

WHAT PARAMETERS DEFINE THE GREEN HOTELS TO INCREASE THEIR FINANCIAL PERFORMANCE? AN EMPIRICAL RESEARCH

¿QUÉ PARÁMETROS DEFINEN A LOS HOTELES VERDES PARA AUMENTAR SU RENDIMIENTO FINANCIERO? UNA INVESTIGACIÓN EMPÍRICA

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Abstract

Based on participatory research involving 279 green hotels from a database of 1200 provided by Ecostars, several key factors have been identified to enhance their performance. One of the most significant is the acquisition of recognized green certifications, which has a direct positive impact on both environmental performance and the market positioning of hotels. Equally important is the management of green elements, such as implementing practices for waste reduction, energy efficiency, and water conservation. The adoption of advanced technology also plays a vital role in optimizing resource use and supporting sustainability goals. Moreover, ongoing employee training is essential for raising environmental awareness and ensuring that sustainable practices are consistently applied across all operational levels. Together, these parameters—certification, management of green elements, technology use, and staff training—are critical for improving the overall environmental impact and competitive edge of green hotels in the market.

Keywords: green hotel, financial performance, sustainability, environmental awareness, technology, training.

Resumen

A partir de una investigación en la que participaron 279 hoteles verdes, de una base de datos de 1.200 proporcionada por Ecostars, se han identificado varios factores clave para mejorar su rendimiento financiero. Uno de los más significativos es la adquisición de certificaciones verdes

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reconocidas, que tiene un impacto positivo directo tanto en el rendimiento medioambiental como en el posicionamiento de los hoteles en el mercado. Igualmente importante es la gestión de elementos verdes, como la aplicación de prácticas de reducción de residuos, eficiencia energética y conservación del agua. La adopción de tecnología avanzada también desempeña un papel vital en la optimización del uso de los recursos y el apoyo a los objetivos de sostenibilidad. Además, la formación continua de los empleados es esencial para aumentar la concienciación medioambiental y garantizar que las prácticas sostenibles se apliquen de forma coherente en todos los niveles operativos. En conjunto, estos parámetros -certificación, gestión de elementos ecológicos, uso de tecnología y formación del personal- son fundamentales para mejorar el impacto ambiental global y la ventaja competitiva de los hoteles ecológicos en el mercado.

Palabras clave: hotel verde, rendimiento financiero, sostenibilidad, concienciación medioambiental, tecnología, formación.

1. INTRODUCTION

Sustainable Development (SD) theory provides a foundational framework for integrating environmental sustainability, social equity, and economic growth (Du Pisani, 2006; Robina-Ramírez, & Medina-Merodio, 2019). In hospitality, SD extends beyond environmental concerns like waste and energy management to influence employment, guest satisfaction, and regional development (Koch et al., 2020; Robina-Ramírez et al., 2021). The literature reveals how SD supports the industry's environmentally Sustainable Development Goals (SDGs) (Alvarez-Risco et al., 2020), strengthens green marketing (Chung, 2020), and enhances guest services (Eid et al., 2021), improving overall economic performance (Aljoghaiman et al., 2024).

Despite progress, a gap exists in empirical research on the key parameters driving economic performance in sustainable hospitality. This gap presents an opportunity to identify and evaluate factors enabling green hotels to achieve economic success while upholding eco-friendly practices, offering insights valuable for hospitality managers and policymakers.

Spain, as the research setting, is ideal due to its status as the second-highest recipient of international tourists, its tourism industry contributing 11.6% of GDP (INE, 2024), and its leadership in sustainable tourism certifications (ICTE, 2023). Using the Ecstars database, the study engaged 1,200 Spanish hotels through a collaborative methodology involving hotel general managers.

From January to June 2024, a qualitative study was conducted with managers and employees to examine sustainable practices in hotels. This bottom-up participatory approach enabled them to define and validate green performance parameters, aligning strategic goals with operational realities in sustainable hotel management.

The next section explores the empirical approach, examining links between environmental management and economic outcomes, followed by a statistical analysis and discussion of findings.

2. BACKGROUND

2.1. Empirical Proposal for Parameter Design

A bottom-up participatory approach allows hotel managers and employees to jointly define green hotel performance parameters. Managers set sustainability goals, while employees assess practical feasibility. This collaborative effort ensures parameters reflect strategic and operational insights, supporting sustainable impact. The empirical methodology included three

stages: (1) Preliminary workshops for parameter identification, (2) In-depth discussions, and (3) Parameter categorization. Each stage involved activities enabling managers and employees to define, analyze, and validate parameters, grounded in their direct experiences.

Stage 1: Preliminary workshop for parameter identification

In this first stage, the research team organized a series of workshops where managers and employees met to share their views on sustainability practices (Sánchez-Oro & Robina Ramírez, 2020). To ensure an empirical, participant-driven online process, managers and employees formed mixed groups, each focused-on brainstorming potential parameters without predefined concepts. The goal was to tap directly into each participant's day-to-day observations, rather than relying on established academic theories.

Managers emphasized high-level strategies and sustainability goals, discussing operational areas they felt directly influenced performance. Employees contributed practical insights based on their routines and operational challenges in areas such as energy conservation, waste management, and sustainable purchasing. These preliminary workshops also involved informal voting exercises to gauge initial support for various parameters discussed, creating a baseline of commonly valued parameters.

Stage 2: In-Depth group discussions and refined parameter development

In Stage 2, managers and employees engaged in focused discussions by operational area to identify key factors for sustainable performance. Each group detailed selected parameters and their impact on operations, such as energy management practices. Employees contributed practical insights, while managers provided strategic alignment with organizational goals and budgets. The collaborative bottom-up participatory approach fostered alignment between managers and employees on sustainability strategies within the hospitality industry in twelve elements (Table 1).

TABLE 1. GROUP DISCUSSIONS AND REFINED PARAMETER DEVELOPMENT		
Topic	Managers	Employees
Energy Conservation Focus	Energy-saving initiatives improve efficiency and reduce operational costs.	Using LED lights saves energy, reducing our electricity bills significantly.
Waste Reduction Strategies	Waste reduction aligns with our sustainability objectives and lowers disposal expenses.	Separating recyclables helps us minimize waste and disposal costs.
Water-Saving Techniques	Efficient water use supports conservation goals and lowers operational costs.	Shorter cleaning routines help save water daily.
Eco-Friendly Amenities	Sustainable amenities enhance our brand's eco-friendly image.	Refillable toiletries help reduce waste and align with green goals.
Minimizing Single-Use Plastics	Reducing plastics aligns with sustainability goals and reduces waste costs.	Reusable items decrease waste and help create a greener environment.
Local Supplier Focus	Local, sustainable vendors align our procurement with broader green goals and community support.	Regional vendors cut emissions, making our sourcing eco-friendly and supportive of local businesses.

TABLE 1. GROUP DISCUSSIONS AND REFINED PARAMETER DEVELOPMENT

Topic	Managers	Employees
Sustainability Training Engagement	Training embeds sustainable practices, ensuring consistency across all operations.	Training provides hands-on skills, making sustainability integral to daily tasks.
Eco-Certification Compliance	Certification affirms commitment; audits help achieve eco-friendly standards.	Audits identify improvements, guiding steps toward certification.
Carbon Footprint Reduction	Efficient transport reduces emissions, aligning with sustainability goals.	Fuel-efficient transport lowers emissions, aiding our carbon reduction efforts.
Guest Sustainability Education	Educating guests fosters an eco-friendly brand and enhances their experience.	Eco-tips for guests encourage shared environmental responsibility.
Optimized Laundry Scheduling	Adjusting laundry timing saves resources, enhancing efficiency.	Scheduling laundry reduces water and energy use, promoting conservation.

Source: Authors' own elaboration.

Through collaborative dialogue, the participants developed five parameter categories: Sustainable Development in Green Hotels (GHA) Environmental Certifications and Standards (CS) Environmental Awareness (EA) Implementation of Green Technologies (T) Training and Development (TSB) Environmental Performance (EP) all grounded in operational realities rather than theory, ensuring practical relevance and effectiveness.

Stage 3: Parameter categorization and grouping

After defining five key parameter categories, managers and employees used a two-stage thematic analysis to ensure optimal grouping based on operational impact. In Stage 1, parameters were mapped to constructs, establishing categories that capture the hotel's sustainability efforts: Green Hotel Attributes (energy, water, waste management), Environmental Certificates and Standards (meeting eco-labels), Environmental Awareness (guest engagement), Technology (green tech solutions), and Training and Capacity Building (sustainability education). Stage 2 focused on practical application, where employees measured Green Hotel Attributes, managers ensured certification compliance, and staff engaged guests. Continuous monitoring and feedback ensured alignment with theoretical frameworks and real-world effectiveness.

Stage 4: Define the indicators

To empirically define the indicators from the chosen parameters, hotel managers and employees reviewed each parameter to identify the specific sustainable practices that could impact hotel performance. Through brainstorming sessions, they proposed preliminary indicators based on tangible activities in resource management, guest engagement, and technological applications. To validate and refine them managers conducted pilot studies within their departments to test the relevance and measurability of proposed indicators. Employees implemented and monitored activities like energy-saving and waste management to determine which indicators captured real impacts (Table 2).

TABLE 2. INDICATORS DRAWN FROM LITERATURE REVIEW CONTRASTED WITH HOTEL MANAGERS

Construct	Construct	Construct
Green hotel Attributes (GHA)	Energy GA1	Energy-saving LED lighting predominates in the hotel.
	Energy GA2	There are motion sensors to adjust lighting to actual needs.
	Water GA3	The showers in the rooms are low-flow.
	Water GA4.	There are stickers in the bathrooms to advise guests to save water.
	Waste GA5	There are different containers to separate and recycle waste
	Waste GA6	Percentage of waste diverted from landfill through recycling
	Materials.GA7	Shampoo, gel, etc. dispensers are refillable.
	Materials.GA8	There is an efficient towel replacement policy.
	Transport GA9	The purchase and consumption of local products are promoted
	Transport GA10	Green transportation initiatives are offered to guests.
Environmental Performance (EP)	EP1	Our hotel has reduced waste
	EP2	Our hotel has saved water.
	EP3	Our hotel has saved energy.
	EP4	Our hotel has improved its market position.
	EP5	Our hotel has reduced overhead costs.
	EP6	Our hotel has reduced purchases of materials, chemicals and non-renewable components.
	EP7	Our hotel has contributed to improving its reputation.
Environmental Certificates and Standards (CS)	CS1	Obtaining certifications and standards has contributed to improving the sustainability of our hotel.
	CS2	After obtaining certifications has reduced its environmental footprint.
	CS3	Having certifications and standards improves the operational efficiency of our hotel.
	CS4	Our certificate hotel has experienced an increased attraction of environmentally conscious customers
	CS5	Obtaining certifications and standards has increased our hotel's commitment to sustainability and environmental awareness.
Ethical Responsibility and Environmental Awareness (EA)	EA1	Using green hotels generates environmental benefits.
	EA2	Tourist awareness improves eco-friendly practices.
	EA3	Tourists' environmental awareness is producing a shift towards environmental sustainability.
	EA4	The green image of hotels has the relationship between ecological practices.
	EA5	Environmental awareness is proving to be a crucial factor in improving environmental performance.

TABLE 2. INDICATORS DRAWN FROM LITERATURE REVIEW CONTRASTED WITH HOTEL MANAGERS

Technology (T)	TE1	Emerging technologies have the capacity to transform the green tourism sector by improving customer service.
	TE2	The use of AI in green hotels improves environmental sustainability.
	TE3	Adoption of information technology fosters innovation in green services.
	TE4	AI enables transformation of processes and customer services by engaging in intelligent customer care.
	TE5	Use of IAG tools facilitates training and awareness in green hotel employees and tourists.
Training and Development (TSB)	TSB1	Environmental and human resource management should integrate to achieve effective economic outcomes.
	TSB2	TSB should address environmental issues and enhance organizational sustainable development.
	TSB3	TSB should improve environmental performance and sustain competitiveness.

Source: Authors' own elaboration.

Once these parameters have been empirically identified, consulting existing research can validate and deepen their understanding by aligning them with Sustainable Development (SD) Theory. This approach helps reinforce the practical findings with established knowledge, provides a foundation for comparing findings across different contexts, and may reveal additional insights into best practices or complementary strategies. This way, the literature doesn't dictate the parameters but instead supports and expands upon what has been verified empirically, leading to a balanced model that combines theory with practical expertise.

3. RESEARCH AND METHODS

3.1. Environmental Performance (EP)

Sustainable development in hotels directly impacts their environmental performance, boosting both reputation and ecological impact (González-Rodríguez et al., 2019). By adopting eco-friendly designs, sourcing green products, and managing resources responsibly, green hotels reduce their environmental footprint while enhancing worker and guest satisfaction (Shehawy et al., 2024; Hsiao et al., 2018), ensuring long-term success.

These practices lead to superior environmental performance (Khalil et al., 2024), with environmental protection becoming essential for hotel industry growth (Nisar et al., 2024). Furthermore, environmental performance is increasingly linked to ecological and social values, which in turn boosts employee performance (Nisar et al., 2021).

This alignment of values positions green hotels as the most sustainable choice, economically benefiting from their environmental and social initiatives (Robina-Ramírez et al., 2024). Employees, recognizing the hotel's efforts, actively contribute to these goals (Irani et al., 2022; Robina Ramírez & Fernández Portillo, 2020). Consequently, hotels worldwide are prioritizing sustainability, focusing on energy and water conservation, waste reduction, and

sourcing eco-friendly, local products (Nisar et al., 2021). These changes in operational practices are shaping travel trends, as both tourists and employees value hotels that promote sustainable tourism, preserve local culture, and support local economies (Kim et al., 2019).

Top green hotels conduct environmental audits, assessing green costs and implementing programs for recycling, energy and water savings, and using recycled products (Haldorai et al., 2022). These initiatives drive sustainability and cost savings (Kim et al., 2019), while also improving operational efficiency and brand image. This offers a competitive advantage, linking environmental performance with economic outcomes in the management of green hotels.

3.2. Sustainable Development in Green Hotels (GHA)

Sustainable hotel development relies on efficient resource management to enhance environmental responsibility and improve operations. Optimizing processes minimizes excess, reducing both environmental impact and costs. The rising demand for eco-friendly accommodation has driven a 15% annual increase in green hotels since 2020 (Van Huy et al., 2024), indicating a shift towards sustainable practices in the industry (Fauzi et al., 2024; Iyengar & Venkatesh, 2024; Koščak & O'Rourke, 2024).

Sustainable hotel development must ensure the functionality of the built environment by integrating place, people, and process through sustainable practices (Khalil et al., 2024). These three elements should meet appropriate conditions to effectively manage sustainable practices, such as cleanliness, adequate ventilation, cooling, and visual presentation (Wan et al., 2017). People should find social elements, like health, sense of community, and satisfaction, to feel comfortable in the hotel, with a focus on the behavior of the end-users (Khalil et al., 2024).

The process must align with place and people to provide a positive return on green investments over the building's life span, including responsible management of energy, water, waste, and eco-materials, as well as the application of environmental certifications (Chua & Han, 2022; Leal-Solís & Robina-Ramírez, 2022). Based on the information provided in the paragraphs, H1 can be developed.

H1: Green Hotel Attributes (GHA) directly impact Environmental Performance (EP).

3.3. Environmental Certifications and Standards (CS)

Sustainable development in hotels is essential for achieving long-term viability, aligning with guest expectations for eco-conscious practices and regulatory standards. Between 2019 and 2023, the hotel sector saw a 23% rise in sustainability certifications, driven by consumer demand for environmentally responsible accommodations and tighter regulations on resource use (Zutshi et al., 2022).

Peiró-Signes et al., (2014) analyzed the difference in green practices between companies with and without any certified environmental management programs. Not only adopting sustainable practices enhances guest satisfaction, brand reputation, and operational resilience (Robina-Ramírez et al., 2019). They founded that companies with certified environmental programs were more demanding to their suppliers. That's why sustainable practices in green hotel are highly meaningful to get the environmental certifications (Chung, 2020; Abdulaali et al., 2020; Qubbaj & Signes, 2022). Certifications like LEED (Leadership in Energy and Environmental Design) reward sustainable design and operations, covering energy efficiency, water conservation, waste management, and promotion of eco-friendly alternatives (Abdulaali et al., 2020; Robinson et al., 2016). Such certifications boost outcomes by embedding sustainability in employee values and skills, fostering respectful environmental behavior (Millar et al., 2012).

Additionally, Green Globe Certification (GGC) assesses environmental and social performance, focusing on resource conservation and sustainable mobility (Duric & Potočník Topler, 2021; Yusoff et al., 2020). GGC promotes efficient resource use, waste reduction, and community engagement in tourism (Mzembe et al., 2021; Karatepe et al., 2022). ISO 14001 further strengthens sustainability by setting requirements for effective Environmental Management Systems (EMS), supporting resource management and operational cost reduction (Qubbaj & Signes, 2022; Acampora et al., 2022).

These certifications underscore a hotel's commitment to sustainability, attract eco-conscious guests, and provide a competitive edge, thus linking sustainable practices, certification, and business success in the green hotel sector (Chung, 2020; Abdulaali et al., 2020; Hsiao et al., 2014). The insights from the paragraphs allow for the formulation of hypotheses H2 and H3.

H2: Green Hotel Attributes (GHA) influence Environmental Certification and Standards (CS).

H3: Environmental Certification and Standards (CS) influence Environmental Performance (EP).

3.4. Ethical Responsibility and Environmental Awareness (EA)

Sustainable development in the hotel industry is not just a strategic response to consumer demand but also an ethical imperative (Robina-Ramírez et al., 2023). Rising environmental awareness (EA) has led eco-conscious travelers to seek accommodations that align with their values, prioritizing sustainability despite challenges in availability and transparency (Fuchs et al., 2024). However, barriers such as policies, management constraints, and financial costs hinder the adoption of green practices (Luo et al., 2021). From an ethical standpoint, strengthening EA—particularly in resource management and waste reduction—is a moral duty that ensures long-term environmental stewardship and intergenerational justice (Han & Ahn., 2020).

EA influences both guests and managers, shaping ethical commitments within the hospitality sector (Robina-Ramírez et al., 2020). Hotel owners and regulators play a key role in fostering a sustainability-driven corporate culture that goes beyond compliance to embrace environmental responsibility as a core value (Rassiah et al., 2022; Robina-Ramírez et al., 2020). Enhanced EA translates into meaningful sustainability initiatives, leading to certifications that reflect a hotel's commitment to ethical environmental practices, ultimately strengthening brand reputation and trust (Hameed et al., 2022). Additionally, consumer EA significantly impacts booking decisions, with transparent green marketing fostering guest trust and reducing perceived risks of greenwashing (Wong & Lai, 2024).

Beyond marketing benefits, EA enhances ethical governance by integrating sustainability into hotel operations. Promoting a green organizational culture ensures that employees engage in responsible resource management, reinforcing ethical behavior through continuous training (Aboramadan & Karatepe, 2021). Key sustainability concerns—including food waste, water conservation, and energy efficiency—are not just operational challenges but ethical obligations aligned with circular economy principles (Bux & Amicarelli, 2023). Investing in employee training and organizational ethics strengthens the practical implementation of sustainability initiatives (Srivastava et al., 2025).

By embedding ethics into EA and aligning business strategies with moral responsibilities, hotels can foster sustainable growth while maintaining stakeholder trust. Ethical leadership ensures that environmental initiatives are not just profit-driven but also guided by principles of fairness and accountability. Ultimately, eco-friendly hotels benefit from increased customer loyalty, higher profitability, and a strengthened social license to operate, reinforcing EA's mutual advantage for both businesses and consumers (Fuchs et al., 2024).

Sustainable development in hotels is increasingly driven by rising environmental awareness (EA), as eco-conscious travelers seek accommodations that offer environmental benefits, despite challenges in availability and transparency (Fuchs et al., 2024). Barriers like policies, management, and costs restrict green adoption (Luo et al., 2021) but strengthening EA—especially in resource management and waste reduction—can help hotels foster sustainability (Han & Ahn, 2020).

Environmental awareness impacts both hotel guests and managers, with owners and regulators influencing managerial commitment to sustainable practices (Rassiah et al., 2022). Enhanced EA translates into greater sustainability initiatives and certifications, boosting brand value and image. Green practices positively impact hotels' perceived value and image, as shown by Hameed et al. (2022). Similarly, consumer EA significantly affects booking decisions, with clear green marketing messages boosting guest trust and reducing perceived risks (Wong & Lai, 2024).

EA also benefits hotel performance by promoting green organizational support and resource management, which improves employee involvement in waste reduction and sustainability practices through continuous training (Aboramadan & Karatepe, 2021). Key sustainability concerns, including food waste, water, and energy, are central to circular economy strategies (Bux & Amicarelli, 2023). Furthermore, organizational culture and training are crucial in reinforcing practical skills for sustainability (Srivastava et al., 2025).

By integrating EA and monitoring stakeholder expectations, hotels strengthen managers' commitment to green practices, gaining benefits like increased profits and customer loyalty (Barakagira & Paapa, 2024). Ultimately, tourists positively perceive eco-friendly hotels, reinforcing EA's mutual benefit to both the industry and consumers (Fuchs et al., 2024). Hypotheses 4 to 6 may be derived from the arguments presented in the paragraphs.

H4: Green Hotel Attributes (GHA) influence Environmental Awareness (EA).

H5: Environmental Awareness (EA) influences Customer Satisfaction (CS)

H6: Environmental Awareness (EA) influences Environmental Performance (EP).

3.5. Implementation of Green Technologies (T)

Studies identify various drivers for adopting environmental technologies, including efficiency improvement, cost reduction, regulatory compliance, and meeting ISO 14001 requirements (Osolase et al., 2023). In hospitality, Tseng and Octavyaputri (2024) emphasized the need for innovation to improve efficiency and competitiveness. That innovation help hotels manage bookings, security, and sustainability efforts like energy conservation and waste reduction.

Although studies have focused on environmental technologies in the hotel industry, many address them in other sectors. Dávid and Dadkhah (2023) explored the relationship between technology and environmental policy developing a model to evaluate policies promoting environmental technologies

Recently, automating processes, optimizing energy use, and enhancing sustainability to meet guest demand for eco-friendly practices has become prominent (Ray et al., 2023). AI, big data, and machine learning optimize resource use and waste reduction (Birim et al., 2024). Moreover, AI is transforming hotel operations, boosting customer service, efficiency, and sustainability efforts (García-Madurga & Grilló-Méndez, 2023), thus enhancing competitiveness and enabling mass personalization (Demir & Demir, 2023).

Beyond operational improvement, AI fosters stakeholder relationships, supporting sustainable investments and customer-centric care (Carvalho & Ivanov, 2024). Advanced

technologies like the metaverse, Web 3.0, and IoT reshape tourism, raising new sustainability and ethical concerns (Elkhwesky et al., 2024). IoT, AI, cloud computing, and big data analytic also elevate service quality and customer satisfaction, providing solutions to ecological challenges (Tong et al., 2022).

Trust in AI promotes environmental, social, and governance (ESG) factors, including sustainable mobility (Kim et al., 2019). AI's practical applications, like chatbots and Generative AI (GAI), provide sustainability information and enhance employee training, completing hotels' technological transformation (Altun et al., 2024). From the discussions in the paragraphs, it is possible to propose hypothesis H7.

H7: Technology (T) influences Environmental Awareness (EA).

3.6. Training and Development (TSB)

Sustainable development in hotels increasingly relies on Green Human Resource Management (GHRM), integrating environmental practices into recruitment, training, and employee management. GHRM fosters eco-consciousness among employees, driving green initiatives that enhance operational sustainability (Bahuguna et al., 2023; Bonilla-Chaves et al., 2024). Though research on GHRM in hotels is limited (Renwick et al., 2013), recent studies (Aboramadan & Karatepe, 2021; Irani et al., 2022) highlight its potential for boosting green outcomes, especially through training and development. "Green" training linked to corporate sustainability enhances staff awareness and engagement (Nisar et al., 2024). Staff participation reduces absenteeism, boosts loyalty, satisfaction, and productivity (Shehawy et al., 2024).

Using the Ability-Motivation-Opportunity (AMO) theory (Appelbaum, 2000), environmental training becomes crucial for efficient results, with employees central to sustainable practices in energy, water, waste management, and eco-friendly transport (Robertson & Barling, 2017). Industry training connects environmental and human resource management for improved economic performance (Martínez-Martínez et al., 2019; Baum, 2015), with GHRM aiming to enhance competitive advantage and environmental performance by motivating employees (Chan & Hsu, 2016; Chan et al., 2014).

Key practices include: (1) clear communication to build environmental awareness, (2) teamwork for effective green initiatives, and (3) problem-solving skills for proactive environmental management. These enhance resource efficiency, waste management, and sustainable materials use, offering guests an eco-friendly experience and strengthening the hotel's sustainability reputation. Considering the points raised in the paragraphs, hypothesis H8 can be articulated.

H8: Technology-Specific Behavior (TSB) influences Environmental Awareness (EA).

4. METHODOLOGY

4.1. Data

Hotels recognized with Ecotars accreditation were selected using a randomized digital system to guarantee impartiality in the sampling process. This method granted each hotel an equal opportunity to be chosen, enhancing the reliability and representativeness of the findings. From a total of 1,200 establishments contacted through electronic and voice communication, 279 submitted complete responses, resulting in a participation rate of 23.5%. These responses came from a diverse mix of hotel types, locations, and sizes, offering a balanced perspective on the certified group.

The research was conducted through a structured three-step approach. Initially, two trial rounds involving 22 randomly chosen establishments were held, with interviews focusing on

sustainability efforts and leadership styles, then linking eco-friendly initiatives to staff morale. Next, digital focus sessions gathered input from 21 different hotels, where professionals shared insights on how green actions affect workplace emotions. Finally, a validated 35-item survey was securely distributed, completed anonymously to ensure honest and reliable data.

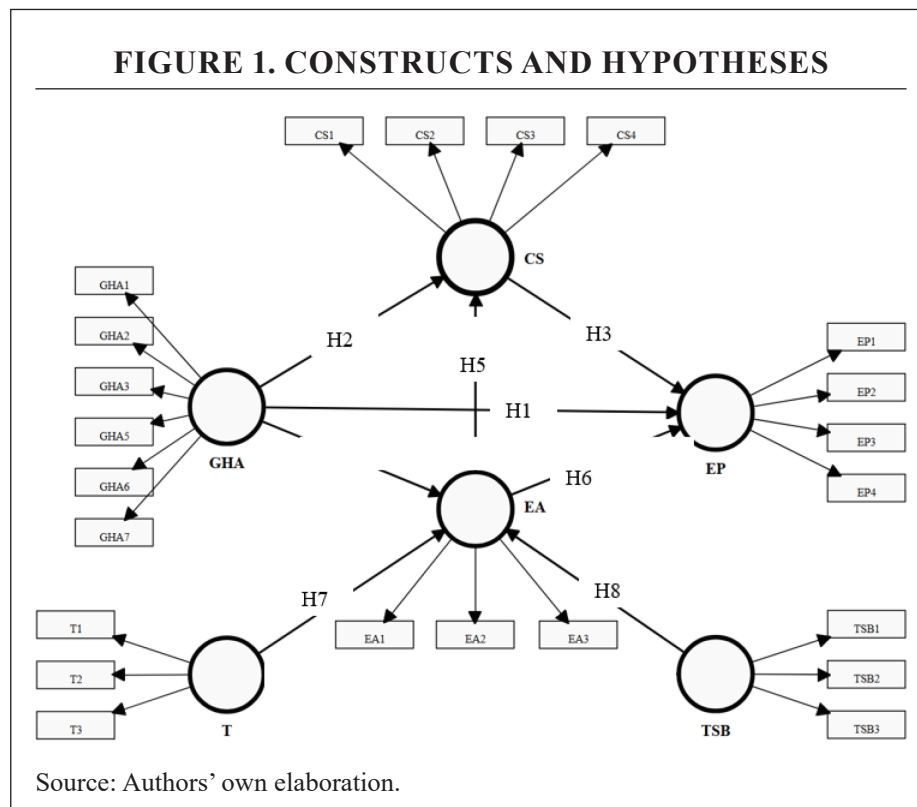
In this way, the qualitative and participatory phase served as a transition for the theoretical construction, the validation of the measurement instrument and the deepening of the hypotheses put forward, which contributed to the proposal of a more precise and relevant SEM model with a more solid empirical base, already tested in other works related to the hotel sector (Folgado-Fernández et al., 2025).

4.2. Working Hypothesis

- H1: GHA influence EP
- H2: GHA influence CS
- H3: CS influence EP
- H4: GHA influence EA
- H5: EA influence CS
- H6: EA influence EP
- H7: T influence EA
- H8: TSB influence T

4.3. Model

Figure 1 shows the relationship between the variables, as well as the nine hypotheses set out below:



5. RESULTS

This study aims to enhance green hotel performance through sustainable practices, though their methodologies and findings differ. Objectives include achieving green certifications, managing waste, energy, and water efficiently, integrating advanced technology, and fostering employee training for environmental awareness. These are seen as vital for improving environmental and market outcomes. In contrast, results use statistical analysis to measure how green attributes, technology, and training influence environmental performance, awareness, and certification. Structural Equation Modeling (SEM) provides empirical support, highlighting certification and awareness as strong predictors and suggesting areas for further study, especially in environmental awareness.

5.1. External Model

The external loadings indicate the correlations between latent variables and observed variables, according to Carmines and Zeller, (1979) values greater than 0.7 although other authors consider that this rule should not be so rigid as can be seen in Table 3.

TABLE 3. OUTER MODEL LOADINGS

	CS	EA	EP	GHA	T	TSB
CS1	0,798					
CS2	0,752					
CS3	0,728					
CS4	0,769					
EA1		0,886				
EA2		0,886				
EA3		0,700				
EP1			0,828			
EP2			0,824			
EP3			0,747			
EP4			0,776			
GHA1				0,801		
GHA2				0,832		
GHA3				0,706		
GHA5				0,679		
GHA6				0,812		
GHA7				0,822		
T1					0,812	
T2					0,860	
T3					0,809	
TSB1						0,910
TSB2						0,901
TSB3						0,730

Source: Authors' own elaboration.

Outer loadings in Table 4 measure the correlation between observed variables and latent constructs, with most exceeding 0.7, confirming strong associations (). For Certifications (CS1 to CS4), loadings range from 0.728 to 0.798, showing a strong connection. Environmental Awareness (EA1 to EA3) and Environmental Performance (EP1 to EP4) also show solid links. Other constructs like Green Hotel Attributes (GHA), Technology, and Training and Capacity Building (TSB) reinforce their relevance. Cronbach's alpha values exceeded 0.70, ensuring reliability Fornell and Larcker (1981). Composite reliability and average variance extracted (AVE) values were also above the minimum acceptable thresholds, ensuring high internal consistency and validity of the model.

Fornell and Larcker (1981) suggest that the square root of the AVE on each latent variable can be used to establish discriminant validity. To confirm discriminant validity between constructs, the square root of the AVE must be greater than the correlation between the constructs. Table 5 presents the square roots of the AVE on the diagonal and the correlations between the constructs. This value is higher than other correlations between latent variables, indicating adequate discriminant validity of the measurements.

Finally, all constructs demonstrate discriminant validity, as the Heterotrait-Monotrait (HTMT) correlation criterion is met, using a conservative threshold of values below 0.85 (see Table 6) (Henseler et al, 2016).

TABLE 4. CRONBACH'S ALPHA COEFFICIENTS, RHO_A, COMPOSITE RELIABILITY AND AVERAGE VARIANCE EXTRACTED (AVE)

	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
CS	0,760	0,765	0,847	0,581
EA	0,774	0,836	0,867	0,687
EP	0,804	0,805	0,872	0,631
GHA	0,868	0,874	0,901	0,605
T	0,769	0,770	0,867	0,685
TSB	0,774	0,933	0,861	0,679

Source: Authors' own elaboration.

TABLE 5. DISCRIMINANT VALIDITY MATRIX (FORNELL-LARCKER CRITERION)

	CS	EA	EP	GHA	T	TSB
CS	0,762					
EA	0,517	0,829				
EP	0,516	0,361	0,794			
GHA	0,574	0,391	0,539	0,778		
T	0,569	0,422	0,425	0,499	0,827	
TSB	0,468	0,401	0,368	0,381	0,274	0,824

Source: Authors' own elaboration.

TABLE 6. DISCRIMINANT VALIDITY MATRIX (HETEROTRAIT-MONOTRAIT RATIO CRITERION)

	CS	EA	EP	GHA	T	TSB
CS						
EA	0,652					
EP	0,653	0,438				
GHA	0,698	0,459	0,650			
T	0,743	0,531	0,539	0,598		
TSB	0,592	0,442	0,495	0,440	0,360	

Source: Authors' own elaboration.

The results indicate that all sustainability objectives related to green hotel performance are supported by the model's discriminant validity, ensuring a clear distinction among the constructs analyzed. Consequently, the findings provide robust empirical support for the validity of the constructs tested within the model (Henseler et al., 2016).

The model fit indicates how well the proposed model reproduces the observed data. The SRMR value of 0.079 is just below the common threshold of 0.08, suggesting an acceptable fit. It is what Williams et al. (2009) indicate. However, the Chi-square statistic is relatively high (1789.818), which may point to some model misspecification, though it's sensitive to sample size. The NFI of 0.866 is below the recommended cutoff of 0.90, indicating room for improvement. The d_ULS (1.903) and d_G (1.502) values reflect residuals; smaller values are better, but interpretation depends on the model context (see Table 7).

5.2. Structural Model Analysis

Structural model analysis assesses the relationships between variables in a theoretical framework, often using techniques like Structural Equation Modeling (SEM). It evaluates how constructs are interrelated, tests hypotheses about these relationships, and estimates direct and indirect effects. This analysis helps validate theoretical models, revealing how variables influence each other and contributing to the understanding of complex systems.

Thus, the choice of PLS over other SEM methods, such as covariance-based SEM (CB-SEM) is justified by the specific objectives of the study, the properties of the data obtained

TABLE 7. FIT SUMMARY

	Saturated model
SRMR	0,079
d_ULS	1,903
d_G	1,502
Chi-square	1789,818
NFI	0,866

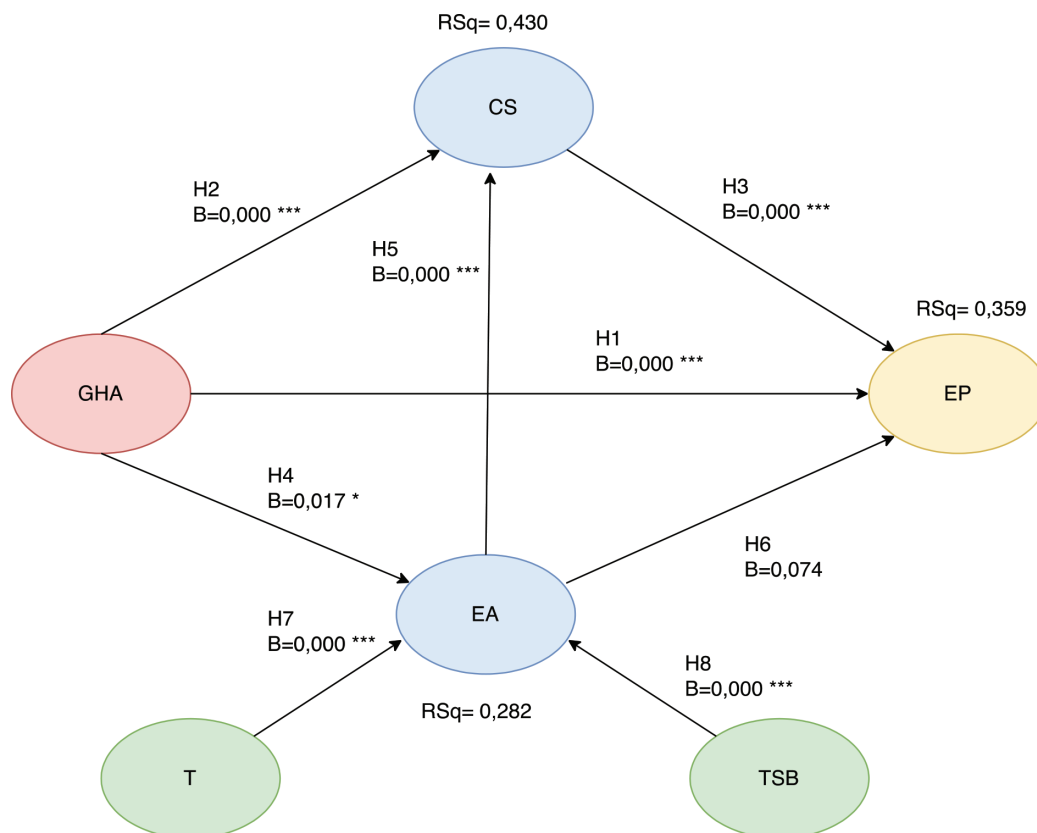
Source: Authors' own elaboration.

and above all by the nature and complexity of the proposed theoretical model, as it includes many constructs and hypotheses (Arenas-Escaso et al., 2024).

The PLS program (SmartPLS 4.1.0.3 version) generates T-statistics for significance testing using bootstrapping, where 10,000 subsamples are taken to compute bootstrap standard errors and approximate T-values for structural path testing. R-squared values, ranging from 0 to 1, indicate the model's predictive capacity. An R-squared above 0.10, with $T > 1.64$, ensures minimum explanatory power (Falk & Miller, 1992). As shown in Table 8, all hypotheses are accepted except for H6 (EA $\rightarrow$ EP). This is reflected in the “sign change,” which affects the reliability of the result, since a coefficient with a variable sign does not allow for a clear conclusion about whether the relationship is positive or negative. Its low statistical significance ($p = 0.074$) further supports its non-acceptance and indicates a weak or inconsistent relationship between the two variables.

The R^2 values indicate the variance explained by independent variables. According to Chin (1998), R^2 values greater than 0.67 are substantial, 0.33–0.67 moderate, and 0.19–0.33 weak. Figure 2 and Table 8 show that our model ($R^2 = 0.282$) provides a good fit to the data. CS (Environmental Certifications) has $R^2 = 0.430$, showing 43% of variance explained by factors like green hotel attributes and performance. EA (Environmental Awareness) has $R^2 = 0.282$,

FIGURE 2. RESULTS OF TESTING THE MODEL



Source: Authors' own elaboration.

TABLE 8. STRUCTURAL MODEL RESULTS. PATH SIGNIFICANCE USING PERCENTILE BOOTSTRAP 95% CONFIDENCE INTERVAL (N = 10.000 SUBSAMPLES)

Hypothesis	Results	Influence	SPC	Sample Mean (M)	Standard Deviation (STDEV)	T Statistic (O/STDEV)	P Values	Change sign
H1	Accepted (*)	GHA -> EP	0,351	0,354	0,058	6,017	0,000	No
H2	Accepted (*)	GHA -> CS	0,438	0,441	0,058	7,512	0,000	No
H3	Accepted (*)	CS -> EP	0,271	0,272	0,070	3,874	0,000	No
H4	Accepted (*)	GHA -> EA	0,154	0,152	0,073	2,115	0,017	No
H5	Accepted (*)	EA -> CS	0,345	0,346	0,053	6,572	0,000	No
H6	No Accepted	EA -> EP	0,083	0,083	0,058	1,446	0,074	Si
H7	Accepted (*)	T -> EA	0,271	0,275	0,064	4,214	0,000	No
H8	Accepted (*)	TSB -> EA	0,268	0,271	0,057	4,720	0,000	No

Significance: *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$

Source: Authors' own elaboration.

suggesting other influences like guest education affect awareness. EP (Environmental Performance) has $R^2 = 0.359$, indicating a strong link between green initiatives and outcomes. Path coefficients show a significant relationship between Green Hotel Attributes and Environmental Certifications. Predictive Relevance Q^2 values indicate strong relevance for CS ($Q^2 = 0.401$), moderate for EA ($Q^2 = 0.257$), and solid for EP ($Q^2 = 0.306$) (Table 9).

Hypothesis H6, which posits that *Environmental Awareness (EA) positively influences Economic Performance (EP)*, is *not accepted* because the statistical evidence is insufficient: the T-statistic is 1.446 and the P-value is 0.074. In hypothesis testing, a common threshold for significance is a P-value < 0.05 . A P-value of 0.074 indicates that the relationship between EA and EP is not strong enough to be statistically significant at the 95% confidence level, although it approaches significance at the 90% level. This suggests a weak or inconclusive relationship between EA and EP in this sample.

6. DISCUSSION

6.1. Green Technologies (T), Environmental Certifications (CS), and Ethical Responsibility in Hotels

Recent studies indicate that the hospitality sector has shown increasing interest in implementing Green Technologies (T), not only to analyze customer behavior and patterns but also to enhance hotel performance (Birim et al., 2024). According to García-Madurga and Grilló-Méndez (2023), AI and machine learning are currently optimizing resources to transform hotel

TABLE 9. STRUCTURAL MODEL RESULTS

	R ²	Sample Mean (M)	Standard Deviation (STDEV)	T Statistic (O/STDEV)	P Values	Q ²
CS	0,430	0,438	0,046	9,433	0,000	0,401
EA	0,282	0,297	0,045	6,285	0,000	0,257
EP	0,359	0,370	0,050	7,128	0,000	0,306

Significance: *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$

Source: Authors' own elaboration.

operations, enhancing customer service, efficiency, and sustainability efforts in the hospitality sector. However, despite the ongoing technological revolution, hotel managers and employees do not yet perceive technology investment as the primary driver of performance improvement.

“Our focus is on achieving recognized environmental certifications over adopting new green technologies. These certifications not only strengthen our reputation but also give our guests confidence in our sustainability efforts. We believe actions that demonstrate real environmental commitment are more meaningful than simply investing in emerging tech.”

or

“We place higher value on earning environmental certifications than on the latest green technology. Certifications directly reflect our dedication to sustainability for guests, investors, and the industry. Right now, we feel tangible practices have a greater impact on resource efficiency than new tech innovations.”

From an ethical standpoint, prioritizing environmental certifications over purely technological solutions aligns with the moral duty of stewardship and responsible hospitality. Achieving sustainability goes beyond profit-driven strategies; it entails an obligation toward environmental justice and the well-being of future generations (Haldorai et al., 2022). Hotel managers acknowledge that certifications serve as verifiable commitments to sustainability, ensuring accountability and transparency in environmental efforts.

On the other side, employees have a similar approach to hotel managers:

“In our work, we’re guided by environmental certifications because they reflect our hotel’s dedication to sustainability in ways guests can easily trust. While green tech is developing, our priority is on actions that make an immediate difference in how we manage resources and serve guests responsibly.”

or

“We’re focused on certifications to show our commitment to sustainability, rather than relying only on green technologies. Earning these credentials gives us a way to improve our daily operations sustainably, and guests recognize our efforts without us needing to rely on emerging tech solutions just yet.”

This perspective is supported by our statistical analysis, where Hypotheses H2 and H5 show the most significant results. Environmental Certifications and Standards (CS) emerge as crucial factors for both hotel managers and employees. The achievement of green certifications stems from both effective management of green hotel attributes (GHA → CS, T-Statistic=7.512) and increased environmental awareness (EA → CS, T-Statistic=6.572), which in turn enhances

green reputation and economic performance (CS → EP, T-Statistic=3.874). These findings reinforce the ethical argument that sustainability should be deeply embedded into corporate social responsibility (CSR) frameworks, ensuring that green commitments are not superficial but integral to a hotel's operational philosophy.

Another interview, replicated across an extensive group of hotel managers, conveys a similar sentiment:

“The environmental certification of a hotel largely depends on how effectively green attributes are implemented. It's not just about installing energy-saving devices or reducing waste; it's about integrating sustainability into daily operations and ensuring the staff and guests embrace eco-friendly practices. Properly executed, these measures create a meaningful impact and demonstrate the hotel's genuine commitment to environmental stewardship, which resonates with environmentally conscious travelers.”

Recognized certifications serve as benchmarks for a hotel's commitment to sustainability, providing credibility in the eyes of guests, investors, and industry stakeholders (Chung, 2020; Abdulaali et al., 2020; Qubbaj & Signes, 2022). Certifications also demonstrate compliance with established environmental standards and regulations, which can be a competitive differentiator (Acampora et al., 2022). They often lead to greater market recognition, attracting environmentally conscious customers, and can enhance a hotel's reputation (Khalil et al., 2024; Qubbaj & Signes, 2022). Beyond their financial benefits, certifications reflect a deeper ethical responsibility, affirming that sustainable development must be driven by genuine care for the planet rather than mere regulatory compliance.

Furthermore, according to Hypothesis H1 (GHA → EP, T-Statistic=6.017), the management of green attributes emerges as the primary driver for improving environmental performance in green hotels. A hotel manager's perspective captures this sentiment:

“In my view, improving environmental performance starts with valuing green attributes as part of our core mission. For us, it's about more than cost savings—it's a commitment to responsible tourism, meeting guest expectations, and creating a healthier, sustainable future for everyone.”

This aligns with Van Huy et al.'s (2024) findings that eco-friendly accommodation demand has driven a 15% annual increase in green hotels since 2020. The impact of green attributes on performance emerges when these attributes successfully integrate place, people, and process through sustainable practices (Khalil et al., 2024), including responsible management of energy, water, waste, and eco-materials, alongside environmental certification implementation (Chua & Han, 2022; Leal-Solís & Robina-Ramírez, 2022).

It is noteworthy that the analysis indicates Ethical Responsibility and Environmental Awareness (EA → EP, T-statistic = 1.446) do not exert a direct influence on the economic performance of green hotels. Instead, their impact is mediated through environmental certifications, which enhance the hotel's reputation and credibility. These certifications foster guest trust and attract environmentally conscious travelers, leading to higher occupancy rates, increased customer loyalty, and improved financial outcomes. Greater environmental awareness drives the implementation of more robust sustainability initiatives, facilitating the attainment of recognized certifications. In turn, these certifications strengthen brand value and corporate image. This relationship is empirically supported by previous studies, such as those by Hameed et al. (2022).

While EA is shown to improve *Environmental Performance* through ethical practices, resource management, and stakeholder engagement, its *direct* economic impact is less immediate or measurable. Implementing environmentally responsible practices often incurs initial costs—green certifications, eco-designs, and employee training—which may not translate into

short-term profits. Although EA contributes to brand value, trust, and customer loyalty, these benefits tend to manifest over time and may be moderated by external factors such as market demand, governmental incentives, or competitive pressures.

Moreover, barriers such as financial constraints, lack of policy support, and managerial limitations (Luo et al., 2021) can hinder the translation of EA into economic gains. EA fosters ethical responsibility and long-term sustainability, but this does not automatically yield measurable financial performance unless combined with strategic investment, marketing alignment, and consumer readiness to pay premium prices.

Thus, although EA is crucial for long-term sustainability and stakeholder engagement, the evidence from the analysis suggests it does not yet have a statistically significant direct impact on short-term economic outcomes in hotels—explaining why H6 is not accepted. It's possible that EA acts more as a *mediator* through improved *environmental performance*, which *then* contributes to economic benefits.

7. CONCLUSIONS

The Spanish tourism sector, a vital contributor to the nation's economy, is undergoing a significant transformation toward sustainability. Anchored by initiatives such as the “Tourism Strategy for Sustainable Development 2030,” this shift reflects a holistic integration of environmental, social, economic, and ethical dimensions. These policies align with the findings of this study, which underscore the importance of environmental certifications, operational efficiency, ethical responsibility, and stakeholder engagement in driving the performance of green hotels. As international tourism increases, Spanish hotels face mounting pressure to adopt eco-friendly practices not only as a strategic advantage but also as an ethical obligation to future generations. However, gaps remain in understanding how specific parameters—identified through hotel managers' and employees' perspectives—can enhance economic and environmental performance, necessitating further exploration.

A notable insight from this research is the prioritization of environmental certifications over green technology. While technology such as AI and machine learning is revolutionizing hospitality operations, hotel managers and employees emphasize the value of certifications in building reputation, guest trust, and demonstrating ethical commitment. These certifications serve as benchmarks of environmental stewardship, aligning with customer expectations and fostering confidence among stakeholders. As statistical analysis confirms, environmental certifications significantly impact economic performance through enhanced reputation and operational efficiency. Managers recognize certifications as strategic tools that validate their efforts and provide competitive advantages in an increasingly eco-conscious market while reinforcing their ethical responsibility toward sustainable tourism.

Green hotels can achieve sustainable performance by optimizing resources such as water, energy, and waste through eco-friendly technologies. This approach not only reduces operational costs but also ensures compliance with environmental regulations, bolstering overall efficiency. However, beyond regulatory compliance, adopting sustainable practices must be seen as an ethical imperative. The success of such strategies relies heavily on effective resource management and the seamless integration of sustainable practices into daily operations. Managers must focus on implementing green attributes beyond symbolic gestures, ensuring these practices align with broader environmental and ethical goals, reinforcing their duty to act as responsible stewards of natural resources.

Employee training emerges as another critical factor in advancing green hotel performance. Investing in comprehensive training programs equips staff with the skills to adopt advanced

environmental management techniques and green technologies. This investment enhances ecological awareness within the organization, enabling employees to actively contribute to sustainability efforts while fostering a culture of ethical responsibility. Furthermore, fostering an organizational culture that values sustainability strengthens a hotel's reputation and attracts eco-conscious clientele. This cultural shift requires integrating environmental objectives into corporate strategies, setting measurable ecological performance metrics, and encouraging active employee participation in sustainability initiatives as a reflection of corporate ethics and social responsibility.

This study, like any research, has certain methodological and theoretical limitations that should be considered. One major limitation is the cross-sectional nature of the study, conducted within a specific time frame. This characteristic may restrict the external validity of the results, as it does not allow for comparison with findings from other periods. Additionally, this study focused exclusively on green hotels located in Spain, limiting the generalizability of the results to an international level. Replicating this study in different countries and regions, and across various time periods, would provide greater external validity and allow for cross-cultural comparisons, thus enriching the global understanding of factors influencing environmental and ethical performance in green hotels.

Future research should delve deeper into the mechanisms linking sustainable practices to economic performance, addressing existing gaps in knowledge. Exploring these connections can inform policies and strategies that enhance sector competitiveness while preserving the environment and upholding ethical standards. The findings highlight the need for a balanced approach that integrates environmental, technological, human, and ethical factors. By doing so, green hotels can navigate the complexities of sustainable tourism, ensuring their operations contribute positively to environmental stewardship, guest satisfaction, economic resilience, and ethical integrity. This study underscores the role of collective effort—spanning policymakers, managers, employees, and guests—in driving the hospitality industry's transformation toward a more sustainable and ethically responsible future.

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AUTHOR'S CONTRIBUTION

'Conceptualisation, J.A.F., A.L.S., J.M.R. and R.R.R.; Methodology, A.L.S. and J.A.M.; Data collection, R.R.R., J.A.M. and J.M.R.; Data analysis, J.A.F. and J.M.R.; Writing - Preparation of original draft, R.R.R. and J.A.F.; Writing - Review and editing, J.A.M., and A.L.S.; Supervision, R.R.R. and J.A.F.'

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