning with global sustainability goals and local conservation needs, these initiatives have the potential to transform Labuan Bajo and Komodo National Park (KNP) into models of sustainable tourism. The integration of these practices supports the overarching aim of maintaining the ecological integrity of these regions while providing tourists with enriching and responsible travel experiences. As such, tourists play a crucial role in the success of green tourism initiatives (Luu, 2021; Yousaf et al., 2021). The

preferences and willingness to pay (WTP) of visitors for sustainable practices have the potential to drive businesses to adopt more eco-friendly operations. Understanding what tourists value in terms of green tourism attributes can facilitate policy-makers and business owners to design and implement initiatives that are both effective and economically viable.

This study aims to explore visitor preferences and WTP for green tourism initiatives in Labuan Bajo and KNP by employing a choice experiment (CE) method. Despite the Indonesian government's ongoing efforts to promote sustainable tourism through initiatives such as green hotels, sustainable transportation, locally sourced products, environmental footprint reduction, and communication with locals, a critical gap remains in understanding how tourists perceive and economically value these measures. Although environmental challenges, such as pollution, inadequate waste management, and unsustainable hospitality practices, are thoroughly documented in KNP, empirical evidence quantifying visitor preferences for specific sustainability attributes remains scarce. This lack of insight is particularly crucial in United Nations Educational, Scientific and Cultural Organization (UNESCO) world heritage sites such as KNP, where maintaining a balance between conservation objectives and tourism development is imperative for ensuring long-term sustainability. Previous studies have largely focused on isolated aspects of sustainable tourism, such as tourists' WTP for individual attributes using contingent valuation method (CVM), e.g., green hotel certifications (Chia-Jung and and Pei-Chun, 2014; Nelson et al., 2021; Galati et al., 2023), or conservation efforts within the context of ecotourism that tend to stand alone without integration into broader tourism frameworks (Musa and Nadarajah, 2023; Schuhmann et al., 2024; Batool et al., 2025). Other studies utilizing CE method have examined visitor preferences for general holiday characteristics; however, it has not specifically addressed integrated green tourism strategies (Boto-García et al., 2022; Li et al., 2023; Zhao and Chan, 2023). To bridge this gap, this study employs the CE method, which effectively simulates real-world decision-making by presenting respondents with hypothetical scenarios to assess their preferences and marginal willingness to pay (MWTP) for various conservation initiatives. This research, by focusing on key attributes such as green hotels, sustainable transportation, locally sourced products, environmental footprint reduction, and communication with locals, provides crucial insights to inform adaptive, visitor-supported policies for sustainable tourism in biodiversity-sensitive destinations like KNP. Moreover, the results of the CE method are employed to formulate three hypothetical scenarios representing combinations of green tourism initiatives, offering data-driven and adaptive policy recommendations for sustainable tourism management in KNP. These scenarios reflect varying degrees of sustainability focus. Specifically, Scenario 1 emphasizes eco-friendly accommodations (Zanon and Teichmann, 2016; Ali and Anjum, 2024), Scenario 2 highlights sustainable transportation and local engagement (Farlynda, 2024; Dolasinski et al., 2025), and Scenario 3 integrates comprehensive green tourism initiatives (Muangasame and McKercher, 2015; Markose et al., 2022; Guo and Chai, 2025). This approach ensures that policy recommendations are grounded in visitor preferences, enhancing the region's feasibility and effectiveness of sustainable tourism strategies.

2. Research framework

Green tourism, also referred to sustainable or responsible tourism, focuses on reducing environmental harm while supporting local communities socially and economically. In Indonesia, the Ministry of Tourism asserted that sustainable tourism should encompass green hotels, eco-friendly transportation, local products, reduced environmental footprints, and enhanced communication with local communities (Chan et al., 2021; Baloch et al., 2023; Luo and Yun, 2023; Ijatuyi et al., 2025). In other countries, similar strategies have also been implemented. Thailand's "7 Greens" program, for instance, encourages collaboration among tourism stakeholders to promote sustainability, as evidenced by a pilot project conducted on Koh Samui (Muangasame and McKercher, 2015). This finding underscores the significance of collaborative efforts for real progress. Green tourism also helps achieve a balance between tourism growth and the preservation of natural resources. Guo and Chai (2025) emphasized the importance of incorporating renewable energy into tourism planning to reduce pollution and address climate change. Kerala of India serves as a prominent illustration of responsible tourism in practice, where tourism has been developed to support local communities and protect the environment (Markose et al., 2022). In England, Jarvis et al. (2010) found that certification schemes for green tourism require effective marketing and educational initiatives to achieve success. The promotion of eco-friendly options through green marketing is also important. In smart cities, energy-efficient planning and effective management are instrumental in fostering the growth of green tourism (Lu et al., 2021). In China, green tourism faces challenges related to unclear regulations, inadequate infrastructure, and

insufficient collaboration between public and private sectors (Luo and Yun, 2023). Lastly, green tourism ought to be part of a larger development strategy that considers population growth, economic needs, and environmental limitations (Sun et al., 2020).

Green hotels play a pivotal role for the realm of sustainable tourism for contributing to energy and water conservation, waste reduction, and the use of eco-friendly practices. In destinations such as Bali, the promotion of green-certified hotels, especially those with a 5-star rating, has contributed to an increase in their popularity through targeted marketing (Astawa et al., 2022). Since the global pandemic, travelers have exhibited an increased interest in health and sustainability, making green hotel practices even more important (Ho et al., 2021). The CHSE certification assists hotels in improving their service quality while meeting environmental standards (Juliana et al., 2024). In Malang Regency of Indonesia, local regulations have also supported hotels to adopt more sustainable practices during the post-pandemic period (Iqbal et al., 2025). A previous study demonstrated that visitor preferences are shifting toward eco-friendly hotels, a trend that benefits both environmental conservation and hotel business performance (Duric and Topler, 2021).

In addition to hotels, transportation constitutes a significant source of carbon emissions in tourism sector. Globally, tourism-related emissions showed an annual increase of 3.50% from 2009 to 2019, twice the rate of economic growth, reaching 5.200×10^9 t CO₂ in 2019, contributing to 8.80% of the total global greenhouse gas emissions (Sun et al., 2024). Research in 95 countries has demonstrated a positive correlation between an increase in tourist arrivals and an escalation in CO₂ emissions, especially from transportation (Le and Nguyen, 2021). In Europe, destination management groups are improving their method for evaluating transport emissions and are working on greener city tourism strategies (Gunter and Wöber, 2021). In China, initiatives such as upgrading recreational areas, offering policy support, and educating tourists have contributed to fostering more sustainable behavior (Wu et al., 2023). Moreover, active involvement in creating and implementing low-carbon tourism policies has significantly reduced emissions (Suryawan et al., 2025a). For instance, tourism-focused cities in China have reduced carbon emissions by 1.622×10^6 t through the implementation of these initiatives (Yang et al., 2022).

The utilization of locally sourced products constitutes a pivotal component of green tourism for conserving the environment and supporting local communities. A study in Hungary revealed that tourists frequently purchase local products at farmers' markets and food festivals, and prefer meals made with local ingredients in restaurants, thereby contributing to a reduction in emissions regarding the transportation of goods (Gonda et al., 2021). In Türkiye, research in several provinces showed that the consumption of local food had a positive impact on sustainable tourism and contributed to the promotion of local food culture (Apak and Gürbüz, 2023). Another key goal of green tourism is the mitigation of its environmental footprint including the reduction of waste and the judicious use of resources through programs such as the 3R principles (Reduce, Reuse, and Recycle) (Bhatia et al., 2023). The implementation of waste management strategies in tourism can also lower carbon emissions (Obersteiner et al., 2021). For instance, a case study in Camino Lebaniego of Spain showed that ecolabels, environmental certifications, and green transport options can encourage tourists to make more eco-friendly choices (Campos et al., 2022).

Communication with locals is a pivotal component of sustainable tourism. Effective communication between tourists and locals facilitates the development of cultural understanding and raises awareness about the environment. The establishment of local knowledge-based tourism businesses can also empower communities, especially through small, locally managed businesses (Dias et al., 2023). In Koto Sentajo, Riau Province, Indonesia, the implementation of the penta-helix model has contributed to the development of tourism villages (Yasir et al., 2021). Innovative approaches, such as the utilization of tourist photography as a medium for cultural exchange, have also been suggested to enhance communication between hosts and visitors (Tabaeian et al., 2023). Furthermore, public-private partnerships play a critical role in promoting responsible tourism (De Matteis et al., 2021). In the Philippines, such partnerships have facilitated the attraction of investment, the training of local communities, and the promotion of tourism through digital marketing (Susilo and Santos, 2023).

Integrating these five attributes creates a complete and clear framework for promoting green tourism (Fig. 1), especially in regions that are environmentally sensitive and culturally important. Despite the Indonesian Ministry of Tourism established the robust policies to support sustainable tourism, the translation of these ideas into practice still remains challenging. The main challenges include a paucity of infrastructure for eco-friendly programs, inadequate coordination among governments, businesses, and local communities, and the challenge of changing tourist behavior toward more sustainable options (Sianipar et al., 2024a, b; Suryawan et al., 2025b). These issues frequently lead to a gap between the objectives of policies and the actual outcomes on the ground. Recent research indicated that it is imperative to align sustainability strategies with the preferences and behavior of tourists

(Elkhwesky 2022; Frías-Jamilena et al., 2022; Ashraf et al., 2024; Li et al., 2024). Market-based approaches, particularly those that assess tourists' WTP for specific green tourism initiatives (Nelson et al., 2021; Galati et al., 2023; Suryawan et al., 2025a, c), are increasingly recognized as valuable tools for bridging this gap.

In order to respond to these challenges, this study employed a CE method with hypothetical scenarios to explore visitor preferences for green tourism. Each scenario focused on different aspects of sustainability. Scenario 1 analyzed the role of green hotels in reducing environmental impact through energy savings, improved waste management, and eco-certifications (Abdou et al., 2020; Gunduz Songur et al., 2023). Scenario 2 highlighted the utilization of eco-friendly transportation methods and the enhancement of communication with local communities (Kanwal et al., 2024; Khater et al., 2024). Scenario 3 integrated all five attributes into a full green tourism strategy. These scenarios were employed to ascertain the impact of diverse combinations of green tourism programs affect visitor support and their WTP.

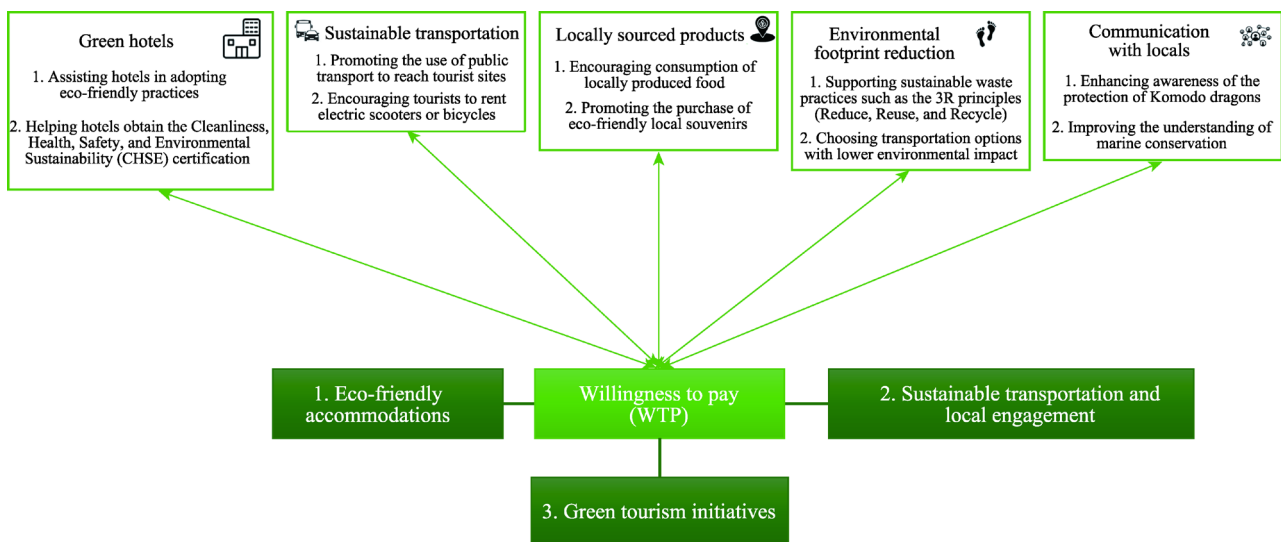


Fig. 1. Conceptual framework for hypothetical scenarios in green tourism initiatives.

3. Methods

3.1. Study location and research design

Labuan Bajo, situated at the western tip of Flores Island in Indonesia, is a prominent tourist destination, largely in view of its role as the gateway to the KNP. KNP, a UNESCO world heritage site, is renowned for its Komodo dragons, diverse marine ecosystems, and beautiful landscapes. The Indonesian government recently designated Labuan Bajo as a “super-premium” tourism destination, showing its importance within the country’s tourism plans. Being a UNESCO site confers upon KNP a degree of international prominence that helps to boost tourism and support for conservation efforts. In 2023, there was a significant increase in the number of tourists with a total of 300,488 visitors, including 184,096 international and 116,392 domestic tourists (Ardin, 2025). However, this increase also brings environmental problems that require green tourism solutions to protect the area (Roblek et al., 2021; Baloch et al., 2023). Green tourism is a pivotal approach for mitigating the negative impact of tourism while also bringing social and economic benefits. This approach emphasizes the efficient utilization of resources, reduction of waste and pollution, and engagement of local communities. It encompasses practices that promote resource efficiency, reduce waste and emissions, and support local communities (Tepluk et al., 2023; Chakraborty, 2024). In Labuan Bajo and KNP, green tourism is not merely an option, it is essential. The area’s ecosystems are highly sensitive and susceptible to degradation from excessive tourism (Sianipar et al., 2024b; Rahman et al., 2025; Sofiyah et al., 2025). Therefore, the protection of nature must be balanced with the promotion of responsible tourism to ensure long-term sustainability.

3.2. Attribute and level selection

This study employed a CE method to examine five key attributes that represent important aspects of green

tourism: green hotels, sustainable transportation, locally sourced products, environmental footprint reduction, and communication with locals. These attributes are based on national tourism guidelines and reflect practical needs in the realm of sustainable tourism development. The CE method facilitates the comprehension of visitor preferences and the estimation of their WTP for improvements in these areas. Each attribute includes a status quo option and different improvement levels to reflect real-world conditions. This structure enables respondents to compare various scenarios and make choices, thereby identifying which sustainability measures are most supported. These attributes and levels are delineated in Table 1.

This study focuses on five key elements of green tourism: green hotels, sustainable transportation, locally sourced products, environmental footprint reduction, and communication with local communities. Currently, the majority of hotels have only partially adopted eco-friendly practices. One such improvement is designed to assist hotels in implementing comprehensive green programs including saving water and energy as well as recycling. Another enhancement is to facilitate the acquisition of CHSE certification to meet high environmental and safety standards. In the context of sustainable transportation, the current lack of public options necessitates that the majority of tourists rely on private vehicles. The implementation of these measures is expected to result in improvements including the provision of public buses and offering electric scooters or bikes as alternative means of clean transportation. The promotion of locally sourced products remains limited; therefore, one option encourages the consumption of local food to support the local economy and reduce food transport emissions. Another supports the purchase of eco-friendly local souvenirs. To reduce environmental impact, the available option remains limited; thus, improvement options include the promotion of waste reduction through 3R practices and the encouragement

Table 1

Attributes and levels related to green tourism initiatives in Labuan Bajo and Komodo National Park (KNP) case study.

Attribute	Status quo and different improvement levels	Variable
Green hotels	Status quo: The implementation of green hotels in Labuan Bajo is not yet comprehensive.	Green hotels 0
	Level 1: Hotels receive support to implement eco-friendly programs focusing on energy efficiency, water conservation, and waste recycling.	Green hotels 1
	Level 2: Hotels receive assistance in obtaining the Cleanliness, Health, Safety, and Environment Sustainability (CHSE) certification, demonstrating compliance with sustainable tourism standards.	Green hotels 2
Sustainable transportation	Status quo: Public transportation access for tourists remains unavailable, forcing reliance on private vehicles.	Sustainable transportation 0
	Level 1: Public bus services are introduced to connect visitors with major tourist destinations, reducing private-vehicle use.	Sustainable transportation 1
	Level 2: Electric scooters and bicycles are available for rent to encourage flexible and zero-emission mobility options for tourists.	Sustainable transportation 2
Locally sourced products	Status quo: National branding and promotion of locally produced goods are still inadequate.	Locally sourced products 0
	Level 1: Visitors are encouraged to consume locally produced food to support farmers and minimize food-transport emissions.	Locally sourced products 1
	Level 2: Tourists are encouraged to purchase eco-friendly local souvenirs, thereby supporting artisans and environmentally responsible small businesses.	Locally sourced products 2
Environmental footprint reduction	Status quo: Opportunities for reducing energy, water, and waste utilities remain limited.	Environmental footprint reduction 0
	Level 1: Tourists participate in sustainable waste management programs promoting the 3R principles (Reduce, Reuse, and Recycle).	Environmental footprint reduction 1
	Level 2: Visitors adopt eco-friendly transport modes—walking, cycling, or using electric vehicles—to minimize carbon emissions.	Environmental footprint reduction 2
Communication with locals	Status quo: Information and education about Komodo dragons and marine ecosystem protection are still inadequate.	Communication with locals 0
	Level 1: Tourists participate in programs that increase knowledge and awareness about the protection of Komodo dragons.	Communication with locals 1
	Level 2: Tourists receive educational sessions to improve understanding of marine ecosystem protection and local ecosystem preservation.	Communication with locals 2
WTP	Status quo: No additional payment is paid (0.000 USD/(person-times)).	WTP
	Level 1: Tourists are willing to pay 13.160 USD/(person-times) to support green tourism initiatives.	
	Level 2: Tourists are willing to pay 19.750 USD/(person-times) to support green tourism initiatives.	
	Level 3: Tourists are willing to pay 32.910 USD/(person-times) to support green tourism initiatives.	
	Level 4: Tourists are willing to pay 210.620 USD/(person-times) to support green tourism initiatives.	

Note: WTP, willingness to pay. 1.00 USD=15,196.35 IDR (as of 1 October 2024).

of walking, cycling, or electric vehicle use. Communication with locals also remained limited; improvement levels aim to raise tourist awareness about the protection of Komodo dragons and marine biodiversity. To measure visitor support, the study incorporated a WTP attribute with four price levels: 13.16, 19.75, 32.91, and 210.62 USD/(person-times), based on a preliminary CVM survey.

3.3. Experimental design and questionnaire development

This study employed a CE framework to assess visitor preferences for green tourism options in KNP. The design incorporated multiple attributes and levels, resulting in 1215 possible combinations. To keep the survey practical and statistically sound, an orthogonal fractional factorial design was adopted to reduce the number of profiles to 12 choice sets. Each set consisted of two hypothetical improvement scenarios and one status quo option, thereby ensuring that the survey remained manageable while still providing reliable data on visitor preferences and WTP. The questionnaire was structured into three sections. The first section introduces the study's purpose, emphasizes the significance of green tourism in KNP, and includes a consent form that ensures voluntary and confidential participation. The second section presents the CE choice tasks, where respondents were shown three choice sets containing two hypothetical improvement scenarios and one status quo option. These scenarios reflect varying levels of improvement across selected attributes and are designed to simulate real-world decisions. The structure enables the identification of trade-offs that visitors are willing to make and the value they assign to various sustainability initiatives. The third section of the questionnaire is designed to elicit information regarding the respondents' demographic characteristics and travel behavior patterns. It includes data such as age, gender, income, education level, visit frequency to KNP, length of stay, and awareness of environmental issues. This information helps identify how personal and behavioral characteristics influence visitor preferences and WTP for green tourism.

3.4. Data collection

The survey was conducted from December 2023 to February 2024 using a hybrid data collection approach that combined online surveys and face-to-face interviews. This method ensured comprehensive and inclusive participation by targeting key entry points in Labuan Bajo, such as the ferry terminal and popular tourist sites. These strategic locations facilitated the capture of a broad range of visitor experiences and preferences, thereby representing the diverse tourist population visiting KNP. A stratified random sampling technique was employed to account for variations in age, gender, nationality, and travel behavior, ensuring that all major visitor groups were proportionally included. A total of 600 responses were collected, exceeding the minimum requirement of 400 and achieving a 5.00% margin of error. This sample size enhanced the statistical power and reliability of the analysis. The survey period was selected to include both peak and off-peak seasons, capturing seasonal differences in tourist behavior. Of the total responses, 287 (47.80%) were obtained through in-person interviews conducted by trained interviewers using a standardized protocol, while 313 (52.20%) were collected online to reach a broader audience. The survey was available in both Bahasa Indonesia and English languages, thus minimizing language barriers for both domestic and international visitors. The dual-mode approach allowed flexibility for tech-savvy respondents and facilitated participation from those requiring additional clarification. This mixed-method strategy combined quantitative and qualitative data, resulting in rich and diverse insights into visitor preferences and WTP for green tourism in KNP.

3.5. Data analysis

The data gathered from the CE method were analyzed using a random parameter logit (RPL) model, selected for its capacity to accommodate unobserved heterogeneity in visitor preferences. This model yielded more precise estimates of the MWTP for different green tourism attributes. The analysis involved several key steps. Initially, the RPL model was employed to estimate coefficients for each attribute level, thus representing the relative importance of each attribute in the respondents' decision-making process (Sofiyah et al., 2025; Suryawan et al., 2025a, c; Yang et al., 2025). The application of the RPL model to the survey data was facilitated by statistical software, then producing the necessary coefficients for further analysis. Once the coefficients for each attribute level were derived, the next step involved the calculation of the MWTP for these attributes. This calculation was performed by dividing the coefficient of each attribute level by the coefficient of the payment attribute, thereby providing an estimate of the amount visitors were willing to pay for specific green tourism initiatives. The utility function for an alternative option i (where i represents each hypothetical choice scenario offered to respondents) was defined as follows:

$$V_i = \beta_1(\text{green hotels})_i + \beta_2(\text{sustainable transportation})_i + \beta_3(\text{locally sourced products})_i + \beta_4(\text{environmental footprint reduction})_i + \beta_5(\text{communication with local communities})_i + \beta_6(\text{payment})_i, \quad (1)$$

where V_i denotes the utility associated with alternative option i ; and $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5$, and β_6 represent the estimated coefficients of the corresponding attribute included in the choice experiment. The MWTP was derived as the ratio of the parameter associated with the attribute ($\beta_{\text{attribute}}$) to the coefficient of the payment parameter (β_{payment}):

$$\text{MWTP} = \frac{-\beta_{\text{attribute}}}{\beta_{\text{payment}}}. \quad (2)$$

To further delve into the heterogeneity of visitor preferences, we used a latent class model (LCM). This model segmented respondents into distinct classes based on their preferences, offering deeper insights into various visitor segments and their specific inclinations towards different green tourism initiatives. The LCM identified the characteristics and behaviors of different visitor groups, providing valuable information on how different segments value and prioritize sustainability initiatives.

4. Results

Table 2 depicts the results of the RPL model, estimating the MWTP of visitors for different green tourism initiatives in Labuan Bajo and KNP. The model is statistically sound, providing significant evidence that the green tourism features offered have influenced visitor preferences. Among the five attributes, sustainable transportation (Sustainable transportation 1) exhibited the highest MWTP, indicating that tourists place significant value on sustainable transportation that mitigates emissions and improves access. Visitors also showed a higher MWTP for eco-friendly hotel practices (Green hotels 1) and for the option to consume locally sourced food (Locally sourced products 1). This indicates that tourists are more willing to pay for sustainable accommodation and dining options that align with environmentally responsible behavior. In addition, there was a positive MWTP for programs that educate tourists about the protection of Komodo dragons (Communication with locals 1), suggesting that visitors appreciate efforts promoting environmental awareness. However, lower or negative MWTP values were identified for hotel CHSE certification (Green hotels 2) and electric scooter or bike rentals (Sustainable transportation 2), meaning tourists do not perceive these as directly improving their experience.

Table 2

Random parameters logit (RPL) model results for green tourism initiatives.

Variable	RPL model with WTP interaction	MWTP (USD/(person-times))	RPL model without WTP interaction
Green hotels 1	0.306*** (0.061)	5.145	0.543*** (0.093)
Green hotels 2	-0.185** (0.081)	-	-0.601*** (0.113)
Sustainable transportation 1	0.329*** (0.068)	6.154	0.670*** (0.108)
Sustainable transportation 2	-0.203** (0.099)	-	-0.613*** (0.152)
Locally sourced products 1	0.276*** (0.078)	5.166	0.590*** (0.112)
Locally sourced products 2	0.143* (0.083)	2.681	0.130 (0.118)
Environmental footprint reduction 1	0.127* (0.070)	2.382	0.262*** (0.098)
Environmental footprint reduction 2	-0.020 (0.075)	-	-0.047 (0.111)
Communication with locals 1	0.206*** (0.071)	3.853	0.308*** (0.103)
Communication with locals 2	-0.004 (0.076)	-	0.017 (0.104)
WTP	-2.648×10 ⁻⁵ *** (3.384×10 ⁻⁶)	-	-
Log likelihood function	-1802.328	-	-1882.327
LLR	350.347	-	357.641
McFadden's pseudo R ²	0.089	-	0.129
AIC/N	2.026	-	1.956
Chi square	38.932	-	37.570
Choice sets	1800	-	1800

Note: MWTP, marginal willingness to pay; LLR, log-likelihood ratio; R², coefficient of determination; AIC, Akaike Information Criterion; N, the number of observations. - represents no data. The values inside parentheses are standard errors. ***, **, and * show significant levels at 1.00%, 5.00%, and 10.00%, respectively.

Table 3 shows the results of the LCM, which identifies different visitor preferences for green tourism in Labuan Bajo and KNP. The model divides respondents into two groups, revealing variations in their support for sustainability efforts. The model demonstrated a satisfactory fit, evidenced by a McFadden's pseudo coefficient of determination (R^2) of 0.195 and a relatively high log-likelihood ratio (LLR=821.648), confirming the reliability of the model results. Class 2, which accounted for 82.00% of the respondents, expressed considerable support for various green tourism initiatives. This group showed high MWTP for hotels with CHSE certification, public transportation, local food, waste management, and marine conservation. These preferences reflect a broad commitment to sustainability. In contrast, Class 1 (representing 18.00% of the respondents) showed weak or insignificant MWTP across green tourism initiatives. While they prefer eco-friendly hotels and travel often, they tend to be more price-sensitive and less consistent in supporting sustainability. The findings suggest that most visitors (Class 2) are willing to pay for integrated green tourism programs, especially those combining certified services, clean transport, and local involvement.

Table 4 presents two groups of tourists based on their preferences for green tourism. Class 2 refers to the larger group and strongly supports sustainable tourism. They have more concern for environmental issues, attain higher incomes, engage in more frequent travel, and demonstrate a greater degree of educational level. This explains their higher MWTP for green tourism programs. On the other hand, Class 1 is smaller and less supportive with lower incomes, infrequent travel, and limited concern for environmental issues. They prefer mass tourism and have different priorities. These findings suggest that green tourism programs should focus on the supportive majority, while using education or incentives to engage the less interested group.

Table 5 depicts how visitors appraise three green tourism scenarios based on their MWTP. Among the three scenarios, Scenario 3 received the highest support, as it integrated eco-friendly hotels, public transportation, local products, waste management, and conservation education. This finding suggests a preference among visitors for a comprehensive and integrated approach to sustainability. However, implementing Scenario 3 fully may present certain challenges in the short term due to cost, infrastructure, and planning requirements. The results from the LCM demonstrated that different groups of tourists value different aspects. Class 2 tourists are willing to pay for various green initiatives, while Class 1 tourists are more selective and less willing to contribute. As a consequence, it is logical to initiate with less complex actions. Scenario 1 and Scenario 2 are considered to be promising initial steps.

Table 3

Latent class model (LCM) results for green tourism initiatives.

Variable	Class 1	Class 2	MWTP (USD/(person-times))
Green hotels 1	35.318 (5329.700)	0.264*** (0.074)	10.405
Green hotels 2	57.379 (7670.714)	-0.449*** (0.114)	17.927
Sustainable transportation 1	-12.984 (29,023.190)	0.455*** (0.086)	-
Sustainable transportation 2	-0.530 (44,046.680)	-0.316** (0.124)	13.982
Locally sourced products 1	4.942 (9387.350)	0.355*** (0.096)	5.892
Locally sourced products 2	-4.123 (5872.383)	0.150* (0.102)	2.677
Environmental footprint reduction 1	-15.739 (21,019.750)	0.163** (0.082)	6.433
Environmental footprint reduction 2	61.483 (12,020.520)	-0.220** (0.108)	-
Communication with locals 1	63.155 (4332.998)	0.097 (0.091)	6.311
Communication with locals 2	-94.050 (7337.722)	0.160** (0.098)	-
WTP	-2.648×10^{-4} (1.001×10^{-2})	-1.671×10^{-6} (4.660×10^{-7})	-
Log likelihood function	-1698.512	-	-
LLR	821.648	-	-
McFadden's pseudo R^2	0.195	-	-
AIC/N	1.792	-	-
Chi square	49.588	-	-
Choice sets	1800	-	-

Note: Class 1 and Class 2 represent the less supportive and more supportive visitor segments toward green tourism, respectively. - represents no data. The values inside parentheses are standard errors. ***, **, and * show significant levels at 1.00%, 5.00%, and 10.00%, respectively.

Table 4

Characteristics of tourist segments: visitor preferences for green tourism initiatives.

Variable	Category	Class 1	Class 2	Chi square	df	P-value
Supporting mass tourism practices	No	20 (3.33%)	209 (34.83%)	21.545	1	<0.010
	Yes	88 (14.67%)	283 (47.17%)			
Preference for eco-friendly hotels	No	37 (6.17%)	165 (27.50%)	0.021	1	0.886
	Yes	71 (11.83%)	327 (54.50%)			
Concern for environmental issues	No	79 (13.17%)	476 (79.33%)	71.097	1	<0.010
	Yes	29 (4.83%)	16 (2.67%)			
Income (USD/month)	<165.000	36 (6.00%)	80 (13.33%)	48.977	4	<0.010
	165.000–330.000	32 (5.33%)	61 (10.17%)			
	330.000–660.000	16 (2.67%)	87 (14.50%)			
	660.000–820.000	12 (2.00%)	130 (21.67%)			
	>820.000	12 (2.00%)	134 (22.33%)			
Frequent travel (times/a)	1	29 (4.83%)	112 (18.67%)	20.470	4	<0.010
	2	31 (5.17%)	129 (21.50%)			
	3	35 (5.83%)	94 (15.67%)			
	4	6 (1.00%)	71 (11.83%)			
	>4	7 (1.17%)	86 (14.33%)			
Education level	High school or below	64 (10.67%)	167 (27.83%)	23.972	1	<0.010
	Diploma or above	44 (7.33%)	325 (54.17%)			
Gender	Male	53 (8.83%)	250 (41.67%)	0.107	1	0.743
	Female	55 (9.17%)	242 (40.33%)			

Note: *df*, degrees of freedom. The values inside parentheses indicate the number of respondents in each class, and the values outside parentheses indicate the percentage of respondents in each class.

Table 5

Hypothetical scenarios for assessing green tourism initiatives.

Attribute	Scenario 1 (eco-friendly accommodations)	Scenario 2 (sustainable transportation and local engagement)	Scenario 3 (comprehensive green tourism initiatives)
Green hotels	Eco-friendly program	-	Eco-friendly program
Sustainable transportation	-	Public bus	Public bus
Locally sourced products	Local food	Eco-friendly souvenirs	Local food+eco-friendly souvenirs
Environmental footprint reduction	Waste management (3R principles)	-	Waste management (3R principles)
Communication with locals	-	Protection of Komodo dragons	Protection of Komodo dragons
MWTP (USD/(person-times))	23.170	22.160	45.330
95.00% confidence interval	23.1567–23.1577	22.1588–22.1596	45.3336–45.3341

Note: - represents no data. The 95.00% confidence interval represents the statistical range of estimated MWTP values for each scenario, indicating the reliability of the mean estimates.

These alternatives are more straightforward to implement and still align with the primary interests of visitors. Starting with smaller-scale initiatives and gradually expanding them over time allows for better planning, stronger infrastructure development, and greater visitor awareness. This gradual approach supports a smoother transition toward the full sustainability model proposed in Scenario 3, ensuring that the process remains practical, cost-effective, and broadly supported by tourists.

5. Discussion

This study offers valuable insights into what tourists value when it comes to green tourism in Labuan Bajo and KNP, a UNESCO world heritage site. The RPL model demonstrated that visitors are willing to pay more for specific sustainability actions, especially those that offer clear environmental benefits. For instance, tourists are willing to

pay approximately 5.145 USD/(person·times) to support hotels that implement eco-friendly programs (Green hotels 1) and around 6.154 USD/(person·times) to utilize public buses to access tourist areas (Sustainable transportation 1). This suggests that visitors prefer practical and visible initiatives that mitigate environmental impacts, especially in transport and accommodation. Conversely, tourists exhibited less support for hotel certification programs (Green hotels 2) and electric bike or scooter rentals (Sustainable transportation 2). These efforts may appear to be overly administrative or place more responsibility on individuals, thereby making them less appealing. The results highlight the significance of focusing on green tourism initiatives that are readily comprehensible to tourists and offer them direct experiential engagement. The substantial support for eco-friendly hotel practices and sustainable public transportation aligns with previous studies highlighting the role of green certifications and infrastructure in promoting tourism sustainability (Rahman et al., 2023; Basendwah et al., 2024; Murtaza et al., 2024). Additionally, the provision of incentives for hotels to invest in green infrastructure and practices can further motivate the industry to adopt sustainable practices (Abdou et al., 2020, 2022). Similarly, the positive perception of public transport initiatives is consistent with findings that sustainable mobility solutions, such as electric buses or shuttle services, can significantly reduce tourism-related emissions (Alamatsaz et al., 2024; Das et al., 2024). This assertion is supported by a study indicating that enhancing public transportation can effectively reduce emissions and enhance the overall sustainability of tourist destinations (Zientara et al., 2024).

The study revealed that, in addition to infrastructure, visitors place high value on consuming local food and purchasing eco-friendly souvenirs. These preferences suggest that tourists appreciate experiences connecting them to local culture and promoting sustainable consumption. The strong support for locally sourced products align with previous research showing that local food consumption contributes to a reduction in tourism's carbon footprint and supports regional economies (Stein and Santini, 2022; Apak and Gürbüz, 2023). Similarly, the preference for eco-friendly souvenirs suggests visitors are aware of the environmental and cultural value of locally made items (Nainggolan et al., 2022). Visitors also showed strong support for sustainable waste management, especially those adhering the 3R principles. The positive MWTP for this attribute reflected tourists' concern about reducing environmental impacts during their stay. These findings are consistent with earlier studies that emphasized the significance of waste management and public awareness in enhancing the sustainability of tourism (BrotoSusilo et al., 2020; Mofid-Nakhaee et al., 2020; Debrah et al., 2021). The provision of adequate infrastructure for waste segregation and recycling can further improve outcomes by facilitating responsible disposal (Wang et al., 2021; Kurniawan et al., 2023). In addition, visitors responded positively to efforts to enhance their knowledge about the protection of Komodo dragons. This suggests that tourists value learning about environmental conservation, especially regarding unique species such as Komodo dragons. Prior research also confirmed that enhancing visitor awareness can promote both pro-environmental behavior and stronger conservation support (Li and Wu, 2020; He et al., 2023). The involvement of local communities in educational programs further strengthens these efforts by fostering a sense of shared responsibility (Gurung and Thapa, 2023).

The LCM analysis offers a deeper understanding of the differences in visitor preferences by segmenting tourists into distinct categories based on their valuation of green tourism initiatives. Class 2, comprising 82.00% of respondents, exhibited robust and consistent support for certain sustainability initiatives. This group highly valued infrastructure improvements that prevented environmental harm (Green hotels 2), with a WTP of approximately 17.927 USD/(person·times). This shows that the majority of visitors prefer visible and environmentally friendly development that supports long-term sustainability goals. Class 2 also supported better communication about marine conservation and local ecosystems (Communication with locals 2) with a WTP approximately 6.311 USD/(person·times). This suggests that visitors appreciate being informed about conservation and local environmental issues in KNP. The interest in education and information reflects that tourists value not only green services, but also the opportunity to learn more about the natural and cultural context of the places they visit. These findings are consistent with earlier studies highlighting the significance of environmental education and communication in promoting more responsible tourist behavior (Ruhanen and Bowles, 2020; Della Lucia et al., 2021). This increased awareness, in turn, can enhance the overall impact of green tourism strategies.

The CE scenarios provide a clear perspective on how visitors prioritize various green tourism strategies. Scenario 1 with a focus on eco-friendly hotel programs exhibited a MWTP of approximately 23.170 USD/(person·times), indicating strong visitor support for sustainable lodging practices, consistent with previous findings highlighting the role of infrastructure and waste management in green tourism (Dawane et al., 2023; Luo and Yun, 2023; Mahmood et al., 2024). Tourists increasingly value hotel operations that adopt energy and water efficiency measures, recycling

programs, and sustainable materials. Scenario 2, which emphasizes public transportation and local engagement, has an MWTP of approximately 22.160 USD/(person·times), reflecting visitor appreciation for improvements in tourism organization and education. The result supports earlier studies on the significance of governance, community involvement, and knowledge sharing in sustainable tourism (Tomasi et al., 2020; Wisnumurti et al., 2020; Elshaer et al., 2021). Visitors appear to value not only environmental impact reduction but also the enhancement of local participation and awareness (Chan et al., 2021; Baloch et al., 2023). Scenario 3, which combined all key green tourism features, exhibited the highest MWTP at approximately 45.340 USD/(person·times). Tourists favor integrated approaches that support green infrastructure, enhanced communication about climate and conservation, and comprehensive transparency. This scenario's strong support reflects tourists' willingness to financially contribute to well-rounded and impactful sustainability strategies. These findings align with broader research suggesting that adaptive, multi-dimensional approaches are most effective for dealing with environmental challenges while maintaining tourists engagement (Juliana et al., 2024; Sianipar et al., 2024a; Suryawan et al., 2025c).

6. Conclusions

This study explores visitor preferences and WTP for green tourism initiatives in Labuan Bajo and KNP, a region with high ecological value and global recognition. It employed a CE method to identify the sustainability attributes most valued by visitors, thereby offering a basis for evidence-based tourism planning in protected areas. The findings indicated the strong support of visitors for eco-friendly hotel programs, public transportation, consumption of locally sourced food, and sustainable waste management. Furthermore, they demonstrated a MWTP more for initiatives that promote awareness about the protection of Komodo dragons, reflecting the importance of education in fostering responsible tourism. Visitors exhibited the highest MWTP for public transport options and hotel sustainability improvements, indicating the preference for infrastructure-based and visible initiatives. In contrast, tourists exhibited less willingness to support options such as hotel certifications or the rental of electric scooters, possibly due to lower perceived value. The study also revealed notable visitor segmentation, indicating that most tourists exhibit a preference for integrated and comprehensive sustainability measures, whereas others tend to prioritize specific or targeted aspects of sustainability. These findings confirmed the necessity to formulate tourism policies that are aligned with varied visitor preferences and expectations. In light of the findings, it is recommended that policy-makers prioritize green hotel programs, improve tourist transportation options, promote local products, and expand educational campaigns on conservation. Collaborative governance involving local communities, tourism operators, non-governmental organizations, and government institutions is deemed pivotal for successful implementation. By integrating visitor preferences into green tourism planning, stakeholders in Labuan Bajo and KNP can strengthen conservation outcomes while supporting local economic growth and enhancing tourist satisfaction. This research offers a replicable model for sustainable tourism development in other ecologically sensitive destinations.

Authorship contribution statement

Ari RAHMAN: conceptualization, formal analysis, and investigation; Evi Siti SOFIYAH: conceptualization, formal analysis, supervision, and investigation; Imelda Masni Juniaty SIANIPAR: conceptualization, formal analysis, supervision, and investigation; Cut Maisarah ZULFA: conceptualization, formal analysis, data curation, validation, and investigation; Sapta SUHARDONO: conceptualization, formal analysis, visualization, and investigation; Chun Hung LEE: conceptualization, formal analysis, supervision, resources, project administration, and investigation; and I Wayan Koko SURYAWAN: conceptualization, formal analysis, visualization, writing - original draft, writing - review & editing, and investigation. All authors approved the manuscript.

Ethics statement

This study received formal research authorization under Research Permit No. 503.707/DPMPTSP/096/XI/2023, issued by the Department of Investment and One-Stop Integrated Services (DPMPTSP) based on the recommendation letter from the Dean of the Faculty of Infrastructure Planning, Universitas Pertamina, dated on 26 October 2023. All participants were informed about the objectives of the research and provided their voluntary informed consent prior to participation.

Declaration of conflict of 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 paper.

Acknowledgements

The authors sincerely thank all respondents who generously participated in this study and shared their valuable time, perspectives, and experiences. Their contributions are essential in providing meaningful insights that strengthen the analysis and findings of this research. Appreciation is also extended to the local communities, tourism operators, and institutional partners who supported the data collection process and facilitated field engagement.

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