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What makes tourists go green? A multidimensional exploration of pro-environmental behavior predictors

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Abstract

Purpose – This study explores the predictors of pro-environmental behavior (PEB) among tourists by integrating psychological, demographic, situational, behavioral and contextual factors. It aims to address theoretical gaps in existing models of PEB within the tourism industry.

Design/methodology/approach – The research employs a stratified random sampling method, surveying 824 domestic and international tourists in Serbia. Data were collected via online surveys and analyzed using linear multiple regression and genetic algorithms to identify significant predictors of PEB.

Findings – The study identifies personal norms, travel companions and perceived effectiveness as the strongest predictors of PEB among tourists. Other influential factors include duration of stay, destination characteristics and demographic variables such as age and education. The results highlight the complex interplay of internal values, social influences and situational factors in shaping sustainable behaviors in tourism.

Practical implications – The findings suggest that tourism stakeholders, including policymakers and managers, should focus on strategies that enhance personal norms and leverage social influences to promote sustainable tourism practices. Emphasizing the perceived effectiveness of eco-friendly actions and providing robust environmental infrastructure can further encourage pro-environmental behavior among tourists.

Originality/value – This research offers a comprehensive model that integrates a diverse range of predictors, providing a holistic understanding of the drivers of PEB in tourism. It advances the literature by addressing the limitations of existing theoretical models and emphasizing the importance of considering broader contextual influences.

Keywords Pro-environmental behavior, Sustainable tourism, Predictors, Psychological factors, Demographic factors, Situational factors, Behavioral factors, Contextual factors

Paper type Research paper

1. Introduction

Pro-environmental behavior (PEB), which encompasses actions that individuals take to minimize their environmental impact, has become an increasingly important area of study in

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the context of tourism (Ardoin *et al.*, 2015; D'Arco *et al.*, 2023; Kubičková *et al.*, 2024). The urgency of addressing environmental challenges has driven researchers to explore the various determinants that encourage sustainable practices among tourists, who play a significant role in either exacerbating or alleviating environmental degradation at their destinations (Han, 2021). Understanding the factors that promote pro-environmental behavior is crucial for developing effective strategies and interventions aimed at fostering sustainable tourism practices. Predicting pro-environmental behavior (PEB) in tourism faces theoretical gaps that limit the effectiveness of existing models. Research typically isolates predictors—psychological, demographic, situational, and contextual—resulting in fragmented insights (Dolnicar *et al.*, 2017). While psychological factors like attitudes and values are well-studied, deeper cognitive and emotional influences, such as norms or emotions like guilt, remain underexplored (Mkono and Hughes, 2020). Situational factors, such as destination characteristics, are rarely integrated with psychological predispositions. Structural elements, including infrastructure and policies, are underrepresented, and the interaction between individual behaviors and these systemic factors is insufficiently studied (Candido *et al.*, 2024). Most models are static, failing to address the dynamic nature of human behavior influenced by changing conditions or personal circumstances (Wyss *et al.*, 2022). Addressing these gaps requires an interdisciplinary approach that integrates psychological, sociological, and environmental perspectives to better predict and promote PEB in tourism.

The current paper aims to address these gaps by exploring a comprehensive range of factors that predict PEB among tourists. It integrates psychological, demographic, situational, behavioral, and contextual predictors to provide a holistic understanding of the drivers of sustainable tourism behavior. This study introduces a novel hybrid analytical approach by combining traditional linear multiple regression with genetic algorithms (GA) to optimize predictor selection for pro-environmental behavior (PEB). While regression models are commonly used in behavioral research (Yang and Li, 2023), the application of GA in tourism studies remains a methodological advancement (Cao, 2022). This integration enables a systematic evaluation of factor significance, allowing for the prioritization of predictors with precision that is often lacking in conventional analyses. Additionally, the study's multidimensional integration of psychological, demographic, situational, behavioral, and contextual predictors into a single comprehensive model represents a significant contribution to the field. Existing research often examines these factors in isolation or limited combinations, leading to fragmented insights (Dolnicar *et al.*, 2017; Esfandiar *et al.*, 2019; Han, 2021). Situational aspects such as travel companions and the duration of stay are often overlooked or studied in isolation (Gabarda-Mallorqui *et al.*, 2021), yet this research emphasizes their critical role in shaping PEB. Similarly, the study underscores the effect of destination characteristics, such as environmental policies, infrastructure, and natural features, which interact with individual behaviors to either enable or constrain pro-environmental actions. Lastly, the study brings renewed attention to the importance of perceived effectiveness, a psychological factor that has been underexplored in tourism-specific PEB research (Han, 2021). By highlighting its significance, this study adds a critical dimension to the understanding of how psychological factors drive sustainable behavior, offering actionable insights for stakeholders seeking to promote pro-environmental practices among tourists.

2. Literature review

2.1 Psychological factors and pro-environmental behavior

Environmental awareness, which encompasses people's concern for and understanding of how their actions affect the environment, is essential for tackling environmental challenges. Elevated environmental awareness frequently results in sustainable actions, whereas a deficiency in awareness can lead to apathy and minimal changes in behavior. Studies have shown a positive relationship between awareness and behavior among various groups, such as students, citizens, and companies (Zhang *et al.*, 2014). However, some studies suggest that

increased awareness does not necessarily result in changes in behavior. In tourism, studies generally indicated a positive correlation, suggesting that tourists with higher environmental awareness are more likely to engage in sustainable practices (Zheng *et al.*, 2018). Considering its pronounced impact, the following hypothesis was proposed:

H1a. Environmental awareness is positively associated with pro-environmental behavior.

Environmental attitudes (EA), which refer to individuals' value judgments about environmental conservation, are a significant predictor of pro-environmental behavior. Research in environmental psychology continuously reveals a positive link between environmental attitudes and pro-environmental behavior (Wyss *et al.*, 2022). Nevertheless, some studies indicated a contradiction between EA and concrete behavior, attributed to inconsistent measurement frameworks (Redondo and Puelles, 2016). Additionally, some reviews highlighted a weak relationship between environmental attitude and behavior. Research in tourism pointed out that tourists with positive environmental attitudes are more inclined to participate in eco-friendly activities and opt for sustainable alternatives (Lopez-Bonilla *et al.*, 2018). This highlights the practical significance of EAs in encouraging sustainable tourism practices, so the following hypothesis was set:

H1b. Environmental attitude is positively associated with pro-environmental behavior.

Studies consistently show that higher levels of environmental knowledge correlate with increased pro-environmental behavior, suggesting that individuals who are well-informed about environmental issues are more likely to engage in actions that benefit the environment (Zheng *et al.*, 2023). However, this relationship is not straightforward, as knowledge alone does not always translate into behavior. In tourism, research indicates that a higher level of environmental knowledge among tourists is often correlated with more sustainable practices and behaviors (Kim and Stepchenkova, 2020). However, the extent of this relationship can vary depending on factors such as personal values and the perceived efficacy of individual actions (Fatima *et al.*, 2016). Despite these variations, the consensus within the literature suggests that increasing environmental knowledge is a critical component in promoting sustainable tourism, so the next hypothesis was suggested:

H1c. Environmental knowledge is positively associated with pro-environmental behavior.

Eco-guilt arises when individuals feel remorse for their contribution to environmental harm, while eco-shame involves a sense of failure or inadequacy in meeting environmental standards (Nielsen *et al.*, 2024). In tourism, researchers have found that tourists who experience higher levels of eco-guilt are more likely to engage in sustainable practices, while eco-shame has been linked to increased efforts to offset carbon footprints and to choose eco-friendly accommodations (Mkono and Hughes, 2020). On the other side, the predictive power of these emotions is not universally consistent. Some studies indicate that while eco-guilt can motivate immediate behavioral changes, its long-term impact may diminish without supportive structural changes or ongoing reinforcement (Bahja and Hancer, 2021). In contrast, eco-shame, though powerful, can sometimes lead to avoidance behaviors or denial, thus reducing its effectiveness as a predictor of sustained eco-friendly actions (Mkono and Hughes, 2020). Considering all of this, the next hypothesis was set:

H1d. Eco-guilt and eco-shame are positively associated with pro-environmental behavior.

The connection between perceived behavioral control, which includes self-efficacy and control beliefs, and pro-environmental behavior has been widely researched, especially in the context of tourism. Self-efficacy, which refers to one's confidence in their capacity to accomplish certain behaviors, and control beliefs, which encompass the apparent simplicity or challenge of carrying out those behaviors, are crucial in influencing whether tourists engage in sustainable practices (Wang *et al.*, 2023). Numerous studies emphasize that higher self-efficacy is positively associated with a greater tendency to engage in pro-environmental

behaviors (Shahzalal and Font, 2017). For example, Yuxiang *et al.* (2024) concluded that tourists with high self-efficacy were more likely to select eco-friendly accommodations. The next hypothesis was put forth:

H1e. Perceived behavioral control is positively associated with pro-environmental behavior.

Personal norms are rooted in a sense of moral duty and self-identity and these norms ensure that behavior aligns with personal values and identity, marking them as highly effective motivators (de Groot *et al.*, 2021). In the tourism sector, personal norms are especially impactful. Budovska *et al.* (2020) found that tourists' intentions to reuse towels and conserve water during their stay in a hotel, were greatly influenced by personal norms. However, Han *et al.* (2018) found that although personal norms do influence pro-environmental behaviors, their effect can be reduced due to impact of perceived behavioral control, suggesting that the influence varies based on certain behaviors and conditions. Regardless of this, compared to social norms, personal norms often had a greater effect on pro-environmental behavior in tourism industry (D'Arco *et al.*, 2023). The following hypothesis was set:

H1f. Personal norms are positively associated with pro-environmental behavior.

Social norms, which are behaviors accepted by society, significantly encourage pro-environmental actions by setting expectations for individuals and the community. These norms have demonstrated a subtle yet significant impact on pro-environmental behaviors. Nonetheless, the effect of social norms is frequently not direct, influenced by personal norms and moral assessments, particularly within the tourism sector (Wang *et al.*, 2023). Studies also pointed out to a lack of consistency, such as social norms occasionally lacking a direct influence on behaviors. In these cases, personal norms and environmental identity play a more significant role (D'Arco *et al.*, 2023). In summary, although social norms significantly predict pro-environmental behavior, their impact is often mediated by personal norms and specific situational factors. Based on this, the next hypothesis is proposed:

H1g. Social norms have no significant correlation with pro-environmental behavior.

Values play a crucial role in shaping pro-environmental behavior, serving to filter or amplify information regarding environmental threats (Lee *et al.*, 2014). In the context of tourism, studies suggest that individuals with strong biospheric and altruistic values are more likely to engage in eco-friendly practices (Kim and Stepchenkova, 2020). These values foster a sense of moral obligation and responsibility towards environmental stewardship, which translates into concrete actions during travel. Additionally, the tourism industry's efforts to promote sustainable practices, through certifications, eco-labels, and awareness campaigns, resonate more with value-driven consumers, enhancing their willingness to pay a premium for green services (Davari *et al.*, 2024). Overall, the following hypothesis was put forth:

H1h. Values are positively associated with pro-environmental behavior.

2.2 Demographic factors and pro-environmental behavior

A comprehensive body of research has explored the impact of sociodemographic factors on pro-environmental behavior, yielding varied and sometimes conflicting results. In general, studies indicate that certain demographic variables such as gender, age, and education significantly influence environmentally-friendly behaviors, while the impact of income remains contentious. For example, Patel *et al.* (2017) highlighted the roles of gender, age, and education in fostering pro-environmental behavior, noting that income did not show a similar effect. This finding aligns with Sanchez *et al.* (2016), who found that higher-educated and older women are more likely to engage in such behaviors. However, Kwon and Ahn (2021) discovered that income negatively impacts green usage behavior and has a positive but statistically insignificant relationship with green purchasing behavior. When examining the

specific context of tourism, similar patterns and inconsistencies emerge. Studies generally agree that women tend to be more environmentally friendly than men, as noted by Lopez-Bonilla *et al.* (2020). Moreover, education regularly had a positive influence on pro-environmental behavior, as shown by Wang *et al.* (2023). Since this heterogeneity warrants further investigation, particularly within the tourism sector, to understand better and predict pro-environmental behaviors across different demographic groups, the following hypothesis was proposed:

H2a,b,c. Gender, age and education are positively associated with pro-environmental behavior.

H2d. Income has no significant correlation with pro-environmental behavior.

2.3 Situational factors and pro-environmental behavior

Several studies suggest that longer stays are positively correlated with more sustainable behaviors, positing that extended exposure to a destination fosters a deeper connection to the local environment and culture, thereby encouraging tourists to adopt and practice eco-friendly habits (Dolnicar *et al.*, 2017). Conversely, some research indicates that short-term visitors, often constrained by time, may prioritize convenience over sustainability, engaging less in pro-environmental behaviors (Gomes de Menezes *et al.*, 2008). Additionally, Ballantyne *et al.* (2011) highlight that short-term tourists often perceive limited opportunities to engage with sustainable activities, which may lead to lower participation in eco-friendly behaviors. On the other hand, Deale *et al.* (2020) argue that the availability of quick and accessible eco-options, such as pre-arranged recycling bins or water-saving programs in accommodations, can mitigate the time constraints of short-term stays and encourage sustainable practices regardless of trip length. Based on the presented, the next hypothesis was set:

H3a. The duration of stay is positively associated with pro-environmental behavior.

The influence of travel companions, including family, friends, or travel groups, on pro-environmental tourist behavior is a multifaceted area of study that highlights the social dimensions of sustainable tourism. Chen *et al.* (2016) found that family members exert a strong influence by fostering a collective sense of responsibility. For instance, parents traveling with children are more likely to adopt sustainable practices to model eco-friendly behavior for the younger generation. Friends, on the other hand, can influence pro-environmental behavior through peer pressure and social norms. Travelers are more inclined to adopt green practices to align with their friends' expectations and to maintain social cohesion within the group. Similarly, D'Arco *et al.* (2023) emphasize that shared values and a common environmental ethic among group members can significantly increase the likelihood of adopting eco-friendly behaviors. This underscores the importance of travel companions in reinforcing social and normative pressures that drive sustainable actions. The following hypothesis was proposed:

H3b. Travel companions are positively associated with pro-environmental behavior.

Studies suggest that stringent environmental policies and practices at a destination play a crucial role in fostering environmentally responsible behavior among tourists. For instance, destinations that implement robust waste management systems and promote the use of renewable energy are more likely to attract tourists who are conscious of their environmental impact and willing to engage in sustainable practices (Han *et al.*, 2018). Additionally, the natural features of a destination, such as pristine beaches can also enhance tourists' appreciation of the environment, encouraging them to adopt pro-environmental behaviors to preserve these attributes (Escario *et al.*, 2020). Han *et al.* (2018) found that tourists are more likely to align their behaviors with local environmental policies when destination authorities actively involve them in sustainability practices, such as participatory conservation efforts or

workshops on waste reduction. These findings highlight the critical role of destination characteristics in creating an environment conducive to sustainable tourism.

H3c. Destination characteristics (environmental policies, practices, and natural features of the destination) are positively associated with pro-environmental behavior.

2.4 Behavioral factors and pro-environmental behavior

Studies such as those by Loureiro *et al.* (2022) and Foroughi *et al.* (2022) indicate that individuals who have previously engaged in sustainable behaviors are more likely to exhibit pro-environmental intentions and actions while traveling. This correlation can be attributed to the formation of habits and the establishment of a personal identity that aligns with environmental values. According to Ajzen's Theory of Planned Behavior, past behavior serves as a crucial predictor of future behavior due to the development of perceived behavioral control and subjective norms around sustainability practices. Furthermore, research by Ardoin *et al.* (2015) suggests that past experiences in environmental actions not only reinforce personal commitment but also enhance awareness and knowledge, thereby facilitating more informed and conscientious decisions as tourists. Based on this, the next hypothesis was set:

H4a. Past behavior is positively associated with pro-environmental behavior.

Numerous studies highlight the crucial role of outcome expectations (individuals' beliefs about the positive and negative consequences of engaging in environmentally-friendly practices) in pro-environmental tourist behavior, showing that tourists are more likely to engage in eco-friendly practices when they believe these actions will yield positive benefits. Conversely, negative outcome expectations, like perceiving eco-friendly behaviors as inconvenient, costly, or ineffective, can deter individuals from acting pro-environmentally (Han, 2021). Overall, fostering positive outcome expectations appears to be a crucial strategy in encouraging environmentally responsible behavior among tourists, so the following hypothesis was proposed:

H4b. Outcome expectations are positively associated with pro-environmental behavior.

Perceived effectiveness, or the belief that individual actions can significantly impact environmental conservation, plays a pivotal role in motivating tourists to engage in environmentally friendly practices. Studies have shown that when tourists believe their actions, such as reducing waste or conserving water can positively affect the environment, they are more likely to adopt and sustain these behaviors (Han, 2021; Han *et al.*, 2018). However, barriers such as lack of knowledge can hinder this relationship, indicating the need for comprehensive strategies to educate and facilitate tourists' pro-environmental actions (Escario *et al.*, 2020). Overall, fostering a strong sense of perceived effectiveness among tourists is essential for promoting sustainable tourism and achieving broader environmental conservation goals. Because of the, the next hypothesis was put:

H4c. Perceived effectiveness is positively associated with pro-environmental behavior.

2.5 Contextual factors

Studies show that tourists are more likely to adopt eco-friendly behaviors when destinations offer green accommodations and efficient public transport (Candido *et al.*, 2024; Wang *et al.*, 2023). Destinations emphasizing sustainable infrastructure attract environmentally conscious tourists, creating a cycle of demand and supply for green practices (Kim *et al.*, 2021). Destinations with green spaces and eco-friendly facilities also attract nature-focused tourists, fostering a stronger connection to environmental conservation (Lee *et al.*, 2014). However, some limitations exist. Green certifications may not guarantee higher tourist engagement, as they are sometimes perceived as costly or less luxurious (Miller *et al.*, 2014). In addition, the

visibility of sustainable infrastructure alone is often insufficient, with many tourists unaware of proper use, limiting effectiveness. Furthermore, green infrastructure may primarily appeal to eco-conscious travelers, leaving broader tourist populations less engaged. Based on this, the next hypothesis was proposed:

H5a. The availability of sustainable infrastructure and facilities is positively associated with pro-environmental behavior.

Mandating environmental standards creates a structured environment encouraging sustainable practices. Incentives like tax breaks for eco-friendly accommodations further influence tourist choices (Escario *et al.*, 2020; Han *et al.*, 2018). Enforcement mechanisms, such as fines or penalties, reduce unsustainable behaviors, as seen in conservation tourism studies (Hu *et al.*, 2018). However, overly strict regulations can face resistance, with tourists viewing them as punitive rather than supportive. Additionally, weak enforcement prioritizing economic growth over conservation may undermine sustainability efforts. Policies relying solely on mandates without fostering intrinsic motivation often see limited long-term success (Lee *et al.*, 2014).

H5b. Government policies and regulations are positively associated with pro-environmental behavior.

Studies show that financial incentives effectively encourage sustainable tourism behaviors by motivating tourists to adopt eco-friendly practices, such as offering discounts on accommodations, transportation, or entrance fees for responsible actions (Hu *et al.*, 2018). However, these incentives have a lasting impact only when paired with intrinsic motivation and environmental education (Loureiro *et al.*, 2022). Dynamic pricing strategies and bundled green services, also promote sustainable choices while addressing issues like over-tourism (Dolnicar *et al.*, 2017). Despite their benefits, financial incentives may have drawbacks. External rewards can undermine intrinsic motivation, leading to behavior dependent on continued incentives ("crowding-out effect"). Additionally, such strategies may attract price-sensitive but less environmentally committed tourists, resulting in superficial compliance (Dolnicar *et al.*, 2017). Continuous reliance on incentives can also strain resources, limiting economic benefits.

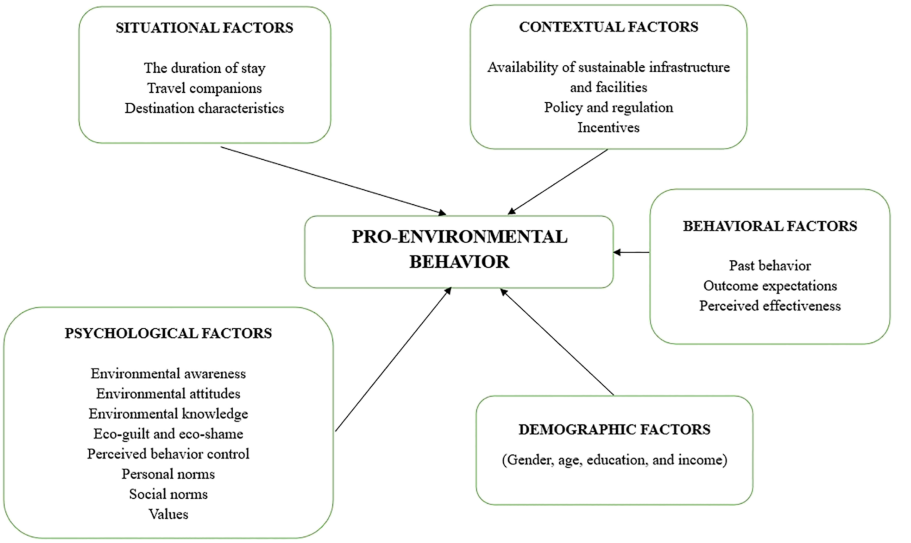
H5c. Incentives are positively associated with pro-environmental behavior.

The structure of the proposed model is illustrated in Figure 1.

3. Method

3.1 Sample and data collection

The study employed a stratified random sampling method to ensure a representative and diverse sample of tourists visiting Serbia. The stratification criteria included key tourist demographics and characteristics such as geographical origin (domestic and international tourists), destination type (natural, cultural, and urban), and tourist type (leisure and business travelers). The target population comprised tourists visiting major destinations across Serbia, including national parks, cultural heritage sites, and urban centers. Data were collected between May and September 2023 using an online survey distributed through email lists provided by accommodation providers, who served as intermediaries in reaching their guests. The survey was conducted in both English and Serbian to accommodate the linguistic diversity of the respondents. Participants were randomly selected within each stratum to minimize selection bias and ensure proportional representation. This stratified approach was chosen to capture variability in pro-environmental behavior across diverse tourist profiles and destination contexts, thereby enhancing the robustness and generalizability of the study findings. The final sample consisted of 824 tourists, with an approximately equal gender distribution (51.6% female, 48.4% male) and a broad age range (18–75 years, with a mean age



Source(s): The authors

Figure 1. The proposed model with all variables

of 35.4 years). The sample was predominantly composed of individuals with higher education, with 40.2% holding a bachelor's degree, reflecting a relatively well-educated tourist population. The majority of the respondents fell within the middle-income bracket, accounting for nearly 39% of the sample, while upper-middle income reported 28.5% respondents.

3.2 Measures

This study employs a variety of established instruments and scales designed to measure the multifaceted factors identified as critical to this exploration. In Table 1 is presented descriptive statistics for all variables.

Psychological factors: Environmental awareness was assessed using the New Ecological Paradigm Scale (Dunlap *et al.*, 2000), with a sample item: "If things continue on their present course, we will soon experience a major ecological catastrophe". Environmental attitude was gauged using the Environmental Attitudes Inventory proposed by Milfont and Duckitt (2010), with a sample item: "Protecting the environment is more important than economic growth". Environmental knowledge was measured through a series of multiple-choice questions adapted from the 19-Item Environmental Knowledge Test (EKT-19), using a sample item "I know action that could mitigate negative impacts on natural environments of the destination". The Eco-Guilt and Eco-Shame Scales (Jackson *et al.*, 2016) were utilized, capturing the emotional responses associated with environmentally harmful behaviors, with a sample item: "The more I know about the human causes of climate change, the more things I feel guilty about". Perceived behavioral control was assessed using a scale adapted from Ajzen's Theory of Planned Behavior (Fishbein and Ajzen, 2010), with a sample item "I would find it easy to integrate environmentally sustainable habits into my travel plans". Personal norms were measured using items adapted from the Schwartz's Norm Activation Model, with a sample item "I know that avoiding non-eco-friendly accommodations (e.g. those that waste water and energy) is important to protect the environment", while social norms were captured using a scale that assesses the perceived social pressure to perform or avoid pro-environmental behaviors. The sample item for this variable was "Most of my friends and family encourage

Table 1. Descriptive statistics for all variables – psychological, situational, behavioral, and contextual factors, and pro-environmental behavior

Variables	Mean	Stand. deviation	Cronbach's α	McDonald's ω	Composite reliability (CR)
Psychological factors			0.86		
Environmental awareness	3.24	0.61	0.74	0.65	0.76
Environmental attitude	3.76	0.73	0.78	0.71	0.82
Environmental knowledge	3.88	0.82	0.81	0.76	0.85
Eco-guilt and eco-shame	3.26	0.80	0.75	0.64	0.77
Perceived behavioral control	3.72	0.72	0.80	0.72	0.86
Personal norms	4.02	0.84	0.87	0.78	0.89
Social norms	3.53	0.74	0.75	0.66	0.79
Values	3.86	0.78	0.81	0.74	0.84
Situational factors			0.87		
The duration of stay	3.91	0.95	0.84	0.82	0.88
Travel companions	4.03	0.84	0.81	0.86	0.87
Destination characteristics	3.84	1.13	0.77	0.78	0.81
Behavioral factors			0.85		
Past behavior	2.79	1.54	0.72	0.54	0.75
Outcome expectations	3.75	1.27	0.79	0.79	0.83
Perceived effectiveness	3.98	0.79	0.86	0.83	0.88
Contextual factors			0.82		
Sustainable infrastructure and facilities	4.01	1.04	0.82	0.84	0.86
Government policies and regulations	3.21	0.96	0.76	0.62	0.78
Incentives	3.66	0.73	0.83	0.79	0.84
Pro-environmental behavior			0.86		

Source(s): The authors

choosing eco-friendly accommodations when traveling". Values were measured using Schwartz's Value Survey, focusing on those values most closely associated with environmental concern (Schwartz, 1992), with a sample item such as "I believe respecting and protecting local ecosystems is a core responsibility of every traveler". Cronbach's α ranged from 0.74 to 0.87, and McDonald's ω ranged from 0.65 to 0.86, indicating acceptable to excellent internal consistency.

Situational factors: The duration of stay was measured using a multi-item scale designed to capture the qualitative aspects of how trip length influences pro-environmental behaviors. Items included statements such as "On shorter trips, I prioritize convenience over sustainability, but I am willing to adopt eco-friendly behaviors if they are simple and quick to implement." Travel companions were assessed through a categorical variable, differentiating between solo travelers, those traveling with family, friends, or as part of a group. The sample item was: "I am more likely to adopt sustainable practices, such as recycling or conserving resources, when traveling with family members who value environmental responsibility". Destination characteristics were measured using a scale adapted from Han (2021), capturing attributes such as natural environment and cultural significance, with a sample item "The presence of unpolluted natural features, such as pristine beaches and diverse wildlife, motivates me to adopt environmentally responsible behaviors to help preserve them". Cronbach's α ranged from 0.77 to 0.87, and McDonald's ω ranged from 0.78 to 0.86, suggesting high reliability.

Behavioral factors: Past behavior was assessed using a self-reported measure of previous engagement in pro-environmental activities during travel, with questions adapted from the General Ecological Behavior scale (Ardoin *et al.*, 2015). A sample item was: "I have reduced

waste while traveling by using reusable water bottles, bags, or utensils". Outcome expectations were measured using a scale that captures the anticipated benefits or consequences of engaging in pro-environmental behaviors, adapted from Bandura's social cognitive theory, with a sample item "I expect that reducing my environmental impact while traveling will contribute to the protection of local ecosystems". Perceived effectiveness was based on previous scales in environmental psychology (Escario *et al.*, 2020), using a sample item "I feel I have gained confidence in planning environmentally responsible trips". Cronbach's α ranged from 0.72 to 0.86, and McDonald's ω ranged from 0.54 to 0.83, with the majority exceeding the 0.70 threshold for reliability.

Contextual factors: Sustainable infrastructure was measured using a scale that captures the availability and quality of environmentally sustainable options at the destination, adapted from the Sustainable Tourism Attitude Scale (Candido *et al.*, 2024), with a sample item "The availability of recycling facilities at a destination encourages me to properly separate my waste". Government policies and regulations were assessed using a scale adapted from previous research in environmental governance, with a sample item "I feel more motivated to adopt sustainable behaviors when local policies integrate cultural preservation with environmental guidelines". Incentives were measured by assessing the availability and attractiveness of incentives, with a sample item "I am more likely to choose eco-friendly accommodations or activities when they offer discounts or financial rewards for sustainable practices". Cronbach's α ranged from 0.76 to 0.83, and McDonald's ω ranged from 0.62 to 0.86, confirming adequate reliability.

Pro-environmental tourism behavior: The final variable was assessed by validated scales developed by Miller *et al.* (2014) measuring tourists' pro-environmental behaviors and focusing on specific actions taken by tourists that contribute to environmental sustainability. The scale includes items related to energy conservation, waste reduction, and support for eco-friendly accommodations and services, with a sample item "I switch lights off when not in use".

3.3 Data analysis

All data analyses were conducted using R, a statistical programming language widely recognized for its robust data analysis capabilities. Descriptive statistics were calculated for all variables to understand the basic characteristics of the sample and the distribution of the data. Next, zero-order bivariate correlations were conducted to explore relationships among the psychological, demographic, situational, behavioral, and contextual variables. These correlations offered insights into potential associations between the predictors and pro-environmental tourism behavior. To further investigate the predictive power of these variables, linear multiple (LM) regression analyses were performed. The models aimed to predict pro-environmental tourism behavior from the identified factors, allowing for the examination of the relative contribution of each predictor. Given the exploratory nature of our study, a multiple regression analysis, rather than separate rounds of simple regression analyses, was conducted. This approach allowed us to simultaneously include all predictor variables, minimizing the risk of Type-1 error inflation associated with multiple individual regressions. Additionally, we employed a genetic algorithm (GA) model to optimize predictor selection systematically, identifying the most significant predictors without redundancy. These methods align with best practices in the literature (Oveido-Garcia, 2016) and provide a robust framework for understanding the relative contributions of predictors to pro-environmental behavior. To validate the regression models and ensure the reliability of the predictor variables, multicollinearity diagnostics were performed. Specifically, a Variance Inflation Factor (VIF) assessment was conducted for all predictors. The VIF values for each variable were well within acceptable limits (i.e. below the threshold of 5), indicating that multicollinearity is not a concern in this dataset. Additionally, all tolerance values exceeded 0.2, further supporting the absence of multicollinearity concerns. To prioritize the predictors by their significance,

relative weights were determined. Additionally, binary genetic algorithms (GAs) were employed to optimize the predictor selection process. This method, as recommended by Gen and Lin (2023), enabled the identification of the most suitable subset of predictors for explaining the variance in pro-environmental tourism behavior. The GA model provided an optimized regression model, which was compared to the full LM model. For both the full LM models and the GA-optimized models, regression weights were calculated for all predictors, and their contribution to the explained variance in pro-environmental tourism behavior was expressed as a percentage of the total variance. This approach allowed for a nuanced understanding of the factors most critical to predicting pro-environmental behavior among tourists.

To ensure the robustness of the data and minimize potential biases, several validation measures were undertaken. Statistically, Harman's single-factor test was conducted to assess the presence of common method variance, and the analysis revealed that the first factor accounted for 27% of the total variance, well below the 50% threshold typically suggested as an indicator of common method bias (Fuller *et al.*, 2016). These findings suggest that common method bias is unlikely to significantly affect the results, thus validating the reliability of the data for further analysis. Next, we evaluated both convergent and discriminant validity. Convergent validity was assessed by examining the factor loadings and the Average Variance Extracted (AVE) for each construct. All item loadings exceeded the recommended threshold of 0.7, indicating that the items adequately converged to measure their respective constructs. Discriminant validity was evaluated using the Fornell-Larcker criterion (Supplementary material 1).

4. Results

4.1 Test of research hypotheses

The Table 2 lists various hypothesized paths that link psychological, demographic, situational, behavioral, and contextual factors to pro-environmental behavior. The path coefficients vary, indicating the strength of each relationship, with personal norms (H1f) showing the strongest effect (0.515) and eco-guilt and eco-shame (H1d) a more moderate effect (0.232). The table highlights that factors such as personal norms (H1f), travel companions (H3b), and perceived effectiveness (H4c) have a notably higher influence on pro-environmental behavior. Additionally, demographic variables like education (H2c) and situational factors such as the duration of stay (H3a) also show significant impacts, though with varying effect sizes. The results confirm that pro-environmental behavior in tourism is influenced by a complex interplay of internal factors like attitudes and norms, external factors such as infrastructure and policies, and contextual factors including past behavior and situational characteristics. This multifaceted approach underlines the importance of considering a wide range of predictors when studying pro-environmental tourism behavior.

4.2 Results from the correlation analysis

Table 3 analyzes the bivariate Pearson correlation between various factors and pro-environmental behavior among tourists, highlighting key relationships. Education (0.17) and age (0.13) show the strongest positive correlations among demographic factors, while gender (0.07) and income (0.06) have weaker links, suggesting limited predictive value. Psychological factors, such as personal norms (0.34) and values (0.17), are strong predictors, emphasizing the role of ethics and standards, alongside perceived behavioral control (0.16) and environmental knowledge (0.14), which reflect the importance of ability and awareness. Contextual factors, including duration of stay (0.24), travel companions (0.30), and destination characteristics (0.28), significantly influence pro-environmental behavior, with sustainable infrastructure (0.20) playing a critical role in supporting eco-friendly actions. Perceived effectiveness (0.26) further highlights the impact of tourists' belief in the effectiveness of their efforts.

Table 2. Hypothesis testing

Hypothesized paths	Path coefficients	*t*-values	*p*-value	Effect size	Decision
H1a: Environmental awareness – pro-environmental behavior	0.226	4.547	0.001	0.028	Supported
H1b: Environmental attitude – pro-environmental behavior	0.357	5.558	0.001	0.043	Supported
H1c: Environmental knowledge – pro-environmental behavior	0.294	5.644	0.001	0.039	Supported
H1d: Eco-guilt and eco-shame – pro-environmental behavior	0.232	4.357	0.001	0.031	Supported
H1e: Perceived behavioral control – pro-environmental behavior	0.375	5.588	0.001	0.036	Supported
H1f: Personal norms – pro-environmental behavior	0.515	6.449	0.001	0.051	Supported
H1g: Social norms – pro-environmental behavior	0.326	4.956	0.06	0.030	Supported
H1h: Values – pro-environmental behavior	0.369	5.676	0.001	0.041	Supported
H2a: Gender – pro-environmental behavior	0.255	4.029	0.001	0.030	Supported
H2b: Age – pro-environmental behavior	0.299	4.247	0.001	0.031	Supported
H2c: Education – pro-environmental behavior	0.387	4.968	0.001	0.39	Supported
H2d: Income – pro-environmental behavior	0.264	3.759	0.08	0.241	Supported
H3a: The duration of stay – pro-environmental behavior	0.480	6.852	0.001	0.055	Supported
H3b: Travel companions – pro-environmental behavior	0.498	6.491	0.001	0.049	Supported
H3c: Destinations characteristics – pro-environmental behavior	0.397	5.996	0.001	0.041	Supported
H4a: Past behavior – pro-environmental behavior	0.421	4.963	0.001	0.396	Supported
H4b: Outcome expectations – pro-environmental behavior	0.484	5.874	0.001	0.428	Supported
H4c: Perceived effectiveness – pro-environmental behavior	0.503	6.965	0.001	0.577	Supported
H5a: Infrastructure and facilities – pro-environmental behavior	0.324	6.788	0.001	0.059	Supported
H5b: Policies and regulations – pro-environmental behavior	0.276	4.369	0.001	0.033	Supported
H5c: Incentives – pro-environmental behavior	0.319	5.783	0.001	0.047	Supported

Source(s): The authors

4.3 Findings from regression analyses

Figure 2 highlights the key predictors of pro-environmental behavior based on the Full and GA models. Personal norms emerge as the strongest positive influence, with relative weights of 22.18% in the Full model and 23.23% in the GA model, emphasizing the importance of moral obligation and personal beliefs. Travel companions and destination characteristics also have significant positive impacts, with weights of 19.49% and 15.16% (Full) and 19.05% and 16.19% (GA), respectively, underlining the role of social context and environmental features. Perceived effectiveness and duration of stay are moderately influential (12–13%), reflecting the impact of perceived benefits and time spent. Values, outcome expectations, and sustainable infrastructure are less critical, while factors like education, environmental attitude, age, and incentives play minor roles.

Table 3. Bivariate Pearson correlation between different factors and outcome variable (pro-environmental behavior)

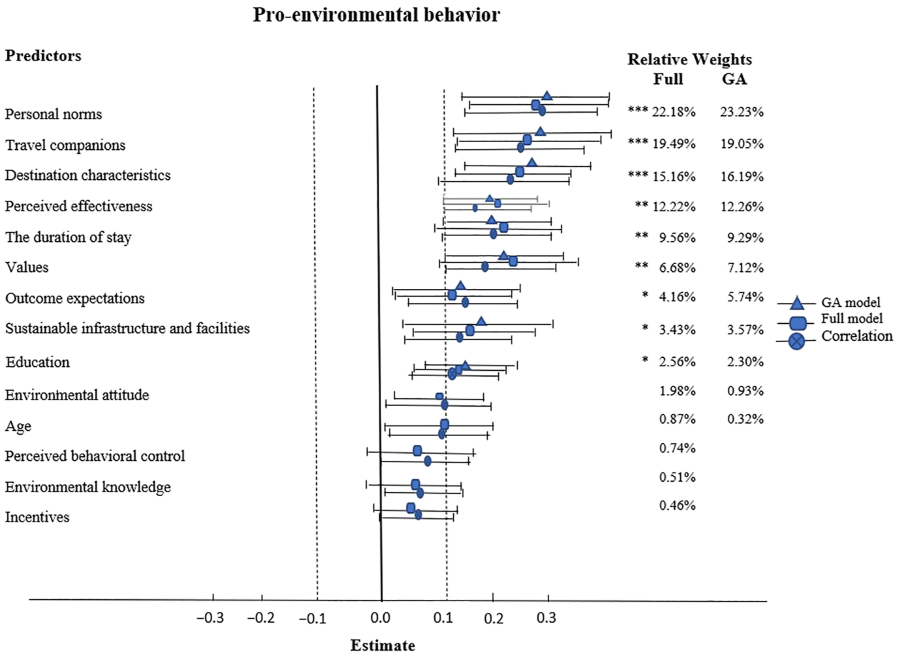
Factors	Pro-environmental behavior – outcome variable
Socio-demographic characteristics	
Gender	0.07
Age	**0.13**
Education	**0.17**
Income	0.06
Psychological factors	
Environmental awareness	0.08
Environmental attitude	**0.11**
Environmental knowledge	**0.14**
Eco-guilt and eco-shame	0.09
Perceived behavioral control	**0.16**
Personal norms	**0.34**
Social norms	0.09
Values	**0.17**
Situational factors	
The duration of stay	**0.24**
Travel companions	**0.30**
Destination characteristics	**0.28**
Behavioral factors	
Past behavior	0.08
Outcome expectations	**0.22**
Perceived effectiveness	**0.26**
Contextual factors	
The availability of sustainable infrastructure and facilities	**0.20**
Government policies and regulations	0.07
Incentives	**0.13**

Note(s): $N = 824$. All correlations that reached values > (0.10) were bolded. Positive correlations were shaded in light grey
Source(s): The authors

5. Discussion and conclusions

5.1 Conclusions

The study found that personal norms, travel companions, and perceived effectiveness were among the strongest predictors of pro-environmental behavior in tourism. Personal norms have been consistently identified as key drivers of pro-environmental behavior, particularly as seen in studies by de Groot *et al.* (2021) and D'Arco *et al.* (2023). The strong influence of travel companions noted in this study aligns with previous research, such as Chen *et al.* (2016), who demonstrated that family members exert a strong influence on individual behaviors by fostering a collective sense of environmental stewardship, particularly during activities such as hiking or visiting national parks. The positive association between perceived behavioral control and pro-environmental behavior is consistent with the findings of Shahzalal and Font (2017), who emphasized that self-efficacy plays a crucial role in sustainable practices. However, the current study's results suggest a somewhat stronger effect than those found in Wang *et al.* (2023), who noted that situational factors often overshadow the role of self-efficacy. Interestingly, while environmental awareness, attitudes, and knowledge were positively associated with pro-environmental behavior, their effects were less pronounced compared to personal norms and perceived effectiveness. The study also reveals the influence of situational factors, such as the duration of stay and destination characteristics, on pro-



Source(s): The authors

Figure 2. Predictors of pro-environmental behavior

environmental behavior, reinforcing the findings of Dolnicar *et al.* (2017) that longer stays can foster a deeper connection and commitment to sustainable practices. However, unlike some studies that found a minimal effect of short stays, this study suggests that even shorter durations can be impactful when paired with strong pro-environmental norms or effective destination management. The findings of this study highlight the significant role that destination characteristics play in promoting pro-environmental behaviors among tourists. These findings align with the work of Lee *et al.* (2014) who observed that natural destinations with pristine landscapes and biodiversity evoke an emotional connection that drives tourists to protect and preserve the environment. Also, the finding mirrors the results of Escario *et al.* (2020), who found that visible environmental commitments, such as eco-certifications and green labeling, enhance tourists' sense of efficacy and align their behaviors with sustainable goals.

This study underscores the pivotal role that sustainable infrastructure and facilities play in encouraging pro-environmental behaviors among tourists. Tourists visiting destinations equipped with eco-friendly accommodations, efficient public transportation, and accessible recycling facilities are significantly more likely to adopt sustainable practices. The availability of such infrastructure not only lowers the barriers to eco-friendly behavior but also enhances tourists' perception of the destination's commitment to sustainability. These findings are consistent with the work of Kim *et al.* (2021) who found that destinations offering robust public transportation options reduce tourists' reliance on private vehicles, thereby minimizing their environmental footprint. In contrast, research by Dolnicar *et al.* (2017) suggests that the mere availability of infrastructure is not always sufficient; its effectiveness depends on how well it integrates with the overall tourism experience. Regarding demographic factors, the study found that age, education, and gender positively influence pro-environmental behavior, which is in line with Sanchez *et al.* (2016) and Patel *et al.* (2017), suggesting that older,

educated women are more likely to engage in such behaviors. However, the impact of income was found to be inconsistent, mirroring the mixed results reported by Kwon and Ahn (2021).

5.2 Theoretical implications

This research supports the theoretical frameworks that emphasize the role of personal norms, perceived behavioral control, and perceived effectiveness in shaping pro-environmental behavior, particularly within tourism contexts. The findings reinforce the Norm Activation Model and the Theory of Planned Behavior, highlighting that internalized personal norms and the belief in one's capability to influence environmental outcomes are critical drivers of sustainable behavior among tourists. Moreover, this study contributes to the literature by demonstrating the significant influence of situational factors such as the duration of stay and travel companions, thereby enriching our understanding of how social and environmental contexts interact with individual psychological determinants. By incorporating a diverse range of predictors, including demographic and contextual elements, this study presents a comprehensive model that captures the multifaceted nature of pro-environmental behavior in tourism. This integrated approach challenges previous assumptions that primarily focus on individual factors and underscores the necessity of considering broader contextual influences. Consequently, the study provides a nuanced perspective that can inform the development of more targeted and effective interventions aimed at promoting sustainable tourism practices. These insights suggest that future theoretical models should account for the complex interplay between individual motivations and situational dynamics, advancing the predictive power and applicability of theories related to pro-environmental behavior.

5.3 Practical implications

To enhance impact of personal norms, tourism stakeholders can develop targeted communication strategies that reinforce tourists' self-identity as environmentally responsible individuals. This can be achieved by creating campaigns that emphasize the personal benefits and ethical significance of sustainable behaviors. For instance, personalized messages in accommodations highlighting guests' contributions to conservation efforts can reinforce these norms. To leverage the influence of travel companions, tourism operators can design group-based eco-friendly activities that foster a collective sense of responsibility. For example, offering discounts for families or groups that participate in sustainable activities, such as guided eco-tours or community service projects, can enhance group cohesion around pro-environmental norms. Destinations should focus on implementing and promoting robust environmental management systems, such as comprehensive recycling programs, the use of renewable energy, and conservation initiatives. To enhance perceived effectiveness, tourism providers should offer clear, quantifiable feedback on the outcomes of sustainable actions, such as energy saved or waste reduced. Digital platforms, like apps or social media, can be utilized to provide real-time updates on how collective tourist actions are making a difference. Additionally, providing options that make sustainable actions easier, such as accessible recycling bins or water-saving devices, can reinforce tourists' sense of efficacy and encourage continued engagement in eco-friendly practices. The length of a tourist's stay positively correlates with pro-environmental behavior, so tourism operators can develop programs that reward longer stays with eco-friendly incentives, such as discounts on sustainable tours or extended access to nature reserves. Additionally, integrating educational components that progressively engage tourists in sustainability over time, such as multi-day conservation workshops or citizen science projects, can further deepen their commitment to pro-environmental practices.

5.4 Limitations and future research

The current research is not without limitations; however, these limitations present valuable opportunities for future studies. The cultural and environmental attitudes specific to Serbia

might not fully represent the diversity of global tourist behaviors, suggesting that results may vary significantly in different regions or among tourists with different cultural backgrounds. Future research should consider expanding the geographical scope to include diverse tourist destinations across different cultural and environmental settings. Further, a cross-sectional design was employed in the study, capturing a snapshot of tourist behaviors at a single point in time. This approach limits the ability to draw causal inferences about the relationships between predictors and pro-environmental behaviors. Longitudinal studies would be better suited to understand the changes in behavior over time and establish causality. Also, while the study identifies key predictors of pro-environmental behavior, it does not extensively explore potential moderating variables such as cultural context or economic status. Understanding these moderators could provide a more nuanced view of the factors that enhance or diminish pro-environmental behavior among tourists. Although only factors that promote pro-environmental actions were included, future research should also consider the barriers that hinder such behaviors. Understanding obstacles such as perceived inconvenience, cost, or lack of facilities can inform strategies to overcome these challenges and enhance sustainable tourism. By addressing these limitations and following these guides, future research can build a more comprehensive understanding of pro-environmental behaviors in tourism.

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Table A1. Discriminant validity

Construct	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1. Environmental awareness	*0.85*	0.52	0.38	0.44	0.35	0.30	0.28	0.32	0.25	0.33	0.29	0.31	0.34	0.27	0.29	0.30	0.36	0.28
2. Environmental attitude	0.42	*0.88*	0.45	0.40	0.39	0.35	0.33	0.46	0.30	0.28	0.31	0.27	0.34	0.36	0.32	0.33	0.38	0.29
3. Environmental knowledge	0.38	0.45	*0.83*	0.48	0.39	0.36	0.40	0.30	0.33	0.32	0.31	0.34	0.35	0.28	0.30	0.30	0.33	0.27
4. Eco-guilt and eco-shame	0.40	0.40	0.48	*0.87*	0.41	0.34	0.36	0.31	0.35	0.34	0.37	0.33	0.42	0.38	0.29	0.29	0.30	0.28
5. Perceived behavioral control	0.35	0.39	0.39	0.41	*0.81*	0.38	0.40	0.33	0.31	0.36	0.34	0.30	0.37	0.32	0.55	0.33	0.38	0.34
6. Personal norms	0.30	0.35	0.36	0.34	0.38	*0.84*	0.37	0.39	0.33	0.34	0.35	0.36	0.34	0.32	0.36	0.35	0.37	0.33
7. Social norms	0.28	0.33	0.40	0.36	0.40	0.37	*0.80*	0.34	0.35	0.33	0.36	0.31	0.34	0.33	0.30	0.32	0.34	0.29
8. Values	0.40	0.41	0.28	0.37	0.51	0.42	0.30	*0.84*	0.27	0.46	0.29	0.41	0.45	0.37	0.51	0.29	0.44	0.34
9. The duration of stay	0.32	0.52	0.39	0.55	0.44	0.29	0.36	0.38	*0.85*	0.28	0.44	0.40	0.32	0.46	0.45	0.36	0.52	0.51
10. Travel companions	0.46	0.40	0.32	0.42	0.29	0.41	0.32	0.30	0.55	*0.81*	0.30	0.28	0.51	0.44	0.39	0.38	0.37	0.40
11. Destination characteristics	0.52	0.29	0.41	0.52	0.55	0.39	0.42	0.40	0.28	0.40	*0.83*	0.38	0.40	0.36	0.41	0.46	0.32	0.41
12. Past behavior	0.51	0.38	0.29	0.40	0.38	0.28	0.27	0.29	0.32	0.29	0.41	*0.86*	0.55	0.34	0.45	0.42	0.36	0.37
13. Outcome expectations	0.39	0.44	0.28	0.51	0.45	0.32	0.41	0.52	0.42	0.29	0.39	0.46	*0.81*	0.37	0.44	0.27	0.40	0.51
14. Perceived effectiveness	0.36	0.28	0.38	0.41	0.44	0.36	0.51	0.37	0.42	0.36	0.30	0.38	0.40	*0.80*	0.29	0.38	0.39	0.34
15. Infrastructure and facilities	0.45	0.52	0.39	0.28	0.37	0.46	0.41	0.38	0.44	0.42	0.40	0.55	0.32	0.30	*0.84*	0.41	0.30	0.44
16. Policies and regulations	0.40	0.37	0.51	0.40	0.36	0.55	0.32	0.28	0.41	0.51	0.46	0.39	0.34	0.36	0.42	*0.81*	0.45	0.36
17. Incentives	0.37	0.29	0.30	0.34	0.37	0.52	0.45	0.38	0.38	0.55	0.28	0.41	0.42	0.30	0.46	0.27	*0.84*	0.29
18. Pro-environmental behavior	0.51	0.40	0.52	0.36	0.32	0.42	0.39	0.41	0.51	0.44	0.40	0.52	0.37	0.36	0.32	0.28	0.46	*0.81*

Note(s): Diagonals (in italic) presents the square root of the Average Variance Extracted (AVE) while the off-diagonals present the correlations
Source(s): The authors