Environment and Social Psychology (2025) Volume 10 Issue 7 ISSN: 2424-8975 (O)
doi: 10.59429/esp.v10i7.3898 2424-7979 (P)

RESEARCH ARTICLE

Green mindfulness, self-efficacy, and environmental awareness in tourism and hospitality businesses: unveiling the pathways to pro-environmental behavior

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ABSTRACT

This study investigates the role of green mindfulness in shaping pro-environmental behavior among employees in the tourism and hospitality sector. Drawing on social cognitive theory, it explores the mediating role of green self-efficacy and the moderating effect of environmental awareness. Data were collected from 412 full-time employees working in five-star hotels and category-A travel agencies in Greater Cairo, Egypt. Using PLS-SEM via WarpPLS 7.0, the findings reveal that green mindfulness positively influences both green self-efficacy and pro-environmental behavior. Green self-efficacy, in turn, significantly enhances pro-environmental behavior and mediates the relationship between mindfulness and behavior. Furthermore, environmental awareness strengthens the positive effect of green mindfulness on self-efficacy. The study highlights the importance of fostering mindfulness and environmental cognition to promote sustainable employee behavior in hospitality contexts.

Keywords: Green Mindfulness, Green Self-Efficacy, Environmental Awareness, Pro-Environmental Behavior, Tourism and Hospitality Businesses.

1. Introduction

In response to escalating global environmental challenges, green mindfulness has emerged as a focal point of both theoretical and practical interest [1]. Green mindfulness integrates the core principles of traditional mindfulness with an active awareness of environmental processes [2]. It involves being fully present and meaningfully engaged with nature, enabling a deeper attunement with the natural world [3]. This stems from the understanding that human health is closely linked to environmental well-being. While relatively new in its "green" application, the concept traces its roots to Buddhist philosophy over 25 centuries

ARTICLE INFO
Received: 13 June 2025 | Accepted: 11 July 2025 | Available online: 22 July 2025

CITATION
Salama WME, Khairy HA,Mansour AA,etc. Green mindfulness, self-efficacy, and environmental awareness in tourism and hospitality businesses: unveiling the pathways to pro-environmental behavior. *Environment and Social Psychology* 2025; 10(7): 3898. doi:10.59429/esp.v10i7.3898

ago and gained popularity in psychology [4].

In an era characterized by growing environmental vulnerability and an urgent global demand for sustainability, organizations across all sectors are increasingly recognizing their role in promoting environmentally responsible practices [4]. Transitioning toward a green economy requires not only technological innovations and policy reform but also meaningful behavioral and cultural change at the individual and organizational levels [5]. This study explores the psychological mechanisms that influence employee engagement in pro-environmental work behavior, emphasizing the interplay between internal dispositions and perceived capabilities [6].

Green mindfulness can be understood as a set of internal values, attitudes, and awareness related to environmental protection and sustainability—an ecologically oriented mindset. Environmental awareness refers to an individual's knowledge of environmental issues, their causes, and potential solutions [7]. It includes a conscious recognition of one's impact on the environment. Green self-efficacy reflects employees' confidence in their ability to carry out actions that support sustainability and contribute to organizational environmental goals [3]. Pro-environmental work behavior includes any voluntary workplace actions that support resource conservation, waste reduction, and advocacy for green initiatives [8].

Despite growing scholarly interest, several research gaps remain unaddressed. First, most existing studies have examined environmental behavior from either a behavioral or attitudinal perspective. Few have empirically explored green mindfulness as a mediating psychological construct linking leadership practices to environmental outcomes [9]. Second, limited research has investigated how green mindfulness interacts with sustainable leadership and long-term sustainability outcomes in service industries like hospitality and tourism, where ecological challenges and stakeholder pressures are high [1]. Moreover, the scalability of green mindfulness as both an individual and organizational practice remains insufficiently theorized and empirically tested [3].

Although individual constructs have been widely studied, the interrelationships among them within organizational contexts are underexplored. This highlights the need for a deeper examination of:

- The direct relationship between green mindfulness and pro-environmental behavior: While broadly assumed, empirical studies confirming this link are only emerging.
- The moderating role of environmental awareness: This requires further exploration to clarify how it influences the relationship between green mindfulness and green self-efficacy, with implications for behavioral interventions.
- The mediating role of green self-efficacy in translating green mindfulness into workplace PEWB.

The study is grounded in Social Cognitive Theory, which posits that behavior results from dynamic interactions between personal, behavioral, and environmental factors. This theoretical framework enables a comprehensive understanding of the psychological drivers behind employee engagement in environmentally responsible actions, thus offering organizations practical tools to cultivate sustainable and ecologically aware workforces.

2. Literature review and hypotheses development

2.1. Green mindfulness

Green mindfulness is a practice that integrates the principles of mindfulness with a deep and holistic appreciation of the natural environment [10]. It involves being fully present and engaged in one's natural surroundings, fostering a sense of connection and harmony with nature. This awareness stems from the

recognition that personal well-being is intrinsically linked to the health of the surrounding environment [3]. Thus, green mindfulness can be defined as a state of conscious awareness in which individuals actively attend to both the context and content of environmental information, contributing to sustainable thought and action.

Green mindfulness includes a heightened awareness of thoughts, emotions, and physical sensations as they relate to the natural world—experienced in the present moment and free from distraction [11,12]. It emphasizes non-judgment, allowing individuals to observe their environmental experiences without bias, cultivating acceptance and compassion toward both oneself and nature [5].

Cognitively, green mindfulness encompasses the processing and understanding of environmental information. Behaviorally, it is reflected in a willingness to explore multiple perspectives, move beyond narrow operational concerns, and engage in thoughtful, responsible action to address environmental challenges. In this way, green mindfulness promotes both awareness and agency in environmental stewardship [4].

2.2. Green self-efficacy

Green self-efficacy is an extension of the concept of self-efficacy introduced by Albert Bandura, which refers to an individual's belief in their ability to perform specific actions and achieve desired outcomes [11]. It reflects a person's conviction that they possess the necessary skills and capabilities to influence environmental outcomes and exercise control over their ecological impact. This belief plays a critical role in shaping behavior, as it determines whether individuals will engage in challenging tasks, the level of effort they will invest, and their persistence in the face of obstacles [12].

A strong sense of self-efficacy motivates individuals to persevere, adapt, and overcome barriers. It fosters resilience, enabling them to view setbacks as learning opportunities rather than insurmountable failures [13,14]. While self-efficacy has been widely studied in domains such as academic achievement and career development, its application to environmental behavior—particularly in promoting sustainable practices—has become increasingly prominent in recent research discourse [15].

2.3. Environmental awareness

Environmental awareness refers to an individual's knowledge and understanding of the natural environment and its interconnectedness with human society—particularly regarding environmental issues, their causes, and potential solutions [16]. It encompasses a conscious appreciation of ecological systems and a commitment to behaviors that promote sustainability and minimize environmental harm [17]. This awareness plays a vital role in shaping responsible attitudes toward conservation and encouraging the adoption of eco-friendly practices across sectors. Recent scholarship underscores its increasing relevance in fostering both individual and collective efforts toward sustainable development [14].

In the context of tourism and hospitality, environmental awareness is becoming increasingly significant, triggering a shift toward sustainable operations and green initiatives. This awareness not only informs employee behavior but also shapes consumer preferences—studies indicate that environmental concern significantly influences guests' intentions to stay in eco-certified accommodations [13]. Given the hospitality industry's intensive use of resources and high waste output, the need for environmentally responsible practices is particularly urgent [18]. Businesses in this sector must therefore align their strategies with rising environmental consciousness to meet consumer expectations while advancing sustainability goals [11].

2.4. Pro-Environmental work behavior (PEWB)

Pro-environmental work behavior (PEWB) refers to actions individuals take with the intention of minimizing the negative impact of human activity on the natural environment—or contributing positively to its protection [19]. These behaviors range from everyday practices such as recycling and conserving energy to more strategic actions like advocating for environmental policies or making eco-conscious consumer choices [20,21]. Promoting PEWB is increasingly recognized as essential to tackling urgent global environmental challenges, given the significant role that both individual and collective behaviors play in either exacerbating or mitigating environmental degradation [17].

Recent research highlights the multifaceted nature of PEWB, pointing to a complex interplay between psychological, social, and contextual factors that shape an individual's willingness and ability to engage in environmentally responsible behaviors [22]. Accordingly, effective promotion of PEWB requires integrated strategies that consider these multiple dimensions to foster lasting environmental commitment.

2.5. Hypotheses development

2.5.1. Underpinning theory

Social Cognitive Theory (SCT), mostly formulated by Albert Bandura, forms one of the most important psychological perspectives that describes human behavior as the effect of a dynamic interaction between personal, behavioral, and environmental factors [23-25]. This reciprocal determinism states that people are not only products of their environment; they also affect it and can be affected by it [25]. The major postulate of SCT has to do with a learning process called observational learning that explains how individuals can learn new behaviors merely through observing others, called models, who perform the behavior, and the consequences that result from it [26]. SCT gives more importance than merely this to cognitive processes in determining behavior, including cognitive processes like that which gets called self-efficacy: that is, how one believes that one can succeed in specific situations; possible outcomes one thinks will happen; or how someone might regulate by thought and action certain behavior [27]. Also today, much research continues to apply and test out SCT in areas such as health promotion, education, and organizational behavior, signifying its strength in the understanding and prediction of human behavior [28,30].

2.5.2. Green mindfulness and employees' pro-environmental behavior

Green mindfulness is increasingly recognized as a critical psychological factor in motivating employees to engage in pro-environmental behaviour [12]. It is defined as a heightened awareness of environmental information and knowledge, fostering a deep, implicit connection between the individual and environmental well-being [31]. This cognitive state encourages employees to become more conscious of the environmental consequences of their actions and more receptive to organizational strategies promoting environmental responsibility [32].

As a robust psychological resource, green mindfulness unconsciously activates an individual's inclination to engage in environmentally sustainable behaviors—often beyond their formal job requirements [31]. It enhances employees' focus, decision-making capacity, and problem-solving skills in relation to environmental issues [12]. Employees with higher levels of green mindfulness are thus more likely to participate in environmental initiatives, advocate for green innovations, and contribute meaningfully to their organization's environmental performance [12]. Furthermore, green human resource management practices—such as green training and empowerment—are known to cultivate green mindfulness, thereby reinforcing employees' interest and engagement in pro-environmental behaviors [32]. Therefore, the following hypothesis is proposed:

H1: Green mindfulness positively influences employees' pro-environmental behavior.

2.5.3. Green mindfulness and employees green self-efficacy

Green mindfulness is expected to exert a significant influence on green self-efficacy among employees [33]. Green mindfulness refers to a mindful, moment-to-moment awareness of environmental information and knowledge, enabling individuals to develop a deeper understanding of environmental issues and their personal role in addressing them [34]. This heightened awareness can enhance an individual's belief in their capability to act responsibly toward the environment—capturing the essence of green self-efficacy [35].

A mindful employee is more likely to recognize environmental challenges and opportunities, thereby developing a greater sense of competence in contributing to sustainable solutions. For instance, such an employee might pay close attention to resource consumption or waste generation during daily tasks, identify areas for improvement, and feel confident in implementing greener practices [36]. This elevated awareness fosters a stronger sense of personal agency and control over environmental outcomes. In turn, green mindfulness enhances employees' belief in their ability to drive change toward sustainability, both within the workplace and beyond [37]. This connection is especially critical for promoting proactive and sustained participation in pro-environmental behaviors [38]. Therefore, the following hypothesis is proposed:

H2: Green mindfulness positively influences employees' green self-efficacy.

2.5.4. Green self-efficacy and pro environmental behavior

Green self-efficacy refers to an individual's belief in their capability to organize and execute the actions required to achieve environmental goals—a construct rooted in both environmental psychology and organizational behavior literature [11]. Employees with high green self-efficacy are confident in their ability to perform environmentally responsible behaviors such as waste reduction, energy conservation, and participation in green initiatives. This confidence increases the likelihood of engaging in such behaviors consistently [12].

Green self-efficacy is essential because it empowers individuals to set more ambitious environmental goals and persist in the face of challenges, believing they possess the necessary resources and competencies to succeed [21]. Conversely, individuals with low green self-efficacy may feel ineffective and are less likely to engage in pro-environmental behavior [30]. Empirical studies have consistently shown that green self-efficacy significantly predicts a wide range of pro-environmental behaviors, both in-role (job-required) and extra-role (voluntary), including participation in environmental management systems, support for green innovation, and advocacy for sustainable practices within organizations. Therefore, developing green self-efficacy among employees is a critical intervention for fostering sustained pro-environmental behavior in the workplace [20]. Hence, the following hypothesis is proposed:

H3: Green self-efficacy positively influences employees' pro-environmental behavior.

2.5.5. Environmental awareness as a moderator

Green mindfulness reflects an employee's values and attitudes toward environmental protection and serves as a foundational driver of pro-environmental behavior. However, the extent to which this mindfulness translates into a belief in one's capability to perform green actions—known as green self-efficacy—largely depends on the level of environmental awareness [39]. Employees with high environmental awareness are more likely to recognize the environmental consequences of their choices, thereby enhancing their perceived competence and confidence in engaging in sustainable behavior [40].

Such awareness makes environmental challenges and opportunities more salient, reinforcing the belief that individual efforts can lead to meaningful environmental outcomes [41]. Therefore, environmental awareness acts as a catalyst, strengthening the positive impact of green mindfulness on green self-efficacy and promoting more active and effective engagement in sustainable workplace practices [42]. Therefore, the following hypothesis is proposed:

H4: Environmental awareness moderates the relationship between employee green mindfulness and green self-efficacy.

2.5.6. Green self-efficacy as a mediator

Green mindfulness incorporates an individual's environmental values, attitudes, and awareness, thereby providing a strong foundation for sustainable action [43]. However, the influence of green mindfulness on behavior is typically strengthened and actualized through the employee's belief in their capability to perform environmentally responsible tasks—referred to as green self-efficacy [44]. Green mindfulness fosters a sense of confidence in acting toward positive environmental outcomes, thereby increasing the likelihood of developing strong green self-efficacy [45]. In turn, higher self-efficacy is closely associated with engaging in a range of pro-environmental behaviors in the workplace, such as conserving resources, reducing waste, and advocating for sustainable practices [46].

Green self-efficacy thus emerges as a critical psychological mechanism that transforms the abstract orientation of green mindfulness into tangible, pro-environmental behavior [47,48]. Consequently, organizations aiming to build an eco-responsible workforce should focus not only on cultivating a green mindset but also on enhancing employees' green self-efficacy through targeted training, empowerment strategies, and supportive environmental policies [49]. Therefore, the following hypothesis is proposed:

H5: Green self-efficacy mediates the relationship between employees' green mindfulness and their pro-environmental behavior.

The theoretical framework of the study is illustrated below in **Figure 1**.

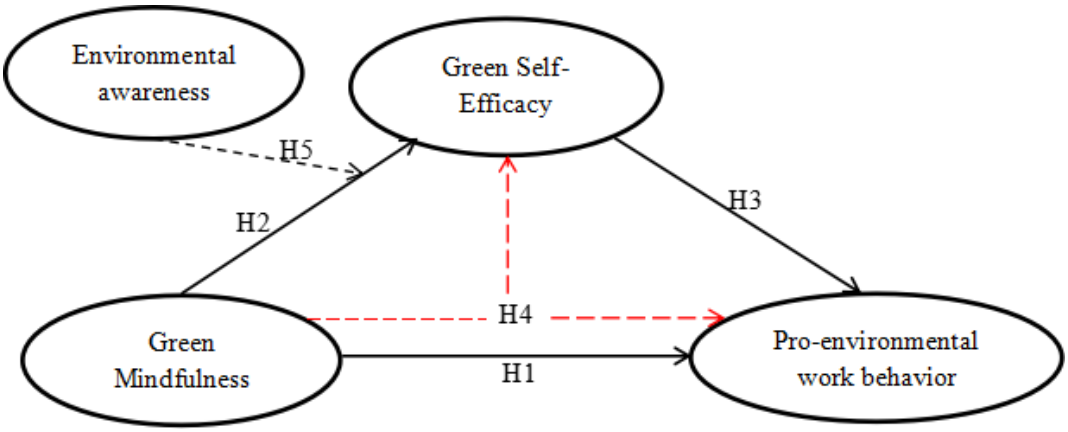

Figure 1. the theoretical framework of the study

3. Methodology

3.1. Sample and data collection procedures

This study targeted full-time employees working in five-star hotels and category-A travel agencies located in the Greater Cairo region of Egypt. These organizations were selected due to their ongoing engagement with green initiatives and sustainability-oriented practices. According to the 2022 records of the

Egyptian Ministry of Tourism and Antiquities [50], the region includes 30 five-star hotels and 1,666 category-A travel agencies.

A judgmental sampling approach was employed to identify and select relevant hotels and agencies that are actively involved in environmental practices. Given the geographical spread and logistical constraints, convenience sampling was used to recruit participants on-site from the selected establishments. Prior to data collection, verbal consent was obtained from each organization for the distribution of the questionnaire within their premises.

The survey yielded 412 valid responses, collected from 65 category-A travel agencies and 22 five-star hotels. Of the respondents, 60.19% were employed in hotels, and 39.81% in travel agencies. All participants had a minimum of one year of work experience, which ensured that responses reflected familiarity with the organization's environmental culture and operations—consistent with Morrison's Morrison, [51] recommendation for studies examining employee perceptions.

3.2. Measurement instruments

All constructs were measured using previously validated scales, adapted to fit the hospitality and tourism context:

- Green mindfulness was assessed using a six-item scale originally developed by Williams and Seaman [52] and recently used by Kalyar et al. [53].
- Pro-environmental work behavior (PEWB) was measured with a seven-item scale adapted from Kim et al., [54], and recently validated by Vu et al., [55].
- Green self-efficacy was evaluated using a six-item scale developed by Chen and Chang [56].
- Environmental awareness was measured using a three-item scale based on Stern et al. [57], and more recently applied by Saifulina et al. [58] in developing country contexts.

The complete list of measurement items is provided in Appendix A. All items were measured on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree).

3.3. Assessment of non-response bias

To assess potential non-response bias, independent sample t-tests were conducted to compare early and late respondents across key study variables. The results revealed no statistically significant differences ($p > 0.05$), indicating that non-response bias is not a concern in this study.

3.4. Assessment of common method bias

To examine the risk of common method variance (CMV), Harman's single-factor test was performed using principal component analysis. The results indicated that no single factor accounted for more than 50% of the total variance, suggesting that CMV is not a significant threat to the validity of the findings. In addition, VIF values were calculated (See **Table 2**) to examine any common method bias issues, confirming that CMV is not a significant threat to the validity of the findings (VIF values <3.3).

3.5. Data analysis technique

The data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM), which is particularly suitable for testing complex theoretical models and for both confirmatory and exploratory research purposes [59]. PLS-SEM is frequently adopted in strategic management and hospitality research due to its flexibility with non-normal data and small to medium sample sizes [60,61]. In this study, WarpPLS version 7.0 was employed to evaluate both the measurement and structural models.

4. Results

4.1. Participants' profile

Table 1 provides a summary of the demographic and organizational characteristics of the study's participants (N=410). The sample comprised 66.5% males and 33.5% females, reflecting the gender distribution in Egypt's hospitality and tourism workforce. In terms of age, nearly half of the respondents (48.54%) were between 30 and 45 years old, followed by 28.64% under the age of 30, and 22.82% over 45. The majority of participants held a bachelor's degree (73.30%), while 16.5% had completed high school and 10.19% held a master's or doctoral degree. Regarding organizational affiliation, 60.19% were employed in hotels and 39.81% in travel agencies.

Table 1. Participant's profile (N=410).

		Frequency	**Percent**
Gender	Male	274	66.50
	Female	138	33.50
Age	18:< 30 years	118	28.64
	30 : 45 years	200	48.54
	>45	94	22.82
Education	High schools	68	16.50
	Bachelor	302	73.30
	Master/PhD	42	10.19
Organization	Hotels	248	60.19
	Travel agencies	164	39.81

4.2. Measurement model

Appendix (B) presents the model fit and quality indices [61] to evaluate the robustness and validity of the structural model. The results indicate that the model demonstrates an acceptable and strong overall fit. Collectively, these indicators affirm the model's quality, reliability, and predictive relevance within the context of the tourism and hospitality sector research.

Table 2 presents the reliability, convergent validity, and multicollinearity for the latent constructs used in the study. All constructions demonstrate excellent internal consistency, with Composite Reliability (CR) values ranging from 0.874 to 0.934 and Cronbach's Alpha (CA) values between 0.782 and 0.915, exceeding the recommended threshold of 0.70. The average variance extracted (AVE) for all constructs—ranging from 0.617 to 0.702—also meets the minimum criterion of 0.50, confirming convergent validity. In addition, individual item loadings for all constructs exceed 0.70, indicating strong indicator reliability. The variance inflation factors (VIF) values range from 2.192 to 3.075, which are below the conservative cut-off value of 3.3, suggesting that multicollinearity is not a concern. These results collectively affirm that the measurement model exhibits strong psychometric properties, justifying its use in subsequent structural model testing.

Table 2. Results of psychometric properties

Construct	Indicators	Loading	CR	CA	AVE	VIF
Green Mindfulness (GM)	GM.1	(0.743)	0.906	0.875	0.617	2.345
	GM.2	(0.777)				
	GM.3	(0.799)				
	GM.4	(0.833)				
	GM.5	(0.816)				
	GM,6	(0.739)				
Pro-environmental work behavior (PEWB)	PEWB.1	(0.863)	0.922	0.901	0.629	2.192
	PEWB.2	(0.797)				
	PEWB.3	(0.803)				
	PEWB.4	(0.728)				
	PEWB.5	(0.831)				
	PEWB.6	(0.775)				
	PEWB.7	(0.747)				
Green Self-Efficacy (GSE)	GSE.1	(0.802)	0.934	0.915	0.702	3.075
	GSE.2	(0.879)				
	GSE.3	(0.850)				
	GSE.4	(0.820)				
	GSE.5	(0.849)				
	GSE.6	(0.827)				
Environmental awareness (EA)	EA.1	(0.862)	0.874	0.782	0.698	2.201
	EA.2	(0.862)				
	EA.3	(0.779)				

"CR: Composite reliability; CA: Cronbach's alpha; AVE: average variance extracted; VIF: variance inflation factors ".

Table 3 presents the inter-construct correlations and the square root of the AVE values along the diagonal, used to assess discriminant validity following the Fornell–Larcker criterion. The square roots of the AVEs for each construct (bold diagonal values) exceed the correlations with all other constructs in the matrix, indicating acceptable levels of discriminant validity. These results collectively confirm that each latent construct captures a unique dimension of the proposed conceptual framework, justifying their use in subsequent structural modeling.

Table 3. Correlations among latent variables with the square root of AVEs

	GSE	GM	PEWB	EA
Green Self-Efficacy (GSE)	**0.838**			
Green Mindfulness (GM)	0.741	**0.785**		
Pro-environmental work behavior (PEWB)	0.614	0.559	**0.793**	
Environmental awareness (EA)	0.488	0.468	0.645	**0.835**

Table 4 reports the results of the Heterotrait-Monotrait Ratio of Correlations (HTMT), a robust method for assessing discriminant validity. All HTMT values are well below the conservative threshold of 0.85,

indicating that the constructs are empirically distinct from one another. These results support the notion that each latent variable measures a unique conceptual domain within the proposed model.

The findings from both HTMT and the Fornell–Larcker criterion (**Table 3**) provide complementary evidence for discriminant validity, affirming the integrity of the measurement model. As such, the constructs demonstrate satisfactory discriminant properties, ensuring reliable interpretation of structural relationships in the subsequent analysis.

Table 4. Discriminant validity (HTMT)

	GSE	GM	PEWB	EA
Green Self-Efficacy (GSE)				
Green Mindfulness (GM)	0.830			
Pro-environmental work behavior (PEWB)	0.680	0.631		
Environmental awareness (EA)	0.579	0.571	0.767	

4.3. Multi-group analysis

Table 5 presents the results of a multigroup analysis (MGA) comparing structural path differences between respondents from five-star hotels and travel agencies. The aim was to assess whether organizational type moderates key relationships within the structural model. Across all four tested paths, the differences in path coefficients between the two groups were statistically non-significant, as indicated by p-values greater than 0.05 and low t-statistics.

Table 5. Multigroup analysis results

Relationship	Path coeff. (Five-Star Hotel)	Path coef. (Travel Agency)	Absolute path coeff. Diff.	p-value (one-tailed)	Tstatistic	Decision
GM → PEWB	0.171	0.191	0.020	0.423	0.195	Not Supported
GM → GSE	0.677	0.724	0.047	0.307	0.505	Not Supported
GSE → PEWB	0.557	0.645	0.088	0.175	0.935	Not Supported
GM * EA → GSE	0.126	0.230	0.104	0.156	1.012	Not Supported

4.4. Structural model and hypotheses testing

Table 6 summarizes the structural path results, including both direct and moderating effects, derived from the structural equation modeling analysis. All hypothesized direct effects are statistically significant at $p < 0.01$, providing strong empirical support for the proposed relationships. Specifically, green mindfulness (GM) has a significant positive effect on pro-environmental work behavior (PEWB) ($\beta = 0.17$, $f^2 = 0.103$), and a stronger effect on green self-efficacy (GSE) ($\beta = 0.70$, $f^2 = 0.527$), indicating substantial influence. Likewise, GSE significantly predicts PEWB ($\beta = 0.59$, $f^2 = 0.424$), highlighting its central role as a driver of environmentally responsible behavior.

The moderation analysis also reveals a significant interaction effect: the interaction term GM × environmental awareness (EA) significantly predicts GSE ($\beta = 0.15$, $p < 0.01$, $f^2 = 0.062$), suggesting that the positive relationship between GM and GSE is strengthened when EA is high. This finding underscores the importance of contextual awareness in enhancing the psychological drivers of green behavior.

The explained variance for the endogenous constructs is notable, with $R^2 = 0.53$ for PEWB and $R^2 = 0.59$ for GSE, indicating that the model explains a substantial portion of the variance in both outcomes.

Collectively, these results validate the proposed conceptual model and emphasize the pivotal role of individual cognition and awareness in fostering pro-environmental behaviors within organizational settings.

Table 6. Direct and moderation effects

H	Structural Paths	Path Coefficient (*β*)	*P*-values	Effect Size (f^2)	Result
Direct Effect					
H1	GM → PEWB	0.17	<0.01	0.103	Supported
H2	GM → GSE	0.70	<0.01	0.527	Supported
H3	GSE → PEWB	0.59	<0.01	0.424	Supported
Moderating Effect					
H5	GM * EA → GSE	0.15	<0.01	0.062	Supported
PEWB $R^{2:} = 0.53$, GSE $R^{2:} = 0.59$					

Table 7 presents the results of the mediation analysis using bootstrapping Preacher and Hayes, [62] to assess the indirect effect of green mindfulness (GM) on pro-environmental work behavior (PEWB) through green self-efficacy (GSE). The analysis confirms a statistically significant mediating effect, supporting Hypothesis H4. Specifically, the path coefficient from GM to GSE (path a) is 0.700, and from GSE to PEWB (path b) is 0.590, resulting in a substantial indirect effect of 0.413. The standard error (SE) for the indirect effect is 0.033, and the t-value is 12.515, indicating a strong mediation effect.

The bootstrapped 95% confidence interval (CI) ranges from 0.348 to 0.478, with no zero value within the interval, further confirming the statistical significance of the mediation. These findings provide robust evidence that green self-efficacy serves as a key psychological mechanism through which green mindfulness enhances pro-environmental work behavior, thereby supporting the theoretical model's explanatory power and validating the proposed indirect pathway.

Table 7. Mediation analysis' bootstrapped confidence interval

Hypo.		Path a	Path b	Indirect Effect	SE	t-value	Bootstrapped Confidence Interval		Mediation
							95% LL	95% UL	
H4	GM→GSE→PEWB	0.700	0.590	0.413	0.033	12.515	0.348	0.478	Yes

5. Discussion

The present study examined the mechanisms through which green mindfulness influences pro-environmental behavior among employees in the tourism and hospitality sector. The findings offer compelling insights into how cognitive and psychological resources interact to shape environmentally responsible workplace behavior.

First, the results reveal that green mindfulness has a direct positive effect on pro-environmental behavior. This finding aligns with previous research Barbaro & Pickett [63], Kumar et al. [64], Thiermann & Sheate [65] suggesting that individuals with heightened environmental awareness and attentiveness are more likely to engage in sustainable actions at work. Mindful employees are better attuned to the ecological consequences of their behavior and more deliberate in aligning their actions with environmental values [66,67]. This supports the theoretical proposition that mindfulness facilitates intentional and value-driven behavior, especially in settings where environmental concerns are salient.

Second, the study confirms that green mindfulness positively influences green self-efficacy, reinforcing the idea that mindfulness not only fosters awareness but also strengthens individuals' belief in their capacity to act pro-environmentally [36,68,69]. This finding is consistent with the tenets of social cognitive theory [70] which posits that cognitive resources such as attention and reflection are instrumental in building self-efficacy. Mindful employees are more likely to feel competent in addressing environmental challenges because they process information more deeply and approach problems with greater clarity and resilience.

Third, the results show that green self-efficacy significantly predicts pro-environmental behavior, further validating its role as a central psychological driver of sustainable actions in the workplace [71,72]. Employees who believe they can make a meaningful environmental difference are more inclined to engage in behaviors such as resource conservation, waste reduction, and support for green initiatives. This extends previous findings in organizational and environmental psychology by reinforcing the motivational role of efficacy beliefs in behavioral outcomes [73,74].

Importantly, the study identifies green self-efficacy as a mediator in the relationship between green mindfulness and pro-environmental behavior. This mediation indicates that mindfulness alone may not be sufficient to produce behavioral change unless it is accompanied by the confidence to act. Green mindfulness, therefore, acts as a foundational cognitive trait that influences behavior indirectly through the development of self-efficacy, offering a more nuanced understanding of how internal states translate into external actions.

Lastly, the study demonstrates that environmental awareness moderates the relationship between green mindfulness and green self-efficacy, such that the effect is stronger when environmental awareness is high. This finding highlights the role of contextual cognition—awareness of environmental issues—as an amplifier of the internal processes that drive sustainable behavior [75,76]. In other words, mindfulness is more likely to translate into efficacy when employees are already attuned to broader environmental challenges, underscoring the importance of combining personal traits with environmental literacy.

Overall, these findings contribute to the growing body of research on sustainability in organizational settings by illuminating the cognitive and psychological pathways that underpin pro-environmental behavior. They underscore the importance of fostering both mindful awareness and efficacy beliefs, especially in industries like tourism and hospitality, where environmental impact is significant and employee engagement is critical to achieving sustainability goals.

6. Theoretical implications

This study offers several noteworthy contributions to the theoretical understanding of pro-environmental work behavior in the tourism and hospitality sector. First, it expands the application of social cognitive theory [70] by confirming that green mindfulness serves as a key antecedent to both green self-efficacy and pro-environmental behavior, highlighting the cognitive mechanisms through which environmentally conscious awareness translates into sustainable actions. Second, the study introduces green self-efficacy as a robust mediator, clarifying the psychological pathway that links green mindfulness to behavioral outcomes, thus offering a deeper explanation for how cognitive orientations are transformed into action. Third, the moderating role of environmental awareness contributes to boundary conditions in the green behavior literature, showing that the relationship between green mindfulness and self-efficacy is contingent upon an individual's environmental awareness. Collectively, these findings bridge gaps between mindfulness research and green behavior theories, suggesting a nuanced model that integrates cognitive, psychological, and contextual factors in shaping pro-environmental work behavior.

7. Practical implications

The findings have practical value for hospitality and tourism managers aiming to enhance environmental sustainability. First, promoting green mindfulness training and awareness programs among employees can serve as a foundational step in fostering environmentally responsible behavior. Such initiatives may include mindfulness workshops with a sustainability focus, encouraging reflective practices that heighten awareness of environmental impacts. Second, by recognizing the pivotal role of green self-efficacy, managers should invest in empowerment programs, such as green skill development and autonomy in environmental decision-making, to reinforce employees' confidence in their ability to engage in sustainable practices. Third, because environmental awareness strengthens the effect of green mindfulness on self-efficacy, communication strategies that emphasize the ecological relevance of employees' roles—through storytelling, visual campaigns, and policy transparency—can further amplify the behavioral impact. These interventions can collectively support a green organizational culture that aligns with broader sustainability goals and enhances brand reputation in eco-conscious markets.

8. Limitations and directions for future research

While the study provides valuable insights, it is not without limitations. First, the use of cross-sectional data limits the ability to infer causality among the variables. Future research could adopt longitudinal or experimental designs to examine the evolution of green mindfulness and its behavioral effects over time. Second, the study's focus on five-star hotels and category-A travel agencies in Greater Cairo may constrain the generalizability of the findings. Future studies could extend this work to include other regions or tourism and hospitality tiers (e.g., restaurants, airlines) to validate the model across diverse settings. Third, self-reported data may introduce social desirability bias. Incorporating multi-source data (e.g., supervisor ratings, behavioral audits) could enhance the robustness of findings. Lastly, future studies might explore additional moderators (e.g., organizational green climate, leadership style) and mediators (e.g., moral obligation, green organizational identity) to offer a more comprehensive view of the drivers of pro-environmental behavior in tourism and hospitality contexts.

9. Conclusion

This study advances our understanding of the psychological and contextual mechanisms that drive pro-environmental behavior among employees in the tourism and hospitality sector. By empirically testing the relationships among green mindfulness, green self-efficacy, and environmental awareness, the findings confirm that green mindfulness significantly enhances employees' environmentally responsible behavior, both directly and indirectly through the mediating role of green self-efficacy. Furthermore, environmental awareness was shown to strengthen the link between green mindfulness and self-efficacy, underscoring its importance as a contextual enhancer of cognitive and behavioral outcomes.

Grounded in social cognitive theory, this research contributes a nuanced framework that integrates cognitive disposition, psychological capability, and environmental context to explain sustainable employee behavior. These insights not only enrich the theoretical discourse on green workplace behavior but also provide actionable strategies for tourism and hospitality managers seeking to cultivate a culture of environmental responsibility. Ultimately, the study highlights that fostering green mindfulness and reinforcing employee confidence through awareness and empowerment initiatives are essential for achieving long-term sustainability in hospitality organizations.

Funding

This work was funding by the Deanship of Scientific Research, Vice Presidency for Graduate Studies and Scientific Research, King Faisal University, Saudi Arabia [KFU252750].

Acknowledgments

This work was supported by the Deanship of Scientific Research, Vice Presidency for Graduate Studies and Scientific Research, King Faisal University, Saudi Arabia [KFU252750].

Conflict of interest

The authors declare no conflict of interest

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Appendix (A) measurement scales

Green mindfulness (GM) Williams and Seaman [52]. Kalyar et al. [53]	GM.1	I feel free to discuss environmental issues and problems.
	GM.2	I am encouraged to express different views with respect to environmental issues and problems.
	GM.3	I pay attention to what is happening if unexpected environmental issues and problems arise.

	GM.4	I am inclined to report environmental information and knowledge that have significant consequences.
	GM.5	I am rewarded if I share and announce new environmental information and knowledge.
	GM.6	I know what is readily available for consultation if unexpected environmental issues and problems arise.
	PEWB.1	Before finishing work, I will turn off electrical equipment such as TV, computer, monitor, etc.
	PEWB.2	I am conscious of using materials and stationery reasonably at work
	PEWB.3	I save water when using the toilet
Pro-environmental behavior (PEWB) Kim et al. [54] Vu et al.[55]	PEWB.4	I have a habit of turning off the lights when leaving unused rooms
	PEWB.5	I often reuse materials and stationery at work
	PEWB.6	I classify and recycle waste at work
	PEWB.7	I am concerned about water leakage problems in hotels
	EA.1	I feel a personal obligation to do whatever I can to prevent climate change
Environmental awareness (EA) Stern et al. [57] Saifulina et al. [58]	EA.2	I would be willing to pay much higher taxes in order to protect the environment
	EA.3	I would be willing to pay much higher prices in order to protect the environment
	GSE1	I feel I can succeed in accomplishing environmental ideas.
	GSE2	I can achieve most of the environmental goals.
	GSE3	I feel competent to deal effectively with environmental tasks.
Green Self-efficacy Chen and Chang [56]	GSE4	I can perform effectively on environmental missions.
	GSE5	I can overcome environmental problems.
	GSE6	I could find creative solutions to environmental problems.

Appendix (B): Model fit and quality indices

Classic índices	Assessment	Criterion	Decision
Average path coefficient (APC)	0.401, P<0.001	P<0.05	Supported
Average R-squared (ARS)	0.558, P<0.001	P<0.05	Supported

Average adjusted R-squared (AARS)	0.556, P<0.001	P<0.05	Supported
Average block VIF (AVIF)	1.772	acceptable if ≤ 5, ideally ≤ 3.3	Supported
Average full collinearity VIF (AFVIF)	2.257	acceptable if ≤ 5, ideally ≤ 3.3	Supported
Tenenhaus GoF (GoF)	0.638	small ≥ 0.1, medium ≥ 0.25, large ≥ 0.36	Supported
Sympson's paradox ratio (SPR)	1.000	acceptable if ≥ 0.7, ideally = 1	Supported
R-squared contribution ratio (RSCR)	1.000	acceptable if ≥ 0.9, ideally = 1	Supported
Statistical suppression ratio (SSR)	1.000	acceptable if ≥ 0.7	Supported
Nonlinear bivariate causality direction ratio (NLBCDR)	1.000	acceptable if ≥ 0.7	Supported
Additional indices (indicator corr. matrix fit)	**Assessment**	**Criterion**	**Decision**
Standardized root mean squared residual (SRMR)=	0.092	acceptable if <= 0.1	Supported
Standardized mean absolute residual (SMAR)	0.074	acceptable if <= 0.1	Supported
Standardized chi-squared with 230 degrees of freedom (SChS)	4.940, P<0.001	P<0.05	Supported
Standardized threshold difference count ratio (STDCR)	0.974	acceptable if >= 0.7, ideally = 1	Supported
Standardized threshold difference sum ratio (STDSR)	0.925	acceptable if >= 0.7, ideally = 1	Supported