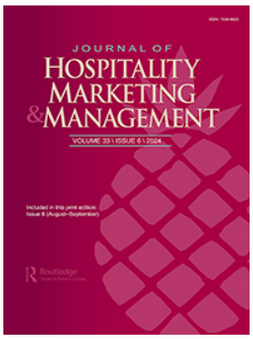

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The antecedents of top management's involvement in green technology innovation

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ABSTRACT

Green technology innovation is a vital strategic driver for the sustainable development of an organization and is pitched toward energy conservation, pollution mitigation, and waste recycling. This study investigates the influence of the green technology orientation of the top management on a hotel's green competitive advantage. It considers the effects of green human capital, green structural capital, and green relational capital. It adopts a partial least square structural equation model (PLS-SEM) to test hypotheses using 380 data samples from top employees of hotels in the USA. The statistical results show that corporate environmental ethics, stakeholder pressure, and market demand for green processes positively affect green technology involvement. Furthermore, findings of green human and structural capital positively affect green competitive advantage. The study sheds light on the significance of green competitive advantage in the hotel industry while providing novel perspectives on the deficiencies and vulnerabilities of the competitive hotel business.

摘要

虽然"人工智能"一词出现在产品描述中可能被视为该产品具有先进功能的标志,但它也可能引发消费者的恐惧和担忧. 因此,本研究探讨了商品和服务描述中"人工智能"一词的包含(与排除)对消费者购买意愿的影响. 它还考察了情感信任的中介作用和感知产品风险在这种关系中的调节作用. 我们进行了六个实验来研究这些关系. 使用T检验和Hayes过程宏观模型4和7对数据进行分析. 研究结果表明,在产品和服务的描述中加入"人工智能"一词会降低购买意愿,而情感信任会调节这种关系. 研究结果进一步表明,与低风险产品相比,高风险产品的情感信任对人工智能术语对购买意愿影响的负面中介作用更强. 这些发现为学术界和从业者提供了宝贵的见解,使他们能够在人工智能的应用中制定更有效、更具吸引力的策略.

KEYWORDS

Top management; green technology; green human capital; green structural capital; green relational capital; green competitive advantage

Introduction

According to the World Tourism Organization, the tourism industry accounts for 8% of global carbon emissions. With the emergence of sustainable development goals, the hospitality industry must adopt green technologies to reduce its environmental footprint. Since unsustainable business responsibilities influence the destruction of natural resources,

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attending to ecological challenges poses a significant obstacle to management authority (Haldorai et al., 2022; Ilyas et al., 2020). For this reason, managers need to adopt a practical perspective to safeguard the environment against the hostile influences of their actions, such as by reducing the use of natural resources and embracing green activities (Munawar et al., 2022; J. Park et al., 2014). Furthermore, green innovation can be categorized into two main activities: the development of eco-friendly products and the implementation of sustainable processes aimed at pollution mitigation, waste minimization, the minimization of energy consumption, and resource recycling, alongside various other environmental management practices (Dang & Wang, 2022; Sun et al., 2022).

The application of green technologies to hospitality firms has a long history and has been carried out for decades; among the first applications were solar panels for hotels and the use of recycled materials (Gunduz Songur et al., 2023). Besides, Marques (2023) mentions that green transformation in the hotel industry encompasses energy management systems, guest room management systems, property management systems, and building management systems. As time passes, new technologies have contributed to an increase in green actions within the hospitality industry, which serves as a crucial strategic driver for achieving energy conservation, pollution mitigation, and waste recycling (Chan et al., 2017). Since the hospitality industry contributes directly to environmental concerns, the preservation of the environment has remained a critical issue (M. J. Kim & Hall, 2020).

Although previous studies have revealed some driving factors in, and barriers to, the adoption of green technologies in the hospitality industry, there are still some research gaps. The collective outcomes of existing studies have uncovered several challenges within the current situation of the hotel industry. These challenges make it more necessary to believe in and value the involvement of top management in adopting green technology. Conversely, an unexplored gap that remains in the hospitality literature concerns how top management's involvement in adopting green technology achieves a competitive advantage within the hotel sector (Gürlek & Tuna, 2018). Consequently, this research aims to investigate the following specific research questions: (1) what are the antecedents of the involvement of a hotel's top management in green technological innovation? (2) what practical tools with green aspects are used to achieve the performance of above-average services and marketing? (3) how does the top management's use of green structure enhance organizational competitive advantages?

To solve the research gap, this study investigates the main elements of top managers' involvement in the adoption of green technology that must take place in hotels to address the types of capital connected to green competitive advantage. The study also develops the existing knowledge of green human capital, green structural capital, and green relational capital to evaluate the green perspective. These concepts are helpful for introducing new strategic elements to address the competition and to work extremely fast to take advantage of sustainability at the decision-making level. By examining the proposed model and testing the corresponding hypotheses, this study is one of the first works to consider such a complex framework and the relationships among numerous constructs. It links corporate environmental ethics, stakeholder pressure, and market demand for green processes with green human capital, green structural capital, and green relational capital by the mediation of top management's green technology involvement. The authors are optimistic that the novelty and effectiveness of the study will contribute to the understanding of the role of top management in adopting green technologies in the hotel industry.

Theoretical background

Green technology in hospitality

Adopting eco-friendly technology has become popular in the hotel industry because of the urgent need to decrease the hospitality sector's carbon footprint. Preserving the planet and promoting sustainable development principles are vital aims that have led to a growing interest in implementing green practices within the hospitality and tourism sector (Cabral & Jabbour, 2020). Eco-friendly management in hotels refers to operating these establishments with a strong emphasis on employing green technology (Choudhary & Datta, 2022). In the past, the hospitality and tourism industry has been slow to embrace sustainable actions and practices (Mejia, 2019). This delay has prompted governments to introduce environmental regulations under the influence of the growing environmental awareness of consumers (Xu & Gursoy, 2015).

Enhancing the green component in the hospitality industry requires different technologies covering renewable energy (Fischer et al., 2018; Mahachi et al., 2015), recycling and waste management systems (Tansel et al., 2021), energy management systems (Wu & Tsai, 2015), green building design (Tanveer et al., 2023), sustainable food and beverage practices (Martin-Rios et al., 2020), energy-efficient lighting (Verma & Jain, 2016), smart thermostats and heating, ventilation and air conditioning systems (Thakur, 2022), water-saving fixtures (Razumova et al., 2016), and e-mobility solutions (Ray, 2020).

Considering the specific nature of the topic, this paper uses the Resource-Based View (RBV). However, to proceed, it is essential to use the analytical scheme of the VRIO framework (J. Barney, 1991), which lends itself to an accurate analysis of network resources. The VRIO framework considers that resources must be organized to have a sustainable competitive advantage (Hossain et al., 2022). Valuable resources allow the company to obtain benefits in terms of cost or to increase its market share (Miao et al., 2017). Rarity depends on whether competing firms own the same resource. In addition to being valuable and rare, if a resource is to allow sustainable competitive advantage, it must not be easy to imitate. Regarding organizational variables, hospitality firms require proper organization, which translates into efficient governance. Therefore, if a resource is valuable, rare, and difficult for organizations to imitate and exploit, it can generate a sustainable competitive advantage. Although a firm will have a set of various resources, green intellectual capital is an essential intangible resource and contributes to the green well-being of hotels (Pham et al., 2019).

Resource-based view (RBV) and stakeholder theory

Since the RBV has gained ground over time through its theoretical and practical contributions, it has been defined as a significant theory in strategic management studies (Helfat et al., 2023). According to the RBV, the reasons for competitive advantage are to be found in the control or availability of resources and skills with specific characteristics. In this view, resources are considered strategic when they are valuable (able to reduce threats and allow opportunities to be caught, reducing costs and increasing revenues), rare (not possessed by all firms in the sector), complex or costly to imitate, and used by the organization.

The Green Hotel Association has defined a green hotel as a structure accommodation that follows environmentally friendly programs and practices, such as saving energy and water, waste reduction, and recycling, which protect the environment and reduce operating

costs (Verma & Jain, 2016). In recent years, the total amount of waste produced by hotel guests has obviously increased because of increased tourist flows and over-tourism. The RBV has been used in managerial studies to highlight the importance of the dependency between the theory and the level of sustainability in hotel firms, as well as the importance of reducing the use of green resources (Hossain et al., 2021). There is a conviction that an increased presence of environmentally knowledgeable and skilled top managers plays a significant role in advancing the development of an environmentally conscious organization (Yong et al., 2019). In line with the RBV, green relational capital emerges as a vital asset in cultivating distinctive capabilities for individual firms and entire supply chains (Yu & Huo, 2018).

According to the stakeholder theory, top managers must not only deliver a satisfactory return on investment to shareholders but also safeguard the welfare of diverse stakeholders, including customers, suppliers, employees, the community, and the environment (Freeman & Liedtka, 2023). This theory acknowledges that the primary goal of any organization is to generate value and that this value should be distributed among all stakeholders, both internal and external. Consequently, stakeholder theory underscores the significance of considering each stakeholder's interests, and it has garnered substantial attention in the academic literature (Rhou & Singal, 2020). Scholars in the hospitality field have also placed a strong emphasis on stakeholder theory in relation to following green practices and obtaining a green competitive advantage (Srivastava & Singh, 2021). Research has shown that the theory plays a crucial role in pinpointing green issues in the hospitality sector and formulating policies aligned with the expectations of different stakeholders (González-Rodríguez et al., 2019). These two rational theories underpin the proposed model (see Figure 1).

Development of hypotheses

Antecedents of top management's involvement in green technology

When hospitality firms prioritize environmental ethics and incorporate sustainability principles into their core values, they set a solid foundation for embracing green technologies throughout their operations (Chan et al., 2017). A commitment to environmental ethics instills a sense of responsibility and accountability within top managers,

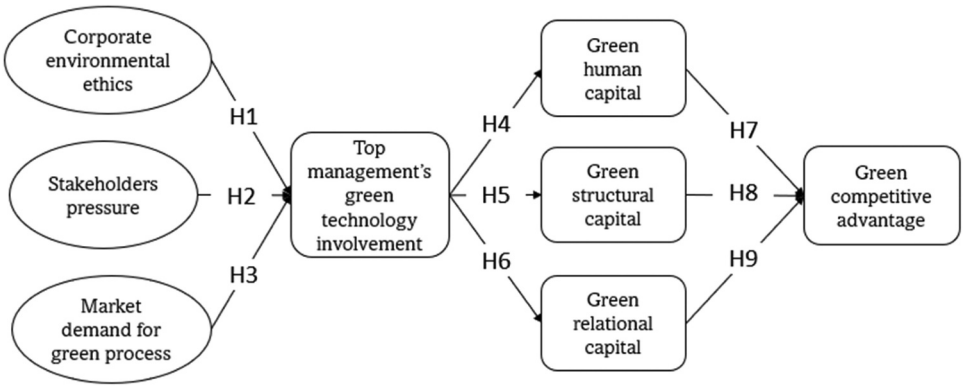

Figure 1. Proposed model.

encouraging them to seek and actively embrace green technology solutions (Jones et al., 2016). These ethical principles guide decision-making processes, prompting leaders to invest in eco-friendly technologies, renewable energy sources, and environmentally conscious practices (Y. Jiang & Gao, 2019). Moreover, corporate environmental ethics foster a culture of environmental stewardship within the organization, making green technology involvement a natural extension of the company's identity (Linneberg et al., 2019). As ethical considerations become integral to the corporate DNA, top management is more inclined to allocate resources to the research, development, and implementation of green technologies, driven by the shared vision of sustainable business practices (Leonidou et al., 2013; Luu, 2022).

H1: *Corporate environmental ethics relate to top management's involvement in green technology.*

When a hospitality firm considers the perspectives and concerns of its stakeholders regarding environmental sustainability, it fosters a sense of shared responsibility and commitment to the adoption of green technologies and eco-friendly practices (Barber et al., 2011). Stakeholders, including customers, employees, investors, suppliers, local communities, and regulatory bodies, have a personal stake in the environmental impact of the hospitality firm (Tsai et al., 2012). Their views and expectations regarding sustainability and responsible business practices significantly influence top management's decisions. As stakeholders increasingly demand greater environmental consciousness and accountability, top management must respond by integrating green technologies and sustainability initiatives into the company's operations (Chan et al., 2017).

H2: *Stakeholder pressure relates to top management's involvement in green technology.*

The influence exerted by customers is connected to the extent of top management's engagement with green technology. This paper distinguishes stakeholder pressure from market demand, as has already been underlined in previous studies (Weng et al., 2015). Regarding market demand, it is necessary to consider the possible market segmentation variables (customers' requirements for green products, price flexibility, and customer benefits). The concept of pressure implies a more determined commitment and attention (influence by the stakeholder). In green technology, besides considering market demand and segmentation, it is essential to consider that there are classes of consumers who are encouraging the adoption of green technologies worldwide. This generates a collective action that, if not addressed, can even threaten a company's reputation, which explains the interest and involvement of top management in the issue (El-Kassar & Singh, 2019).

As environmental consciousness becomes a critical factor in purchasing decisions, hotels must align their strategies with these changing preferences (Martínez-Martínez et al., 2021). Top management then recognizes that investing in green technologies is a responsible choice and a strategic imperative that allows the cost structure to be monitored and efficient solutions for greener hospitality to be implemented (F. Jiang & Kim, 2015). Moreover, market demand for sustainable products and services drives innovation and technological

development. Top managers then realize that incorporating green technologies can enhance service efficiency, reduce waste, and minimize environmental impact, which meets the expectations of environmentally conscious guests (Berezan et al., 2013).

H3: *Market demand relates to top management's involvement in green technology.*

Top management's involvement in green technology and the dimensions of this involvement

Top management plays a pivotal role in shaping an organization's sustainability strategy and driving the adoption of green technologies. Understanding how the involvement of top management influences the integration of green technology within the hospitality sector is crucial for advancing sustainable practices and achieving long-term environmental, social, and economic benefits. Previous researchers have highlighted the fact that strategic decisions belong at the individual level in an organization (Felin & Hesterly, 2007). Therefore, there have been calls for research into the concept of intellectual capital and its applicability in the specific sustainability domain (Chen, 2008). The complete inventory of intangible assets encompasses knowledge, abilities, and connections related to environmental conservation or green innovation at an organizational level to gain a competitive advantage (López-Bernabé et al., 2021).

The green technology initiatives of top management include spreading green technology practices, respecting environmental sustainability regulations, and raising consumers' ecological consciousness (Huang & Kung, 2011). The existing literature recognizes three dimensions here: green human capital, green structural capital, and green relational capital (Yong et al., 2019). Although scholars agree that human capital can generate a sustainable competitive advantage, it is worth emphasizing that employees can also explain the possible volatility of human resources from one organization to another (Datta & Iskandar-Datta, 2014). RBV supports the idea that top management's commitment to green technology can be a valuable and unique resource that enhances green human capital. Due to this specificity, top management's role in promoting and disseminating elements of green technology throughout the organization has a solid firm-specific effect.

H4: *Top management's involvement in green technology relates to green human capital.*

Another essential concept in the landscape of green intellectual capital is green structural capital. This encompasses the tangible resources and intangible assets that drive an organization's commitment to environmental protection and green innovation. These assets, including knowledge management systems, reward structures, and organizational culture, form the bedrock upon which an eco-friendly and socially responsible organization is built. This corporate culture and the systems, processes, standards, routines, and technologies are acquired, built, shaped, and exploited by top management (M. Ali et al., 2023). Top management's involvement in green technology also creates a green organizational culture that is part of green structural capital and can instill a green mind-set at all levels of the organization. Top management's involvement in green technology enhances the intangible infrastructure and reinforces green systems, platforms, and knowledge inside the organization.

According to the RBV, top management's involvement in green technology contributes directly to the development of green structural capital. Even if top managers possess the highest intellectual capabilities, the absence of an effective organizational structure, systems, and processes to facilitate their contributions renders the organization unable to realize its complete potential (T. Kim et al., 2012). The role of top managers therefore lies in the coordination and organization of structural capital, serving the purpose of safeguarding knowledge derived from previous successful implementations, and creating environmentally friendly procedures (Li & Liu, 2018).

H5: *Top management's involvement in green technology relates to green structural capital.*

In the boundaries of the business landscape of a firm, sustainability and environmental consciousness are critical factors for success. As defined by Chen (2008, p. 278), green structural capital encompasses the company's interactive relationships with customers, suppliers, network members, and partners, all revolving around corporate environmental management and green innovation. These relationships function as a reservoir of opportunities that enable the organization to thrive and gain a competitive edge in the market. The significance of relational capital extends beyond the mere transactional aspect of business, if we take stakeholder theory into account. Indeed, Ferrary and Claude Paraponaris Dr Martine Sigal (2015) emphasized its intangible nature, highlighting the importance of nurturing and preserving strong relationships with various stakeholders that can influence the organization's position in the market. In a world where reputation, trust, and social responsibility matter, organizations must build and maintain positive relationships with stakeholders who share their values.

H6: *Top management's involvement in green technology relates to green relational capital.*

Green intellectual capital and green competitive advantage

Organizations must recognize that human capital is their most critical asset in pursuing environmental sustainability. Investing in employees' training, ecological knowledge, and skills is a strategic move and a moral imperative today (Cabral & Jabbour, 2020; Choudhary & Datta, 2022). A knowledge-sharing culture plays a pivotal role in this process. Participating in environmental projects enhances individuals' tacit environmental knowledge, leading to a better understanding of how to identify the critical points for energy consumption, and the use of high-consumption resources (Boiral & Paillé, 2012). The development of employees' awareness of and sensitivity toward the environment can be translated into a greater propensity for conformity to environmental standards and into cost reductions connected to the more appropriate use of natural resources. Furthermore, in terms of competitive advantage, green human capital can shape organizational productivity, particularly in fostering innovation (Munawar et al., 2022). It assimilates organization-specific characteristics that prove more advantageous for the green initiatives of one establishment than those of its market competitors (Irani et al., 2022).

H7: *Green human capital relates to an organization's green competitive advantage.*

Prior research has consistently shown that structural capital is vital for achieving a competitive advantage (Yaseen et al., 2016). Green structural capital emerges when environmental knowledge is converted into codified routines, activity rules, and procedures, transforming tacit knowledge into a systematic and shareable resource (Astuti & Datrini, 2021). Such organizational structures allow the organization to fortify itself in the light of green principles. The company can then strengthen its competitive position while contributing positively to environmental conservation and societal well-being.

Green structural capital, therefore, forms the foundation for a hospitality firm's competitive advantage. It enables the firm to engage in diverse green business activities and innovations, often centered around eco-friendly technologies, well-designed organizational structures, an environmentally conscious culture, and efficient management systems (Yusliza et al., 2020). In terms of competitive advantage, green structural capital can be employed in R&D initiatives to craft environmentally sustainable products and services that align with the preferences and needs of customers (Haldorai et al., 2022). Consequently, a competitive edge is likely to emerge through the strategic alignment of green structural capital with innovation, environmentally friendly practices, and the generation of environmentally sustainable products and services based on solid differentiation (Espino-Rodríguez & Ramírez-Fierro, 2017).

H8: *Green structural capital relates to an organization's green competitive advantage.*

By leveraging the green knowledge and skills acquired through network relationships (referred to as green relational capital), a hospitality firm gains the ability not only to develop but also to enhance its green products and services, effectively meeting the evolving needs of its customers (S. Huang et al., 2022). According to the RBV, green relational capital holds a unique and valuable position within a hospitality company, originating in distinctive relationships with various partners. As a strategic resource, green relational capital can generate significant value and can contribute to the hospitality company's competitive advantage (Tosun et al., 2022). Therefore, when a hospitality company embraces a strategic orientation emphasizing green innovation, it opens up avenues to acquire green relational capital from its network relationships, creating enhanced competitive advantages. Hence, we propose the following hypothesis:

H9: *Green relational capital relates to an organization's green competitive advantage.*

Methods

A survey-based questionnaire was employed to gather relevant data, with all the measurement scales adapted and modified from prior research (see Appendix A). Using a seven-point Likert-type scale, items for corporate environmental ethics, stakeholder pressure, and market demand for green processes were adopted from the paper by El-Kassar and Singh (2019), and top management's involvement in green technology was measured using the scale by Ilyas et al. (2020). The measurement of green human capital, green structural capital, and green relational capital was adopted from the scale by Dang and Wang (2022). Finally, green competitive advantage was measured using a scale adapted from the paper by

Muisyo et al. (2022). Non-probability purposive sampling was used to determine the sample size, following the recommendation of Krejcie and Morgan (1970). The "rule of thumb" that indicates that the number of items (37) should be divided by ten to validate the PLS-SEM sample size was used.

Before sending out the questionnaire to the target respondents, a pilot study was conducted to ensure its validity. For the pilot study, 50 questionnaires were distributed. The pilot study results indicated no issues with the questionnaire's validity. To obtain the survey questionnaire results, approximately 410 hotel departmental supervisors, managers, and top managers (e.g., chief executive officers) were approached by McKibbon Hospitality Group in Tampa, Florida. This group runs the most iconic hotel brands (from Marriott and Hilton to Hyatt and Kimpton) around the US. The human resources (HR) director of McKibbon was contacted to check the questionnaire, and the purpose of the study was described. After the HR director had given their approval, a survey questionnaire was delivered through the HR office to participants so they could participate in the survey during their free time. The data collection produced 410 responses, of which 30 were incomplete demographic information, so 380 questionnaires were selected for analysis. The data collection was carried out between April and June 2023 (three months). The objective was to obtain responses that would adequately represent the entire scenario of green technology innovation in the United States hotel industry.

Data collection and analysis procedures

PLS-SEM was considered to be the most suitable method for achieving the objective of the survey. It is one of the principal methodologies in social sciences, especially from a quantitative perspective. In this case, given that the aim of the research was to explore and analyze the hypotheses, PLM-SEM is the most appropriate analytical procedure (Kock, 2015). PLS-SEM is well-suited to intricate models involving numerous latent variables and indicators. It exhibits strong resilience when dealing with small sample sizes and is less prone to being affected by deviations from standard assumptions. The alternative, covariance-based structural equation modeling (CB-SEM), is commonly suggested for studies with higher sample sizes and data that follow a more normal distribution. It is more suitable when the emphasis is on the adequacy of the model and the estimation of population parameters. PLS-SEM is more flexible regarding the assumptions it makes about the distribution of the data. As a non-parametric method, it applies to data that may not meet rigorous distributional constraints, as it does not presuppose multivariate normality. Violations of the multivariate normality assumption may impact the results of CB-SEM. The reliability of CB-SEM results can be compromised if the data exhibit substantial non-normality.

Two main procedures were used to study the latent variables: measurement and structural modeling. Measurement assessment allows the latent variables to be measured (J. F. Hair et al., 2019), extracting them from other variables and sharing their variance with the other variables. Therefore, it opens the spectrum of analysis, estimates the latent variables as a function of the correlation with the data, and has several advantages, such as reducing the data dimensions and working on multiple indicators to better drive the correlation with the dataset. The structural assessment determines the relationships of the proposed model. However, this model's latent variables are singled out in advance from

theoretical and consolidated knowledge (J. F. Hair et al., 2011). With such integrations, the PLS-SEM model can measure latent variables or evaluate the dependencies in different pathways. Besides, when the object of analysis is still not widely developed, the PLS-SEM allows us to explore causal relationships following reflective measurements as a Mode (A).

The study utilized PLS-SEM to evaluate the internal variance inflation factor (VIF) values to identify the Common Method Bias (CMB). When the VIF is above 3.3, this suggests that multicollinearity may affect the model, as stated by Kock (2020). Thus, if all VIFs in the inner model, as determined by a comprehensive collinearity test, are less than or equal to 3.3, the model can be deemed devoid of CMB. In the present exploration, the VIF values are below the threshold of 3.3. This indicates that there is no CMB issue. The CMB was then evaluated using the HT – MT (Heterotrait – Monotrait) ratio. As stated by Nitzl (2016), the presence of CMB is proved if there is a strong correlation ($r > 0.90$) between the main variables. However, all the correlation values between the variables are below 0.90, as shown in Table 3. This confirms the absence of CMB, as the most significant correlation value observed is 0.708.

Descriptive findings

In the present study, 65.5% of the hotels' top employees were male and 34.5% were female. The lowest percentage of respondents (8.8%) were aged between 25 and 30 years, while the highest percentage (38%) were between 45 and 50. Most of the employees were white/Caucasian (49.1%), while Asian employees (19.5%) had the lowest representation in the hotels. Furthermore, the survey found that 26.3% of the respondents had a high school diploma, 45.2% had an undergraduate degree and 23.9% were post-graduates. As regards job positions, 35.1% of the responses were from supervisors, which is the largest group, and 9.3% were from chief executive officers. Finally, 75.3% of the respondents were married, while the lowest percentage (16.1%) were in the group of respondents separated from their partner.

Assessment of the measurement model

The indicator loadings reached the recommended values of more than 0.70 that ensure indicator reliability for every variable in the model. According to the advice of F. Ali et al. (2018), the study variables were analyzed using the consistent algorithm approach to determine whether they exhibited convergent or discriminant validity. A minimum item loading of 0.60, a composite reliability (CR) of greater than 0.70, and an Average Variance Extracted (AVE) of greater than 0.50 are required to demonstrate convergent validity. Table 1 represents all the variables that had Cronbach's alpha (α) values between 0.741 and 0.930, CR values that ranged from 0.787 to 0.947, and AVE values that ranged between 0.612 and 0.847, which are the ranges recommended by J. Hair and Alamer (2022).

All the variables were considered reliable as they met the minimum threshold for reliability and were found to meet the concurrent validity criterion, as reported by Ramayah et al. (2018). To establish discriminant validity, it is necessary to determine and establish the Fornell – Larcker criteria and the HT – MT value. Initially, the Fornell – Larcker criterion was applied to determine whether the constructs in question possessed

Table 1. Construct validity and reliability.

Construct	Loadings	Cronbach's alpha	CR	AVE
Corporate environmental ethics	0.919	0.907	0.941	0.843
	0.908			
	0.927			
Stakeholder pressure	0.823	0.930	0.947	0.781
	0.831			
	0.768			
	0.742			
	0.731			
Market demand for green processes	0.730	0.856	0.899	0.816
	0.927			
TMGTI	0.874	0.925	0.947	0.692
	0.849			
	0.887			
	0.862			
	0.848			
Green human capital	0.714	0.897	0.921	0.664
	0.885			
	0.833			
	0.883			
Green structural capital	0.920	0.885	0.866	0.629
	0.880			
	0.892			
	0.881			
Green relational capital	0.912	0.741	0.787	0.612
	0.922			
	0.888			
	0.891			
Green competitive advantage	0.872	0.915	0.936	0.747
	0.913			
	0.892			
	0.880			
	0.862			

discriminant validity. In most cases, the square roots of the AVE and the correlation coefficients were employed to test the validity of the discriminant function. As seen in Table 2, the square root of the AVE for each variable was higher than the correlation coefficient between that variable and the other variables. Because the correlations are lower than the values shown in bold, discriminant validity between the variables in this study was confirmed.

The evaluation of discriminant validity was then improved by considering the HT – MT ratio. This approach entails assessing the correlations between distinct constructs and comparing them to the correlations among items within the same construct. A ratio of less than 0.9 is considered satisfactory (Henseler et al., 2015). The results indicate that the

Table 2. Fornell–Larcker criterion for discriminant validity.

	1	2	3	4	5	6	7	8
(1) Corporate environmental ethics	**0.844**							
(2) Green competitive advantage	0.166	**0.890**						
(3) Green human capital	0.158	0.233	**0.829**					
(4) Green relational capital	0.085	0.471	0.529	**0.846**				
(5) Green structural capital	0.200	0.274	0.742	0.675	**0.841**			
(6) Market demand for green processes	0.174	0.146	0.189	0.093	0.182	**0.886**		
(7) Stakeholder pressure	0.513	0.094	0.138	0.113	0.161	0.269	**0.877**	
(8) TMGTI	0.145	0.283	0.619	0.332	0.585	0.424	0.164	**0.882**

Table 3. HT – MT (heterotrait – monotrait) ratio.

	1	2	3	4	5	6	7	8
(1) Corporate environmental ethics								
(2) Green competitive advantage	0.190							
(3) Green human capital	0.201	0.275						
(4) Green relational capital	0.107	0.512	0.652					
(5) Green structural capital	0.252	0.312	0.504	0.771				
(6) Market demand for green processes	0.194	0.158	0.227	0.115	0.208			
(7) Stakeholder pressure	0.622	0.116	0.170	0.142	0.189	0.328		
(8) TMGTI	0.160	0.328	0.708	0.381	0.673	0.469	0.191	

correlation values between the latent variables consistently remained below the threshold of 0.9, as highlighted and demonstrated in Table 3. These results confirm that the measurement constructs in this study have clear and sufficient discriminant validity.

The Standardized Root Mean Residual (SRMR) statistic was also used to evaluate the quality of the model. The precise value of the SRMR was 0.079, which is acceptable according to the recommendations of F. Ali et al. (2018). This indicates that the model is adequate, with moderate effects and predictive relevance. According to Cheah et al. (2018), the R^2 and F^2 values for direct involvement of top management green technology innovation (TMGTI), green human capital, green structural capital, green relational capital, and green competitive advantage can be considered satisfactory. It is also advised that the intensity of the Q^2 values be examined as a measure of predictive accuracy and a criterion of predictive importance. The blindfolding procedure obtains the PLS path model's Q^2 value for the latent variables. All the Q^2 measurements are above 0.317. Table 4 displays the values of R^2, Q^2, and F^2.

Assessment of the structural model and testing of hypotheses

The study utilized PLS-SEM and consistent bootstrapping techniques to test the proposed hypotheses. The analysis was conducted on the data from 380 respondents, with over 5,000 resamples being used to examine the direct effects (Rasoolimanesh et al., 2021). The results are presented in Table 5. The salient findings of the PLS-SEM were that corporate environmental ethics and TMGTI have a significant relationship ($\beta = 0.143$, $t = 1.705$, and

Table 4. Quality of the model and fit indices.

Variables	R^2 (Coefficient determination)	Q^2 (Predictive relevance)	f^2 (Effect size)	SRMR (Standardized root mean residual) (Model fit)
Corporate environmental ethics			0.025	0.079
Stakeholder pressure			0.015	
Market demand for green processes			1.085	
TMGTI	0.662	0.317	1.097	
			0.245	
			0.376	
Green human capital	0.523	0.415	0.022	
Green structural capital	0.273	0.353	0.023	
Green relational capital	0.197	0.343	5.308	
Green competitive advantage	0.944	0.654		

Table 5. Test of hypotheses.

						Confidence interval bias corrected		
Hypothesis	Relationship	B	Std. Dev.	t-values	*p*- values	2.50%	97.50%	
H1	CEE→TMGTI	0.143	0.018	1.705	0.003	0.078	0.156	Supported
H2	SP→TMGTI	0.041	0.016	2.667	0.008	0.073	0.113	Supported
H3	MDGP →TMGTI	0.114	0.017	2.823	0.005	0.145	0.220	Supported
H4	TMGTI→GHC	1.001	0.012	34.980	0.000	0.778	0.924	Supported
H5	TMGTI→GSC	0.781	0.041	18.936	0.000	0.693	0.855	Supported
H6	TMGTI→GRC	0.013	0.068	0.197	0.844	−0.120	0.146	Unsupported
H7	GHC→GCA	0.723	0.022	33.244	0.000	0.676	0.763	Supported
H8	GSC→GCA	0.444	0.054	8.142	0.000	0.327	0.540	Supported
H9	GRC→GCA	0.523	0.052	9.967	0.000	0.408	0.618	Supported

Note: *$p \le 0.001$ or $t \ge 3.29$; **$p \le 0.01$ or $t \ge 2.58$; ***$p \le 0.05$ or $t \ge 1.96$; β = path coefficient.
CEE: corporate environmental ethics, SP: stakeholder pressure, MDGP: market demand for green processes, TMGTI: top management's green technology involvement, GHC: green human capital, GSC: green structural capital, GRC: green relational capital, GCA: green competitive advantage.

p-value = 0.003); as a result, H1 was supported. The relationship between stakeholder pressure and TMGTI (β = 0.041, $t = 2.667$, and $p = 0.008$) was shown to have a considerably significant effect and this supports H2. Market demand was shown to have a considerable significant effect on TMGTI (β = 0.114, $t = 2.823$, and $p = 0.001$), and the findings support H3.

The relationship between TMGTI and green human capital (β = 1.001, $t = 34.980$, and $p = 0.000$) was confirmed, with the findings showing a considerable significant effect and supporting H4. The relationship between TMGTI and green structural capital (β = 0.781, $t = 18.936$, and $p = 0.000$) was confirmed, with the findings showing a considerable significant effect and supporting H5. The relationship between TMGTI and green relational capital (β = 0.013, $t = 0.197$, and $p = 0.844$) was confirmed, but the findings showed only an insignificant effect and did not support H6. The relationship between green human capital and green competitive advantage (β = 0.723, $t = 33.224$, and $p = 0.000$) was confirmed, with the findings showing a considerable significant effect and supporting H7. The relationship between green structural capital and green competitive advantage (β = 0.444, $t = 8.142$, and $p = 0.000$) was confirmed, and the findings showed a considerable significant effect and supported H8. The relationship between green relational capital and green competitive advantage (β = 0.523, $t = 9.967$, and $p = 0.000$) was confirmed, and the findings showed a considerable significant effect and supported H9.

Table 5 displays the bias-corrected confidence intervals, which indicate the range of values likely in the valid population parameter with a specified degree of confidence. Traditional intervals may not provide an accurate representation of the valid population parameter because of biases that can be caused by factors such as sample size and distribution.

The evaluation of possible endogeneity is based on Becker et al. (2022) systematic methodology, which begins with the implementation of S. Park and Gupta's (2012) Gaussian copula approach. This approach utilizes the latent variable scores from the initial model estimation as input. First, it was verified whether the variables which potentially had endogeneity were generally not distributed. The Gaussian copula test for multiple combinations (e.g., single, double, and triple) was performed, but the paper only reports on a single copula test. The results in Table 6 show that all the variables have insignificant values; thus,

Table 6. Assessment of endogeneity using Gaussian copula.

Constructs	Coefficient	P values
GC (CEE) -> TMGTI	−0.038	0.739
GC (SP) -> TMGTI	−0.201	0.061
GC (MDGP) -> TMGTI	0.033	0.775
GC (TMGTI) -> GHC	−0.003	0.492
GC (TMGTI) -> GSC	−0.095	0.266
GC (TMGTI) -> GRC	0.221	0.095
GC (GHC) -> GCA	−0.197	0.053
GC (GSC) -> GCA	−0.101	0.167
GC (GRC) -> GCA	0.171	0.129

no endogeneity problem was detected. It is essential to mention that all other combinations of Gaussian copulas that are part of the model were thoroughly examined, and none of them showed any meaningful results. PLS-SEM is often less susceptible to endogeneity concerns than other approaches, such as CB-SEM. However, it is still crucial to acknowledge that there are potential endogeneity issues and to implement measures to address them.

Discussion

The salient findings of the study from the PLS-SEM were that corporate environmental ethics have a positive and significant effect on the involvement of top management in green technology. In support of this proposition, green ethics in the workplace encourage businesses to waste fewer resources and reduce their degradation of the environment using technological involvement (Yen & Yen, 2012). The findings show that stakeholder pressure has a positive and significant effect on top management's involvement in green technology. In support of these results, Freeman and Liedtka (2023) stated that an organization is a system of key stakeholders. Its survival and success depend on its technological ability to satisfy the stakeholders' demands and expectations. Top management is crucial in implementing technology management programs to address stakeholder pressure and business demand (Shao et al., 2022).

Consequently, practicing green actions will bring long-term economic opportunities linked to green management and will increase awareness of the use of green technology in environmental preservation measures (Singjai et al., 2018). Besides, market demand for green processes significantly predicts the technological involvement of top managers in a hotel. Greenmarket orientation is a crucial factor in an organization's technological performance. Therefore, market demand is a necessary element of TMGTI in a hotel. The study also found a positive correlation between top management's involvement in green technology and green human capital, which supports previous hospitality research. The active participation of top management in green technology is vital for hotels aspiring to be recognized for their green human capital, as it significantly contributes to enhancing their green competitive advantage. Top management teams that possess a strong awareness of technology can effectively facilitate the coordination of green human capital across the various departments of a hotel as well as within them.

The above findings also suggested that top management's involvement in green technology significantly enhances green structural capital. Once top managers acknowledge the potential benefits of green technology projects, they will demonstrate a commitment to

engaging in actions that will ultimately strengthen the hotel's green structural capital. The study revealed that the involvement of top managers in a hotel in green technology is not significant in predicting green relational capital.

The findings also showed that green human capital significantly supports the enhancement of green competitive advantage in hotels. In support of these findings, Yusliza et al. (2020) found that green human capital is strongly correlated with organizational performance. Green human capital plays a crucial role in providing strategic resources, as it equips individuals with the necessary skills to effectively implement strategies and practices that ensure the long-term viability and competitive advantage of hotels in the ever-changing business landscape. It is posited that, according to the model, green human capital is a robust predictor of green competitive advantage. The outcomes of this study are aligned with the existing theoretical frameworks. Most of the hypotheses proposed in alignment with the RBV are supported by this study's findings. Based on the RBV, a hotel has the potential to optimize its green competitive advantage when its resources possess rarity, inimitability, value, non-substitutability, and non-tradability (J. B. Barney, 2001).

Theoretical implications

Over the past few decades, there has been heightened societal and global customer interest in green businesses and environmental conservation. Hotels address environmental challenges to meet their customers' expectations and to respond to stakeholder pressure (Hitt et al., 2012). This research enhances the existing body of knowledge by clarifying the role of intellectual capital in green competitive advantage. While numerous studies have delved into the subject of the impact on competitive advantage of top management's green technology involvement and its dimensions (Xin & Wang, 2023), limited attention has been given to scrutinizing the antecedents of top management's green technology involvement (corporate environmental ethics, stakeholder pressure, and market demand for green processes) in the process that leads to competitive advantage for the firm.

This research broadens the scope of the RBV by incorporating green intellectual capital as an intangible resource of a firm. This asset, shaped by green human capital, green structural capital, and green relational capital, exhibits qualities such as rarity, value, non-imitability, and non-substitutability, in line with the VRIO framework (J. Barney, 1991). This study identifies the antecedents of top management's involvement in green technology. Top management's involvement in green technology plays an essential role in influencing the intellectual capital that generates competitive advantage.

Therefore, our theoretical contribution demonstrates that the effective exploitation of green human capital and structural capital can lead to a competitive advantage in cost reduction, the quality of green products and services, green innovation, and profits (Muisyo et al., 2022). This study also contributes to the overlap between the RBV and stakeholder theory, particularly regarding the influence of green relational capital on green competitive advantage. This study demonstrates that no green technologies provide competitive advantage but, rather, green resources and the competencies of top management (green human capital, green structural capital) constitute valuable, rare, inimitable, and organizationally embedded resources that can lead to green results.

The clear link between green relational capital and green competitive advantage that was found in previous studies (Chiou et al., 2011) is not supported. Indeed, this finding aligns with

the stream of research of Della Corte et al. (2021) on the difficulties of operating in the hospitality industry because of competitive behavior. Indeed, hospitality firms are skeptical about working with their competitors because they do not want to share their strategic resources. This result bolsters the literature on green technology and competitive advantage, highlighting that green relational capital does not impact green competitive advantage in the hospitality industry. Hospitality businesses prioritize the development of other resources, such as green human capital or green structural capital, over green relational capital.

Aligning with the RBV theory, a hotel can optimize its green competitive advantage by possessing rare resources. This underscores the importance of unique and valuable green resources in gaining a competitive edge. In summary, this study provides valuable insights into the relationship between corporate environmental ethics, stakeholder pressure, market dynamics, green human and structural capital, and top management's involvement in green technology. These findings contribute to our understanding of the adoption of green technology within the hotel industry, and align with established theoretical frameworks, such as the RBV and stakeholder theory, offering a robust foundation for future research and practical applications in sustainable business management.

Practical implications

The findings of this study have several practical and managerial implications for businesses in the hotel industry that are aiming to enhance their sustainability and competitive advantage through green technology initiatives. First, hotel firms should prioritize and promote a solid corporate environmental ethics framework. Top management should develop and communicate clear environmental ethics policies and standards throughout the organization, fostering a culture that values sustainability and environmental responsibility.

Secondly, it is paramount that hotel firms engage with customers, understand their sustainability concerns, and integrate their feedback into green technology strategies and initiatives. Regarding long-term economic opportunities, top management must understand that embracing green practices and technology can lead to sustainable economic benefits. It should invest in environmentally friendly technologies and practices, focusing on long-term profitability and cost savings through resource efficiency. Top management must proactively propose new solutions and address market demand for environmentally friendly services and products (Gursoy et al., 2022). This translates into investing in training and development programs to enhance employees' green skills and knowledge, and encouraging top management to support and actively participate in these initiatives.

Thirdly, the study reveals that top management's decision to invest in technology can create sustainable and environmentally friendly assets and processes within the hotel organization, which has an impact on sustainable competitive advantage. For example, hotels investing in energy-efficient systems reduce their energy consumption and enhance the overall guest experience.

Fourth, the study finds that top management's involvement in green technology is unrelated to relational capital. Top management's involvement in green technology often focuses on customer-facing initiatives (e.g., energy-efficient lighting, water conservation, and waste reduction) rather than on building and developing relationships with competitors or other partners. This result highlights the importance of implementing a strategic

shift in mind-set to engage in actions with competitors and other actors at a tourist destination to build joint green initiatives.

In conclusion, hotel businesses should integrate these practical and managerial insights into their sustainability strategies. The study results suggest that "stuck-in-the-middle" strategic behavior (J. B. Barney et al., 2011), which involves implementing differentiation and cost leadership strategies concurrently, is what top managers must do for the green development of hotels. This raises questions about how effectively hotels can balance offering unique, environmentally friendly experiences with maintaining cost competitiveness. Hotel top managers must identify areas where differentiation can be achieved, without compromising their cost-effectiveness. The study suggests that top managers must navigate a delicate balance between meeting consumer expectations for sustainability and not compromising the uniqueness of the hotel's concept. By emphasizing corporate environmental ethics, responding to stakeholder pressures, seizing long-term economic opportunities, and aligning themselves with market demands, organizations can enhance their green technology initiatives, improve their competitive advantage, and contribute to a more sustainable future.

Limitations and future research

While the study provides valuable insights into the relationship between various factors and the adoption of green technology in the hotel industry, it also has some limitations that should be considered. First, it collected data from 380 respondents, who may not represent the entire population of hotel managers in the United States. This limited sample size can affect the generalizability of the findings in a broader context. The study collected data from hotel managers within the McKibbon Hospitality Group in Tampa, Florida. This single-source data collection approach might limit the diversity of responses and perspectives, potentially leading to biased results. The study has a cross-sectional design, meaning that it captures all the data at the same time. This design may not capture changes or trends over time, limiting the ability to establish causality. Future research could address some of these limitations to enhance our understanding of the topic further, and could enlarge the sample size, consider other countries, and monitor trends over time.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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Appendices

Appendix A: Measurement Items

- ***Corporate environmental ethics (CEE)***

CEE1. This hotel has clear and concrete environmental policies.
CEE2. This hotel's budget planning includes concerns about environmental investment or procurement.
CEE3. This hotel has integrated its environmental plan, vision, or mission into its marketing events.

- ***Stakeholder pressure (SP)***

SP1. Our major competitors set environmental standards for their operations and products.
SP2. Our major competitors implement environmental strategies.
SP3. The environmental strategies we implement considerably affect our environmental reputation with customers.
SP4. The impact of our industry's green reputation on the environment is of concern to our customers.
SP5. The impact of our industry's green operations on the environment is of concern to our customers.

- ***Market demand for green processes (MDGP)***

MDGP1. The segmentation of the market demand for green processes.
MDGP2. Customers' requirements for green products.
MDGP3. Price flexibility of demand for green products.
MDGP4. Customer benefits for green products.

- ***Involvement of top management's green technology innovation (TMGTI)***

TMGTI1. Our top managers have defined the hotel's environmental policy well.
TMGTI2. Our top managers are likely to approve a special fund for investment in green practices.
TMGTI3. Our top managers are willing to invest the resources needed to implement green practices.
TMGTI4. Our top managers show a positive attitude toward green practices.
TMGTI5. Our top managers proactively support the implementation of green practices.

- ***Green human capital (GHP)***

GHP1. The contribution to the protection of the environment by employees in our hotel is better than that of our major competitors.
GHP 2. Our hotel's employee competence concerning environmental protection is better than that of our major competitors.
GHP 3. Our hotel's employees provide better environmental protection products and services than our major competitors.
GHP 4. The amount of cooperative teamwork concerning environmental protection in our hotel is greater than that of our major competitors.

- ***Green structural capital (GSC)***

GSC 1. Our hotel's management system for environmental protection is superior to that of our major competitors.

GSC 2. Our hotel is more innovative in terms of environmental protection than our major competitors.
GSC 3. Our hotel's profit from environmental protection activities is greater than that of its major competitors.
GSC 4. The ratio of investments in R&D expenditure to our hotel's environmental protection sales is more than that of our major competitors.
GSC 5. The ratio of employees in our hotel who are engaged in environmental management to the total employees is more than that of our major competitors.
GSC 6. Our hotel's investments in environmental protection facilities are greater than those of our major competitors.

- ***Green relational capital (GRC)***

GRC 1. Our hotel designs products and services in compliance with the environmental desires of our customers.
GRC 2. Customer satisfaction regarding our hotel's environmental protection is better than that of our major competitors.
GRC 3. The cooperative relationships concerning the environmental protection of our hotel with our upstream suppliers and downstream clients or channels are stable.
GRC 4. Our hotel has a good cooperative relationship with our strategic partners concerning environmental protection.

- ***Green competitive advantage (GCA)***

GCA1. Our hotel has earned a competitive cost advantage through environmental management and green innovation over our major competitors.
GCA2. Our hotel offers a superior quality of green products to that of our competitors.
GCA3. Our hotel has a more robust capability in environmental R&D and green innovation than that of our major competitors.
GCA4. Our hotel is more capable of environmental management than its major competitors.
GCA5. The profits generated by our hotel concerning its green products are impressive.
GCA6. The growth of our hotel as a result of its green products is better than that of our major competitors.