# The Impact of Circular Economy on Environmental Performance in the Tourism and Hospitality Industry: The Role of Low-Carbon Behavior and Eco-friendly Behavior

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| ARTICLE INFO | Abstract |
|---|---|
| | The circular economy (CE) can serve as a crucial framework for revolutionizing the tourism sector, particularly from the perspective of industry experts. This approach emphasizes sustainability and resource efficiency, enabling firms to innovate and adapt their practices in alignment with CE principles. By integrating these strategies, the tourism industry can foster a more sustainable future, benefitting both the environment and local economies. Tourism and hospitality enterprises are currently undergoing a transformation, as indicated by their environmental initiatives, which point towards a commitment to long-term sustainability in the workplace. This research aims to explore how the circular economy (CE) contributes to low-carbon behavior (LB) and enhances environmental performance (EP). The study employed questionnaires and gathered 180 responses from a sample of LinkedIn professionals with a minimum of five years of experience in the hospitality and tourism sectors in both Saudi Arabia and Egypt. The hypotheses of the study were analyzed using partial least squares structural equation modeling. Key findings from the research include: First, CE positively influences LB. Second, the results indicated that LB has a beneficial impact on EP. Lastly, the research confirmed that eco-friendly behavior (EB) moderates the relationship between LB and EP. These findings contribute to the ongoing dialogue regarding CE and provide insights on how to promote both LB and EP. |

## Introduction

The tourism and hospitality industries are undeniably pivotal to the functioning of the global economy, as they not only create vast employment opportunities for millions around the world but also significantly contribute to the gross domestic product (GDP) of numerous countries across different continents. Nevertheless, it is important to recognize that these industries are incredibly

resource-heavy and, as a consequence, they often come with a host of environmental repercussions that cannot be overlooked, such as the generation of high levels of carbon emissions, extensive waste production, and a considerable dependency on non-renewable resources that could threaten future sustainability (Mihalic, 2024). As the urgency to confront the pressing issues of climate change and environmental deterioration becomes increasingly apparent, there is mounting pressure on these sectors to embrace and implement sustainable practices that effectively mitigate their ecological footprints and promote overall environmental health. In light of this, the concept of the circular economy (CE) has surfaced as a highly promising framework, designed specifically to transform traditional linear economic models into more resource-efficient, closed-loop systems that prioritize sustainability (Jain et al., 2024). By placing a strong emphasis on the principles of reusing, recycling, and minimizing waste wherever possible, the CE encourages industries to adopt practices that are not only economically feasible but also environmentally considerate, fostering a balanced approach to growth and resource management (Fernando et al., 2023).

Within the context of Saudi Arabia and Egypt, two nations that are currently experiencing rapid economic and social transformations that are reshaping their landscapes, the tourism and hospitality sectors are considered to hold considerable strategic importance in driving these changes forward. As part of their comprehensive sustainability agendas, both of these countries have made it a priority to focus on environmental protection and the minimization of resource consumption to ensure a better future for their citizens and the planet. Notably, Saudi Arabia's Vision 2030 initiative, alongside Egypt's Sustainable Development Strategy, highlights a clear emphasis on the necessity for innovative and forward-thinking approaches to sustainability, thus creating a fertile environment for the integration of CE principles into their development strategies (Zaki, 2024). These national ambitions underscore the critical relevance of the CE in shaping tourism and hospitality operations that are low-carbon and sustainable, consequently paving the way for the adoption of practices that not only support long-term ecological balance but also meet the increasing expectations of consumers who are becoming more environmentally conscious and socially responsible.

Despite the encouraging role that the CE can potentially play across various industries, it is worth noting that research regarding its application in the tourism and hospitality sectors remains rather limited and underexplored (Bittner, 2022; Şahin et al., 2024). While the concept of the CE has been thoroughly examined in manufacturing sectors and other resource-intensive industries, there exists a noticeable gap in understanding how CE can specifically drive low-carbon behavior (LB) and improve environmental performance (EP) within the tourism context. Moreover, there is a scarcity of empirical evidence that examines how individual eco-friendly behaviors (EB) among tourism professionals can influence these crucial outcomes in a meaningful way (Dung et al., 2024). By taking the initiative to address these significant gaps in research, this study aims to contribute valuable insights that pertain to the sector-specific impacts of the CE, with a particular emphasis on how the principles of CE can cultivate a culture that prioritizes low-carbon initiatives and high-performance standards within the tourism and hospitality industries.

The primary objective of this study is to thoroughly examine the intricate relationship between CE principles and low-carbon behavior among seasoned professionals operating in the tourism sectors of Saudi Arabia and Egypt, while also assessing how this low-carbon behavior can subsequently influence environmental performance, as well as exploring the moderating role that individual eco-friendly behavior plays in the relationship between LB and EP. Through this focused approach, the research seeks to address key questions that are relevant to the ongoing transition towards sustainable business practices in industries that are known for their resource intensity and environmental impact. By utilizing partial least squares structural equation modeling (PLS-SEM) on a carefully curated dataset gathered from experienced hospitality professionals, this study endeavors to provide an evidence-based perspective on how the principles of the CE can be effectively operationalized to yield beneficial outcomes for both environmental health and organizational efficiency within the tourism sector.

## Literature review
### Theory background and hypotheses development

The connection between CE, LB, and performance within the tourism and hospitality sectors is underpinned by various theoretical frameworks. These frameworks underscore the significance of sustainable practices and resource efficiency, which are crucial for minimizing carbon footprints and improving overall sector performance.

One key framework is the *Value-Belief-Norm* theory, which highlights the personal norms and beliefs that motivate individuals and organizations to embrace CE practices. This adoption significantly influences their environmental performance (Stern et al., 1999). Another important approach is the *Dynamic Capabilities* framework, which asserts that organizations must cultivate the ability to adapt and innovate in response to environmental challenges, thus enhancing their CE performance. Additionally, *Institutional theory* suggests that external factors, including regulations and societal expectations, drive organizations to implement sustainable practices, ultimately leading to better performance outcomes (Jain et al., 2024).

The *Natural Resource-Based View* (NRBV) theory offers a foundational framework for understanding the impact of the CE on the performance of tourism and hospitality sectors (Hart, 1995). Companies in this sector possess dynamic capabilities and environmentally sustainable resources, which include the ability to reintegrate, reinvent, regenerate, and reconfigure both internal and external resources. This enables them to effectively tackle environmental challenges while seizing sustainability opportunities. Key elements of CE, such as redesign, buyback/purchasing, production, circulation/reuse, consumption, and recovery, are integral to a firm's dynamic capabilities and are designed to achieve favorable environmental outcomes while enhancing competitiveness (Zaki, 2024). These actions serve as critical drivers of performance. Incorporating CE into corporate strategies is essential for securing a sustainability advantage (Chabowski et al., 2023). As hotels and tourism companies operate in dynamic market environments, CE practices are increasingly attracting the attention of stakeholders. Consequently,

it is no longer sufficient for businesses to focus solely on resource allocation for environmental benefits; performance must also be a priority. In response, many firms are striving to address sustainability issues impacting climate and ecosystems by optimizing their resources, skills, and technologies to enhance overall performance (Fernando et al., 2023). To address the study objectives, a conceptual framework (Figure 1) has been developed.
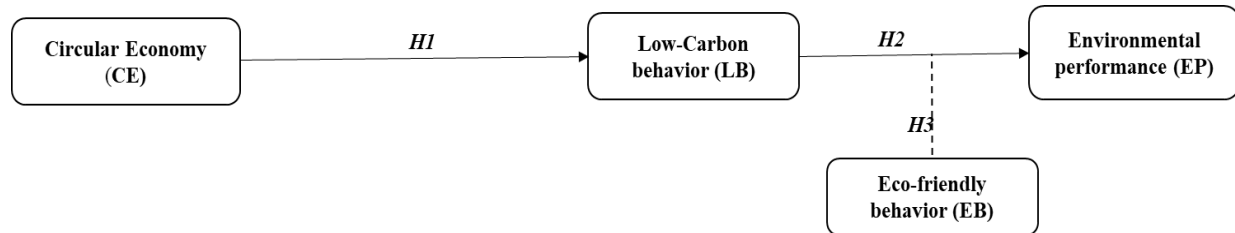
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┌─────────────────┐           ┌──────────────────┐          ┌──────────────────┐
│ Circular Economy│    H1     │   Low-Carbon     │   H2     │  Environmental   │
│      (CE)        │ ────────► │  behavior (LB)   │ ───────► │ performance (EP) │
└─────────────────┘           └──────────────────┘          └──────────────────┘
                                                   H3
                                        ┌──────────────────┐
                                        │   Eco-friendly   │
                                        │  behavior (EB)   │
                                        └──────────────────┘
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Figure 1 The conceptual model

## *The relationship between CE and LB*

The link between the CE and low-carbon practices in the tourism and hospitality sectors is increasingly recognized as vital for advancing sustainability. By prioritizing waste reduction and resource efficiency, CE principles play a crucial role in diminishing carbon footprints in these industries, aligning with broader environmental objectives. This connection is evident through several key factors that showcase the practical advantages of CE in tourism.

In the tourism and hospitality sectors, which are characterized by high resource consumption, CE promotes resource efficiency by advocating for the continual use of materials and minimizing reliance on raw resources and energy (Şahin et al., 2024). Effective waste management is also pivotal, with CE strategies such as recycling and composting addressing the substantial waste produced in these sectors, thereby reducing their environmental impact (Makoondlall-Chadee & Bokhoree, 2024).

Encouraging low-carbon practices within tourism and hospitality reinforces this sustainable framework. The implementation of environmentally friendly initiatives, including energy-efficient technologies and water-saving measures, directly targets the carbon emissions linked to tourism activities. Furthermore, engaging local communities in sustainability efforts fosters a shared commitment to environmental stewardship, enhancing the effectiveness of low-carbon initiatives and yielding positive results (Mihalic, 2024).

Nevertheless, while the incorporation of CE principles offers significant opportunities, the tourism industry faces challenges in adopting these practices. Businesses, especially in emerging economies, often struggle with barriers such as limited access to information and insufficient infrastructure (Bittner et al., 2024). Addressing these challenges requires ongoing research and

interdisciplinary strategies to enhance understanding and implement CE within the sector. Such initiatives can lead to innovative, low-carbon solutions that benefit both businesses and the environment (Tomassini et al., 2024).

To put it briefly, while the integration of CE and low-carbon practices in tourism presents considerable promise for sustainability, it highlights the necessity for continued research and the establishment of practical frameworks. Overcoming these challenges will help realize the full potential of these principles, fostering a more sustainable future for the tourism and hospitality industries. The RBV theory explains the relationship between CE and LB as a combination of strategic resources and capabilities that enables firms to gain a sustainable competitive edge. The CE model enhances a firm's internal resources, while LB improves the firm's human capabilities, positioning it to thrive in sustainability, promote a green culture, and achieve overall performance that competitors may struggle to imitate. Therefore, based on empirical evidence and the RBV theory, this study puts forth the following hypothesis:

*H1: CE positively and significantly influences LB.*

### The connection between LB and EP

Low-carbon behavior (LB) and pro-environmental behavior (PEB) within the tourism and hospitality industries are unified by the common objective of enhancing sustainability and diminishing environmental impact. Both concepts advocate for the adoption of practices that can alleviate ecological harm, thereby promoting a more responsible and environmentally aware industry.

These behaviors share similar goals, particularly in their commitment to sustainability. Both LB and PEB strive to reduce the carbon footprint linked to tourism and hospitality activities by promoting eco-friendly practices (Chi et al., 2023; Chou, 2014). Furthermore, they highlight the importance of community involvement, encouraging partnerships with local communities to ensure fair resource distribution and nurture environmental responsibility (Nosrati et al., 2023; Wang & Jiao, 2024). Several pivotal factors drive these behaviors. Cultural values significantly influence individual actions, as behaviors shaped by cultural norms impact both low-carbon and pro-environmental initiatives, underscoring the role of societal expectations in fostering sustainable practices (Nosrati et al., 2023). Additionally, employee participation is crucial; engaging staff in sustainability efforts within the hospitality sector can improve organizational performance and reinforce both behaviors (Chi et al., 2023).

Regarding implementation, eco-friendly practices are fundamental to both LB and PEB. The adoption of energy-efficient technologies, robust waste management systems, and conservation initiatives are essential for promoting sustainability across these behaviors (Fauzi et al., 2023). Educating tourists about sustainable practices is another vital strategy, as informed consumers are

more inclined to make choices that align with both low-carbon and pro-environmental objectives (Irene et al., 2024).

The connection between LB and EP in the tourism and hospitality industry is intricate, underscoring the significance of employee engagement and effective policy frameworks. Engaging in low-carbon practices, such as enhancing energy efficiency and minimizing waste, is critical for improving corporate environmental performance within this sector.

Employee involvement is a pivotal factor in fostering LB. The green self-efficacy and environmental awareness of employees significantly impact their adoption of sustainable practices, which in turn enhances the corporate environmental performance of hotels (Sampene et al., 2024). Additionally, motivations like employees' attitudes and perceived behavioral control play a vital role in driving pro-environmental decision-making, thereby strengthening their commitment to sustainable practices (Chi et al., 2023). Together, these elements contribute to a greater commitment to LB that ultimately benefit the organization's overall EP.

Moreover, policy frameworks significantly influence LB in the tourism sector. The implementation of low-carbon city policies has resulted in a substantial decrease in $CO_2$ emissions within the hotel industry, particularly in affluent tourist destinations (Sun et al., 2024). In response to the rising demand for responsible tourism, hotels are increasingly adopting green practices, including eco-friendly initiatives and effective waste management strategies (Makoondlall-Chadee & Bokhoree, 2024). However, despite the crucial role of low-carbon behaviors in enhancing EP, challenges persist in maintaining consistent employee engagement and adherence to sustainable practices across the industry. These obstacles highlight the necessity for continued support through robust policies and workplace initiatives to cultivate a sustainability-oriented culture throughout the tourism and hospitality sectors.

By integrating both LB and EP, organizations within tourism sectors can enhance their resource efficiency and minimize waste. This approach is consistent with the RBV, which highlights the importance of utilizing distinctive internal resources for sustained success. When sustainable practices are embedded in the organization's fundamental operations, they create a unique competitive advantage that is challenging for rivals to imitate, particularly in industries where environmental impact is under rigorous examination. The RBV theory demonstrates that LB and EP can serve as vital strategic assets for tourism and hospitality organizations, enabling them to secure a competitive edge. By incorporating sustainable practices into their operational frameworks and fostering a culture of environmental responsibility, these organizations can enhance their brand, attract environmentally conscious consumers, and position themselves as frontrunners in sustainable tourism. This aligns with the RBV's assertion that unique resources and capabilities are pivotal for achieving long-term success. Based on empirical evidence and the RBV theory, this study proposes the following hypothesis:

*H2: LB positively and significantly influences EP.*

*The moderating influence of environmentally friendly behavior (EB)*

The tourism sector, a significant contributor to global greenhouse gas emissions, is under increasing pressure to adopt green performs. A key aspect of this transition involves the implementation of low-carbon behaviors, which include reducing energy consumption and waste generation (Sun et al., 2024). The effectiveness of these low-carbon initiatives on EP can be amplified through eco-friendly behaviors that also benefit the environment. When individuals practice both low-carbon and eco-friendly actions, a synergistic effect occurs, leading to a more substantial positive impact on EP (Arya, Auruskeviciene, et al., 2024). For instance, a hotel guest who conserves energy by switching off lights may also engage in recycling, resulting in a greater environmental benefit than if they participated in either activity separately. Similarly, the tourism destination customer has the opportunity to engage in various conservation efforts that positively impact both the destination and the local community (Arya, Sahni, et al., 2024).  Moreover, engaging in eco-friendly behaviors can help establish habits, making it easier for individuals to consistently adopt low-carbon practices. Social influence can also encourage others to embrace these behaviors, contributing to the creation of a positive social norm (Dung et al., 2024). To leverage these benefits, hotel directors should foster a culture that promotes eco-friendly practices, provide clear guidelines for minimizing carbon footprints, offer education and training, and continuously evaluate the effectiveness of these initiatives to improve sustainability outcomes (Aljoghaiman et al., 2024). Understanding the supportive role of EB allows for the development of targeted strategies aimed at reducing environmental impact and enhancing sustainability within the tourism industry. This study posits that EB moderates the relationship between LB and EP, addressing a critical gap in the literature.

*H3: EB moderates the LB-EP connection.*

## Methodology

This research utilized a diagnostic survey method to assess the suggested research model, employing a structured 5-point Likert scale to gauge perceptions related to CE, LB, EB, and EP. The survey comprised 36 items spanning these four variables and collected demographic data, including gender, age, educational level, and years of professional experience. The methodology, sampling techniques, and measurement scales used in this study are elaborated in the subsequent sections.

*Sample and data collection*

The target demographic for this study consisted of tourism professionals from Saudi Arabia and Egypt. Due to the specialized nature of this group, a snowball sampling method was utilized, leveraging platforms such as LinkedIn and other professional networks to connect with a diverse array of pertinent experts. A total of 250 questionnaires were distributed, yielding 180 valid responses, which corresponds to a response rate of 72%.

According to the recommendation by (Hair et al., 2021), a sample size of 360 would be optimal for analyzing 36 items, based on a 1:10 sample-to-item ratio. Nonetheless, it can be argued that a sample of 180 is statistically acceptable for Partial Least Squares Structural Equation Modeling (PLS-SEM), especially in the context of exploratory research involving complex models. PLS-SEM is particularly suited for smaller sample sizes compared to traditional covariance-based SEM, especially when the main objective is to predict outcomes and explore models rather than confirm theoretical frameworks. (Becker et al., 2023) also point out that PLS-SEM can deliver reliable results with smaller samples, as it emphasizes maximizing explained variance without relying heavily on distributional assumptions. Notably, PLS-SEM is widely used in the tourism context similar studies (Salama et al., 2022; Zaki & Shared, 2023) Thus, the sample size of 180 aligns with the minimum thresholds necessary for exploratory PLS-SEM analysis, particularly in light of other studies that have demonstrated acceptable reliability and predictive power with sample sizes reflecting a 1:5 ratio in PLS-SEM contexts. To further substantiate these findings, power analyses using G*Power or similar tools could confirm that the sample size of 180 possesses adequate statistical power for identifying significant relationships within the model, providing a more comprehensive rationale alongside the guidelines established by (Hair et al., 2021).

*Measures*

- Factor 1(CE): The concept of CE was initially framed as a unidimensional construct, as posited by (Zaki, 2024). In order to enhance survey efficiency, Zaki's original scale underwent modifications, specifically through the condensation of items, in alignment with the suggestions of (Aboramadan & Karatepe, 2021)to bolster clarity and maintain participant engagement during extensive questionnaires by making the survey short.

- Factor 2(LB): This was measured utilizing a 10-item scale refined from (Chou, 2014), which has previously been validated in research for its applicability to sustainable tourism and environmental conduct.

- Factor 3(EB): The research assessed EB through a 7-item scale crafted by (Steg et al., 2005), which effectively encapsulates actions directly related to ecological conservation and environmental accountability.

- Factor 4(EP): EP was appraised via a 7-item scale derived from Zaki (2024), enabling experts to evaluate the significance of each item according to their expertise, on a scale ranging from 1 ("Extremely unimportant") to 5 ("Extremely imperative").

*Demographic variables*

Demographic data collected included gender, age, education level, and years of experience, providing contextual insights into the sample's composition. Among the 180 respondents, the majority 62% were male, and half of the sample was above the age of 30, highlighting a relatively senior and predominantly male cohort of experts within the field.

*Data analysis*

   Data analysis was performed utilizing Partial Least Squares Structural Equation Modeling (PLS-SEM), as outlined by Hair et al. (2021). This advanced analytical method is widely recognized in the fields of tourism and hospitality research, particularly for its effectiveness in examining intricate models and hypotheses, especially when working with limited sample sizes. The PLS-SEM approach facilitated a thorough evaluation of both measurement and structural models, assessing construct validity, path coefficients, and the proposed relationships among CE, LB, EB, and EP. Table 1 presents summary statistics that detail the demographic characteristics of the respondents, offering insights into the sample's composition and essential traits pertinent to the study's objectives. The application of PLS-SEM in this research not only augments methodological rigor but also enables a holistic assessment of the interrelationships within the research framework, thereby enhancing the credibility of the findings in the realm of sustainable tourism and hospitality.

**Table 1.** Expert's profile

| Factor | Category | Frequency | Percent |
|---|---|---|---|
| Gender | Female | 68 | 37.8 |
|  | Male | 112 | 62.2 |
| Age | Less than 30 | 45 | 25 |
|  | 31-35 | 45 | 25 |
|  | 36 and more | 90 | 50 |
| Education | Intermediate | 10 | 5.6 |
|  | 2 years college | 35 | 19.4 |
|  | University | 85 | 47.2 |
|  | Master/PhD | 50 | 27.8 |
| Tenure | ≤5 years | 90 | 50 |
|  | 5-10 | 38 | 21.1 |
|  | 11-15 | 48 | 26.7 |
|  | ≥16 years | 4 | 2.2 |
| Background | Tourism destinations | 45 | 25 |
|  | Hoteliers | 50 | 27.8 |
|  | Travel agency | 45 | 25 |
|  | Academic tourism & hospitality expert | 40 | 22.2 |

**Results**

   This research utilized PLS-SEM via Smart PLS 4 package to evaluate the proposed hypotheses. The PLS-SEM methodology empowers researchers to manage complex models that integrate multiple constructs, concepts, and structural relationships, all while circumventing the limitations imposed by particular data distribution assumptions. This predictive SEM approach emphasizes

the estimation phase throughout the model assessment process (Franke & Sarstedt, 2019; Sarstedt et al., 2022).

### *Discriminate validity*

Discriminant validity is essential prior to conducting the study model. Study model is deemed valid when the constructs of the structural model do not surpass a threshold of 0.90 (Henseler et al., 2015). The evidence presented in Table 2 reinforces the established guidelines set forth by previous researchers. Consequently, the findings indicate that both the *Heterotrait-monotrait* (HTMT) criteria for discriminant validity is met in this study, as all construct values remain below 0.90. The results suggest that the proposed model of this study possesses strong psychometric properties.

**Table 2.** Discriminant validity by HTMT ratio

|  | CE | LB | EB | EP |
|---|---|---|---|---|
| **CE** | 1 |  |  |  |
| **LB** | 0.068 | 1 |  |  |
| **EB** | 0.038 | 0.058 | 1 |  |
| **EP** | 0.047 | 0.078 | 0.03 | 1 |

### *The measurement and structural models*

The evaluation of both measurement and structural models is a critical component in the field of quantitative research, as it lays the foundation for understanding the relationships between various constructs within a given theoretical framework. Initially, the assessment of a measurement's reliability and validity is a multifaceted process that can be effectively conducted by meticulously examining internal consistency, convergent validity, and discriminant validity, which are widely acknowledged as essential criteria for this comprehensive evaluation (Hair et al., 2020). To rigorously assess convergent validity, it is of paramount importance that the factor loading values consistently exceed the threshold of 0.7, while simultaneously ensuring that the average variance extracted (AVE) is greater than 0.5, as these metrics are indicative of the extent to which a set of indicators reflects the underlying construct. In terms of discriminant validity, it is imperative that the square root of the AVE is greater than the correlation values among the variables; this condition ensures that each construct is distinct and not merely a reflection of another variable. When discussing reliability, a composite reliability value that surpasses 0.7 is deemed acceptable and serves as a benchmark for the robustness of the measurement model. The results, as illustrated in Table 3, comprehensively reflect the evaluations of both reliability and validity, providing empirical evidence for the assessment process. Reliability testing encompassed both the outer loading values and the composite reliability (CR) values, while the AVE value was employed as a crucial metric for validity assessments, collectively contributing to a rigorous analysis. The findings unequivocally indicate that all variables successfully achieved outer loading and composite reliability values that exceed the recommended threshold, thereby confirming the

reliability of all indicators associated with these variables. In addition, the thorough analysis of the AVE values reveals that each variable surpasses the critical threshold of 0.5, thereby validating both the variables in question and their respective indicators, thus reinforcing the integrity of the measurement model.

Notably, the measurement model has been conclusively defined through a detailed process, summarizing various factors alongside their respective factor loadings, which provides a comprehensive overview of the interrelationships among the constructs. The reliability and validity of the model were firmly established through critical indicators, such as factor loadings, composite reliability (CR), and average variance extracted (AVE), all of which exceeded the acceptable thresholds established in the literature, thereby confirming the robustness of the constructs employed in this analysis. Furthermore, the meticulous analysis of variance inflation factors (VIF) indicated that there was no significant common method bias present in the data, which further supports the model's overall validity and reliability (Sarstedt et al., 2022). Secondly, the structural model became apparent through an intricate Path analysis (Figure 2), which utilized the PLS-SEM technique to assess the validity of model hypotheses with a high degree of rigor, as confirmatory factor analysis was systematically assessed through path constraints, t-values, and p-values, thereby establishing significant thresholds for evaluation. The comprehensive analysis of a sample comprising 180 participants revealed favorable model fit indices, which included a chi-square to degrees of freedom ratio ($\chi2$ / df = 1.006), an RMSEA of 0.064, and various comparative indices that collectively affirm the model's adequacy, with an SRMR value of 0.077 (Ringle et al., 2023). These statistical measures not only demonstrate the robustness of the model but also provide substantial evidence for the theoretical framework underpinning the research, illustrating the intricate relationships among the variables and their contribution to the overall study.

**Table 3.** Measurement model statistics

| Factor | Variables | Loadings | α | AVE | VIF | CR |
|--------|-----------|----------|---|-----|-----|-----|
| **CE** | Customers assess the company based on its compliance with environmental regulations. | 0.85 | 0.91 | 0.75 | 1.129 | 0.92 |
|  | Operational frameworks are established to optimize the use of energy, water, and other resources. | 0.87 |  |  |  |  |
|  | Environmental considerations are integrated into supplier selection criteria. | 0.88 |  |  |  |  |
|  | Environmental certifications play a significant role in the contractor selection process. | 0.83 |  |  |  |  |
|  | Comprehensive health and safety records are meticulously maintained. | 0.82 |  |  |  |  |
|  | The system enhances the efficient utilization of various energy sources. | 0.84 |  |  |  |  |
|  | The company adheres strictly to emission and environmental regulations. | 0.86 |  |  |  |  |
|  | Engaging with diverse groups of customers, suppliers, and investors is prioritized to promote products with regenerative qualities. | 0.85 |  |  |  |  |
|  | Company strategies emphasize the retrieval of products | 0.81 |  |  |  |  |

|  |  |  |  |  |  |  |
|---|---|---|---|---|---|---|
|  | from customers as needed. |  |  |  |  |  |
|  | Closed-loop production systems are implemented to prevent leaks and minimize waste. | 0.89 |  |  |  |  |
|  | Industrial materials and waste generated during processes—including chemicals, oils, packaging, plastics, and other non-biodegradable substances—are recycled. | 0.90 |  |  |  |  |
|  | The inflow of resources (such as food, packaging, energy, and water) is monitored and subsequently circularized. | 0.88 |  |  |  |  |
| **LB** | The customer ensures lights and electrical equipment are switched off when not in use. | 0.87 | 0.88 | 0.50 | 1.365 | 0.93 |
|  | The customer chooses stairs over elevators when moving between 2-3 floors. | 0.80 |  |  |  |  |
|  | The customer actively conserves water in daily activities. | 0.85 |  |  |  |  |
|  | Before leaving the workplace, the customer ensures all electric appliances, such as computers, printers, and copy machines, are turned off. | 0.82 |  |  |  |  |
|  | The customer turns off lights when the office or work area is unoccupied. | 0.81 |  |  |  |  |
|  | The customer sorts and recycles waste generated in the workplace. | 0.84 |  |  |  |  |
|  | The customer minimizes paper usage by opting for double-sided printing. | 0.83 |  |  |  |  |
|  | For informal documents, the customer prints using recycled paper. | 0.79 |  |  |  |  |
|  | The customer uses a personal reusable cup instead of disposable ones. | 0.85 |  |  |  |  |
|  | The customer brings their own reusable utensils instead of using disposable ones. | 0.80 |  |  |  |  |
| **EB** | The client is enthusiastic about enhancing the efficiency of electricity usage. | 0.86 | 0.93 | 0.52 | 1.241 | 0.90 |
|  | The client guarantees that lighting is switched off during periods of non-use. | 0.84 |  |  |  |  |
|  | The client is committed to promoting recycling efforts. | 0.87 |  |  |  |  |
|  | The client follows eco-friendly guidelines and practices diligently. | 0.85 |  |  |  |  |
|  | The client seeks to repurpose materials for recycling whenever feasible. | 0.83 |  |  |  |  |
|  | The client endeavors to utilize resources, including water and energy, with maximal efficiency. | 0.88 |  |  |  |  |
|  | The client swiftly responds to any incidents of water leakage or waste | 0.82 |  |  |  |  |
| **EP** | Decreasing waste generation, encompassing food, water, and energy | 0.85 | 0.95 | 0.53 | 1.241 | 0.91 |
|  | Curtailing the utilization of energy resources | 0.84 |  |  |  |  |
|  | Mitigating the reliance on radioactive substances | 0.80 |  |  |  |  |
|  | Lessening environmental occurrences | 0.83 |  |  |  |  |
|  | Enhancing health and safety measures for consumers | 0.86 |  |  |  |  |
|  | Fostering health and safety initiatives for staff | 0.87 |  |  |  |  |
|  | Advancing the welfare of management personnel | 0.88 |  |  |  |  |

*Hypotheses assessment*

In this research, two direct hypotheses and one moderator hypothesis were examined. The results of the study are summarized in Table 4 and depicted in Figure 2. The survey findings indicated that CE exerts a significant and positive effect on the LB construct, specifically H1 ($\beta$=0.431, t=4.28;  p-value=0.001$\beta$=0.431,  *t*=4.28;  *p*-value=0.001)  and H2 ($\beta$=0.334, t=5.14;  p-value=0.001$\beta$=0.334, *t*=5.14; *p*-value=0.001), highlighting that LB has a considerable impact on EP. Furthermore, Figure 3 illustrates the moderation effect, indicating that EB enhance the positive correlation between LB and EP.
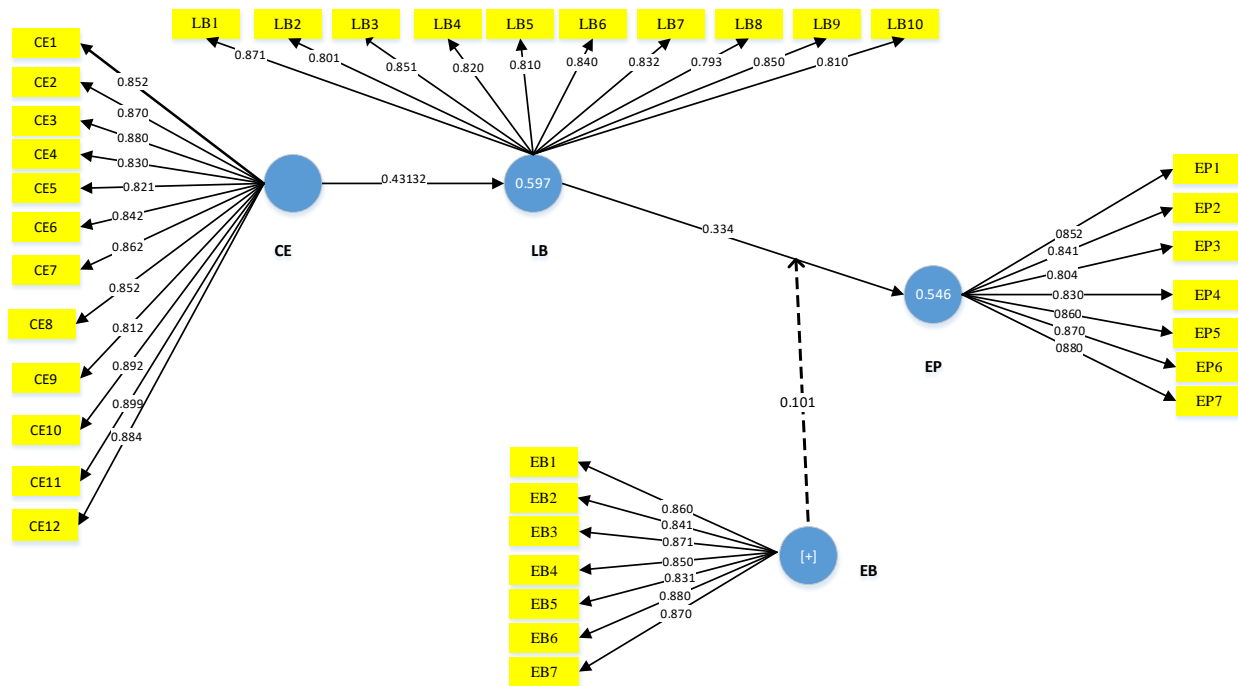


**Figure 2.** Structural model output

**Table 4.** Hypotheses test

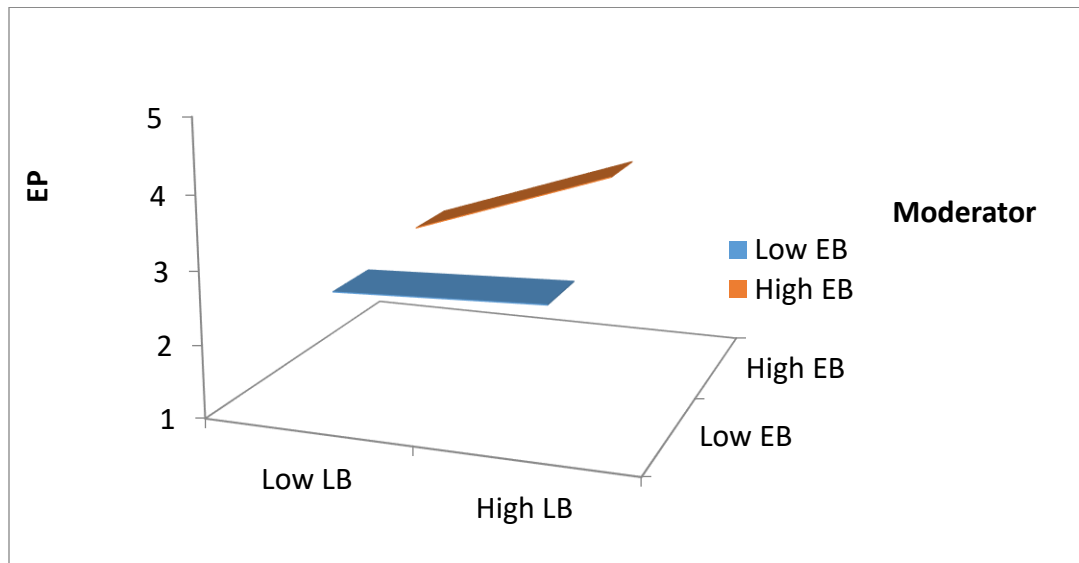| H | Path direction | β | P-value | *t*-value | F² | R² | Q² | Decision |
|---|---|---|---|---|---|---|---|---|
| *H1* | CE -> LB | 0.431 | 0.001 | 4.28 | 0.101 | LB =0.597 | 0.54 | **Support** |
| *H2* | LB -> EP | 0.334 | 0.001 | 5.14 | 0.010 | EP=0.546 | 0.52 | **Support** |
| | **Moderation** | | | | | | | |
| | LB*EB-> EP | | | | | | | |
| *H3* | Low EB | 0.101 | 0.042 | 2.89 | | | | **Support** |
| | High EB | 0.161 | 0.001 | 3.27 | | | | **Support** |

**Figure 3.** The moderation effect

## Discussion

The results derived from this comprehensive study provide profound and significant insights into the multifaceted effects of the CE on promoting sustainable behaviors and enhancing EP within the dynamic and multifarious realms of the tourism and hospitality sectors. The established positive correlation between CE and LB underscores the notion that the principles inherent in CE can act as a powerful catalyst, stimulating the adoption of environmentally responsible practices throughout these critically important industries. By actively advocating for the reuse, recycling, and optimization of resources, the circular economy not only encourages but also necessitates that professionals within these sectors embrace practices that contribute to a marked reduction in carbon emissions, thereby aligning closely with the objectives of sustainable development. This finding is in harmony with previous scholarly research that posits that initiatives driven by CE have the potential to fundamentally transform sectors that have historically relied on resource-intensive operations, as is particularly evident in the tourism and hospitality industries, by effectively embedding sustainable practices into the very fabric of organizational culture (Bittner et al., 2024; Tomassini et al., 2024; Zaki, 2024).

Furthermore, the demonstrated connection between LB and enhanced EP serves to further illuminate the inherent value of fostering low-carbon actions within various workplace environments. As industries associated with tourism and hospitality increasingly confront mounting pressures to mitigate their detrimental environmental impacts, the imperative shift toward adopting behaviors that directly bolster EP becomes critically important and urgent (Carlisle et al., 2021). This relationship corroborates prior literature that identifies LB as a crucial component for attaining sustainable business outcomes, especially in sectors where environmental

degradation has been a longstanding concern and challenge (Chou, 2014; Sun et al., 2024). By reinforcing EP through the promotion of LB, firms operating in these sectors can realize operational efficiencies that not only contribute positively to their bottom line but also enhance their reputational standing, thereby cultivating greater trust and loyalty among consumers who are increasingly conscious of environmental issues.

Moreover, the findings of this study introduce a nuanced perspective by highlighting the moderating role of EB in the intricate relationship between LB and EP. The data suggests that EB serves to amplify the impact of LB on EP, thereby indicating that the cultivation of a workplace culture steeped in environmental awareness and commitment can significantly enhance the benefits associated with low-carbon initiatives (Dung et al., 2024). This moderating effect serves to underscore the paramount importance of not only adopting the principles of CE but also actively fostering a proactive and engaged attitude toward environmental stewardship among all employees within the organization. When professionals in the hospitality sector wholeheartedly embrace eco-friendly attitudes, they are likely to become more actively engaged in the implementation of low-carbon practices, which in turn can yield considerably greater environmental outcomes for their respective organizations and enterprises (Sun et al., 2024).

These insightful findings contribute significantly to the broader understanding of how CE principles can be effectively operationalized in order to cultivate a low-carbon, high-performance organizational culture specifically tailored for the tourism and hospitality sectors. They highlight the critical importance of strong leadership support and genuine employee engagement in creating a workplace environment that is conducive to the adoption and implementation of sustainable practices. For practitioners and industry leaders, this research offers actionable insights that emphasize the necessity of investing in CE-oriented training programs and policies, which can facilitate a smoother transition for firms operating in resource-intensive sectors toward more sustainable operational models, thereby aligning with the increasing global calls for urgent climate action and environmental responsibility.

### *Theoretical implications*

This study contributes to the literature by deepening the understanding of the NRBV theory in the context of the tourism and hospitality sectors, specifically as it relates to CE practices. According to the NRBV, competitive advantage in firms can be derived from resources that are valuable, rare, inimitable, and sustainable (Hart, 1995). Our findings align with this perspective, showing that CE practices such as resource redesign, reuse, and recovery are integral to fostering both EP and operational competitiveness (Zaki, 2024). By demonstrating the positive relationship between CE and LB, this study extends the NRBV framework to show how resource-efficient practices contribute to a firm's dynamic capabilities and enhance environmental outcomes.

Key elements of CE, including buyback programs, waste minimization, and closed-loop systems, serve as critical components of an organization's dynamic capabilities. These practices enable firms to adapt and respond to environmental challenges while seizing sustainability opportunities.

This study's focus on CE as a source of sustainability advantage supports the NRBV's assertion that proactive environmental strategies can drive firm performance. By systematically reconfiguring resources in alignment with CE principles, firms in tourism and hospitality are well-positioned to address the dual demands of performance and environmental responsibility (Chabowski et al., 2023).

### *Practical implications*

The findings of this study hold significant practical implications for professionals in the tourism and hospitality sectors who aim to utilize CE principles for sustainable development and gaining a competitive edge. The research indicates that the adoption of CE practices can improve EP and mitigate environmental impacts, aligning with the increasing expectations of stakeholders for sustainable practices in resource-heavy industries. To effectively implement CE principles, managers in these fields should focus on resource-efficient strategies, such as rethinking product life cycles, promoting reuse, and establishing closed-loop recycling systems. These strategies not only contribute to a reduction in carbon emissions but also result in considerable cost savings through better resource management. Additionally, training employees to engage in low-carbon behaviors that align with CE principles can further enhance EP, thus benefiting both the environmental and financial aspects of the organization.

It is advisable for managers to cultivate partnerships with suppliers and other stakeholders to promote circular practices, which can encourage a collective commitment to sustainability across the industry. Such efforts can bolster brand reputation and position companies as frontrunners in environmental stewardship, ultimately providing both competitive and ecological advantages.

### *Limitations*

Although this particular study possesses a multitude of commendable qualities, it is imperative for subsequent research endeavors to take into account certain inherent limitations that may affect the overall validity and applicability of the findings presented herein. Consequently, the concept of CE can be regarded as a relatively recent and innovative construct within the field; therefore, forthcoming investigations should delve deeper into the ways in which this concept may exert influence over the actions, decisions, and behavioral patterns exhibited by other employees within various organizational contexts. Moreover, the statistical methodologies that have been utilized in the current analysis are predominantly designed to assess net effects and linear relationships, which consequently limits the capacity of the research to effectively capture and quantify asymmetric and combinatorial effects that might arise in real-world scenarios. Consequently, it is suggested that future research initiatives consider adopting alternative methodological frameworks, such as fuzzy Bayesian approaches and neural network techniques, which have the potential to provide richer insights and more nuanced understandings of the complex dynamics at play. In light of these considerations, it becomes increasingly evident that a broader repertoire of analytical tools could significantly enhance the depth and rigor of future studies exploring the implications of CE.

Ultimately, the evolution of research in this domain will greatly benefit from a more diversified approach that embraces the intricacies of human behavior and organizational dynamics.


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# تأثير الاقتصاد الدائري في الأداء البيئي في صناعة السياحة والضيافة:

## دور السلوك منخفض الكربون والسلوك الصديق للبيئة

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**الملخص باللغة العربية:**

يمكن أن يعمل الاقتصاد الدائري كإطار حاسم لإحداث ثورة في قطاع السياحة، وخاصة من منظور خبراء الصناعة. ويؤكد هذا النهج على الاستدامة وكفاءة الموارد، مما يمكن الشركات من الابتكار وتكييف ممارساتها بما يتماشى مع مبادئ الاقتصاد الدائري. ومن خلال دمج هذه الاستراتيجيات، يمكن لصناعة السياحة تعزيز مستقبل أكثر استدامة، مما يعود بالنفع على البيئة والاقتصادات المحلية. تخضع شركات السياحة والضيافة حاليًا للتحول، كما يتضح من مبادراتها البيئية، والتي تشير إلى الالتزام بالاستدامة طويلة الأجل في مكان العمل. يهدف هذا البحث إلى استكشاف كيف يساهم الاقتصاد الدائري في السلوك المنخفض الكربون ويعزز الأداء البيئي. استخدمت الدراسة الاستبيانات وجمعت ١٨٠ استجابة من عينة من محترفي LinkedIn الذين لديهم خبرة لا تقل عن خمس سنوات في قطاعي الضيافة والسياحة في كل من المملكة العربية السعودية ومصر. تم تحليل فرضيات الدراسة باستخدام نمذجة المعادلات الهيكلية الجزئية للمربعات الصغرى. تشمل النتائج الرئيسية من البحث ما يلي: أولاً، يؤثر الاقتصاد الدائري بشكل إيجابي على السلوك المنخفض الكربون. ثانيًا، أشارت النتائج إلى أن الاقتصاد الدائري له تأثير مفيد على الأداء البيئي.

**الكلمات المفتاحية:** الاقتصاد الدائري، السلوك المنخفض الكربون، الأداء البيئي، السياحة والضيافة