

Article

Save It for Later: Understanding How Circular Economy Practices and Global Energy Threats Drive Energy Resilience in Sustainable Hotels

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Abstract

The current paper concerns the interplay of the circular economy (CE) and global energy threats facing the hospitality industry. Despite the growing emphasis on CE implementation within sustainable hospitality, little empirical evidence explains how CE practices enhance hotels' green energy resilience amid escalating global energy threats and resource uncertainty, particularly in emerging markets. Addressing this research gap, this paper investigates how the 6R CE model (Redesign, Reduce, Reuse, Recycle, Recover, and Rethink) strengthens green energy resilience in sustainable hotels while examining the moderating roles of policy clarity and regulations together with the influences of stakeholder collaboration and management commitment within the Saudi Arabian hospitality sector. The study adopted a four-wave temporally separated quantitative survey design, collecting data from 360 managers working in Saudi sustainable hotels across four time intervals. The proposed conceptual model was evaluated using partial least squares structural equation modeling (PLS-SEM), complemented by mediation and moderation analyses. The findings demonstrate that global energy threats strongly stimulate CE adoption ($\beta = 0.848, p < 0.001$), while CE practices substantially improve green energy resilience ($\beta = 0.719, p < 0.001$). The results further reveal a strong indirect effect through the Strength of CE Implementation ($\beta = 0.813, p < 0.001$), highlighting implementation maturity as a critical mechanism through which circular initiatives translate into resilience outcomes. The proposed model explained 55% of the variance in CE implementation and demonstrated substantial predictive capability for energy resilience. Policy clarity and regulations significantly strengthen the CE–resilience relationship, while stakeholder collaboration and management commitment further enhance these relationships. The results further identify the 6R circularity framework as an effective strategic pathway through which sustainable hotels can mitigate global energy threats while enhancing organizational resilience. This study contributes to the CE and sustainable hospitality literature by providing one of the first empirical models linking CE implementation with green energy resilience under conditions of global energy uncertainty, offering actionable implications for policymakers, hotel managers, and the implementation of Saudi Vision 2030.



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1. Introduction

Hotels, resorts, restaurants, and recreational facilities rely heavily on energy-intensive operations, including heating, cooling, laundry services, food preparation, and water management systems, making hospitality one of the most resource-intensive segments of the global tourism economy. Energy risk has increasingly become a strategic problem rather than an operational one in an era characterized by climate stress, rising utility costs, supply interruptions, and decarbonization pledges. The circular economy (CE) offers a promising response by replacing conventional linear “take-make-dispose” models with resource management, reuse, recycling, recovery, and closed-loop systems. For the hospitality sector, this means lowering food waste, reusing water, installing energy-efficient systems, changing purchasing to support circular items, and changing working methods to ease demand on limited resources [1,2]. These efforts are significant for Saudi Arabia, which is striving to expand its tourism sector at the same time as implementing a green transformation under Vision 2030; in this context, a more energy-conscious hospitality sector is essential [3].

The urgency of these challenges has intensified due to global energy disruptions, including fossil fuel price volatility, increasing electricity demand, climate-related infrastructure risks, geopolitical supply chain disturbances, and growing regulatory pressure to reduce carbon emissions. Hotels are especially sensitive to these demands given their high energy needs to offer a good degree of service, maintain guest comfort, and allow round-the-clock operation. Consequently, industry requires strategies that not only contain operational costs but also strengthen organizational resilience against external shocks. The CE advances these objectives by cutting material and energy use all along the hotel value chain, therefore fostering effective resource use and less reliance on erratic energy sources. An expanding body of evidence increasingly identifies circularity as an effective strategic response to environmental constraints and market uncertainty [4,5]. Research in the hospitality industry and the broader area of sustainability management suggests that CE practices contribute to resource efficiency and meeting expectations of relevant stakeholders; however, the nature and scale of these benefits vary depending on the context [5].

This study investigates the link between the adoption of CE and worldwide energy issues in the hotel sector, especially in the setting of Saudi Arabia. The study examines whether and how circular practices impact the resiliency of hotels and other hospitality locations against worldwide energy threats. More precisely, the study inspects food waste reduction projects, recycling schemes, water conservation efforts, and reuse of materials and services, as well as energy efficiency measures and their relationship to the industry’s ability to react to the swings of energy supplies and the mounting demands for environmentally friendly operations. Theoretically, it helps to clarify how ideas of CE work in a highly energy-intensive service setting and offers data for hotel managers and decision makers in Saudi Arabia to create plans in line with Vision 2030.

Despite growing scholarly attention to CE implementation in hospitality, important theoretical and empirical gaps remain. Existing studies have predominantly focused on European economies or other developed markets and have typically examined isolated sustainability practices such as food waste management, recycling programs, or generic green initiatives rather than investigating integrated circular systems and their resilience implications [2,6]. A review of existing literature shows that energy, water and food waste are the areas of most interest, whereas other aspects like ecosystem protection, the development of analytical dashboards and tools for implementing CE practices remain less developed.

Previous studies have also highlighted the importance of stakeholder engagement, governmental support, and managerial commitment in facilitating sustainability transitions within hospitality organizations, yet these relationships have rarely been investigated within the rapidly expanding Saudi tourism sector [7]. Accordingly, this study examines whether circular practices enhance hotels' capacity to absorb and adapt to global energy shocks and whether organizational and institutional conditions strengthen these relationships. Despite the growing body of research on the CE within hospitality, several important theoretical and empirical gaps remain. Existing studies have largely investigated isolated sustainability practices, such as food waste reduction, recycling initiatives, or energy efficiency, rather than examining how an integrated 6R CE framework enhances hotels' ability to withstand global energy threats and build green energy resilience. Moreover, previous research has primarily focused on European and developed economies, leaving emerging tourism destinations, particularly Saudi Arabia, substantially underrepresented [2]. Beyond this geographical limitation, little empirical evidence explains the mechanisms through which CE practices translate into resilience outcomes or identifies the organizational and institutional conditions under which these relationships become stronger. Consequently, the mediating role of the strength of CE implementation, together with the moderating influences of stakeholder collaboration and management commitment, remains largely unexplored within sustainable hospitality research [3,8].

This study therefore advances literature by developing and empirically validating an integrated framework (Figure 1) that links the 6R CE model with green energy resilience under conditions of global energy uncertainty. Unlike previous studies that predominantly examined direct sustainability outcomes, the proposed framework explains how operational CE practices are transformed into resilience capabilities through the institutionalization and routinization of circular activities captured by the strength of CE implementation construct, and under which organizational conditions these relationships become stronger. By embedding these relationships within the context of Saudi Arabia's rapidly growing sustainable hospitality sector, the study extends current knowledge beyond conventional resource-efficiency perspectives toward a resilience-oriented understanding of CE implementation [3,4,9]. This study aims to investigate how CE practices based on the 6R framework influence green energy resilience in sustainable hotels facing global energy threats. Specifically, the study examines the mediating role of the strength of CE implementation and the moderating effects of stakeholder collaboration and management commitment. By addressing these relationships within the context of Saudi Arabia, the study contributes to CE theory, advances resilience research in hospitality, and provides evidence-based recommendations for hotel managers and policymakers seeking to achieve the sustainability objectives of Saudi Vision 2030 [7,10–12].

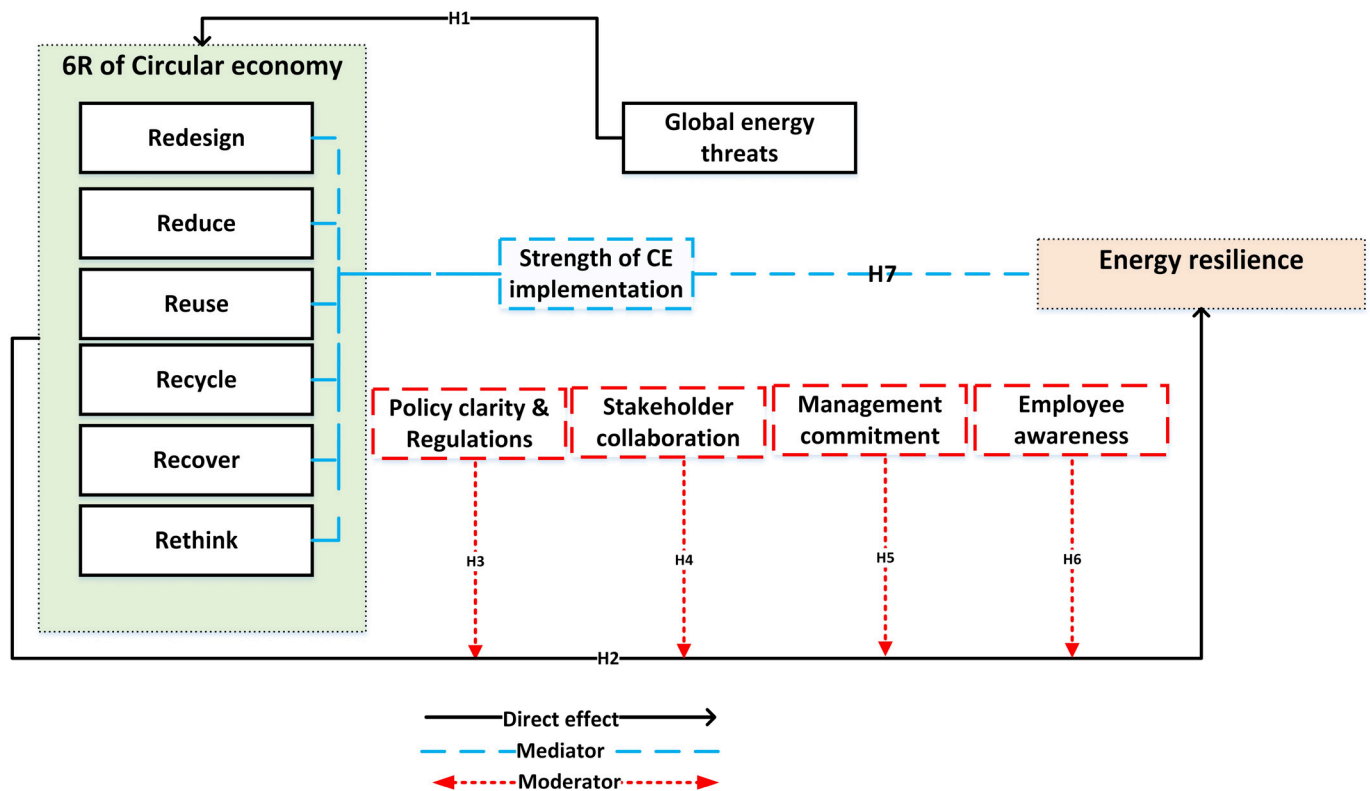


Figure 1. Study framework.

2. Literature Review

2.1. Theory and Hypotheses

Organizational resilience theory, the Resource-Based View (RBV), and Institutional Theory jointly provide the theoretical foundation for the proposed conceptual framework rather than representing independent perspectives. Organizational resilience explains how firms develop adaptive capabilities that enable them to anticipate, absorb, respond to, and recover from external disruptions while maintaining operational continuity [13–16]. Within the hospitality sector, these capabilities are particularly important because hotels operate under high levels of energy dependence and service continuity requirements.

The RBV, originally developed by [17] and extended by [18], argues that organizations achieve sustainable competitive advantage by developing valuable, rare, inimitable, and non-substitutable resources and capabilities. CE practices which include redesign, reuse, recycling, recovery, and resource optimization constitute strategic organizational capabilities that improve resource efficiency while simultaneously reducing operational vulnerability to energy disruptions [19–22].

Institutional Theory further complements RBV by explaining why organizations decide to develop these capabilities. According to seminal institutional scholars, organizational decisions are shaped by coercive regulations, normative expectations, and stakeholder pressures. Within Saudi Arabia, initiatives such as Vision 2030, the Saudi Green Initiative, and the Circular Carbon Economy (CCE) framework provide strong institutional pressures encouraging hotels to adopt CE practices as strategic responses to sustainability and energy challenges [23–27]. Integrating these three theoretical perspectives provides a stronger explanation of the proposed conceptual model. Institutional Theory explains why hotels adopt CE practices in response to external institutional pressures. RBV explains how these practices evolve into valuable organizational capabilities that enhance operational efficiency and competitive advantage. Organizational Resilience Theory subsequently explains

how these capabilities strengthen hotels' capacity to withstand global energy threats and maintain operational continuity under environmental uncertainty. Consequently, the three theories operate sequentially rather than independently, providing a coherent theoretical explanation for the proposed relationships among global energy threats, CE implementation, and green energy resilience.

2.2. Global Energy Threats

Global energy threats refer to the combination of geopolitical, economic, environmental, and infrastructural factors that disrupt stable and affordable energy access. These include fossil-fuel price shocks, supply chain interruptions, carbon-transition pressures, extreme-weather-related grid instability, and the rising demand for energy in rapidly growing economies. The hospitality sector appears exposed both because continued operations and guest experiences hinge on dependable power and because a large proportion of hotel budgets is tied to electricity costs and thermal systems. Longer term, the Saudi Arabian context suggests that energy factors play a critical role in determining long-run environmental standards and that shifts towards a greener and blue economy will help alleviate these pressures [28]. From the perspective of Organizational Resilience Theory, external energy disruptions represent environmental disturbances that require organizations to develop adaptive capabilities capable of maintaining operational continuity under conditions of uncertainty [13–16]. Complementing this perspective, the RBV suggests that organizations confronted with resource scarcity are more likely to invest in strategic capabilities that improve resource efficiency and reduce dependence on vulnerable external resources. Within the hospitality industry, CE practices constitute such strategic capabilities because they enable hotels to optimize resource utilization, minimize waste generation, recover valuable materials, and reduce overall energy dependence [17–20]. More recent research shows that food waste, water usage and energy usage remain the most significant sustainability challenges facing hotels, indicating that isolated environmental initiatives are insufficient to address increasingly complex resource constraints [1,2]. Rather than representing isolated operational improvements, CE practices that include food waste prevention, efficient procurement, linen reuse, building retrofitting, water recycling, and waste-to-energy initiatives collectively enhanced organizational adaptability by reducing resource dependency and improving operational flexibility. Consequently, hotels experiencing greater exposure to energy uncertainty are theoretically expected to perceive stronger incentives to adopt CE practices as proactive strategies for mitigating operational risks while simultaneously improving environmental and economic performance [2].

The Saudi Arabian context further reinforces this theoretical expectation. Institutional Theory suggests that organizations respond not only to resource constraints but also to regulatory expectations and societal pressures. Saudi Vision 2030, together with the CCE framework and related sustainability initiatives, provides a strong institutional environment encouraging hotels to adopt CE practices as strategic responses to increasing energy uncertainty and environmental challenges [12,29,30].

Empirical evidence supports this theoretical reasoning by demonstrating that rising energy costs, increasingly stringent environmental regulations, and decarbonization pressures significantly threaten hotel profitability and operational continuity because hospitality operations depend heavily on electricity-intensive systems, including climate control, refrigeration, lighting, and laundry services [31–33].

Nevertheless, previous empirical studies conducted in Saudi Arabian hotels indicate that although managers recognize growing energy threats, many energy conservation initiatives remain underutilized because of financial concerns, regulatory uncertainty, and limited organizational awareness [6,34]. This inconsistency suggests that perceived global

energy threats alone may not automatically improve organizational resilience; instead, they are more likely to motivate hotels to adopt strategic CE practices that subsequently strengthen resilience. Despite this theoretical proposition, existing hospitality research has not empirically examined whether perceived global energy threats serve as a direct antecedent of CE adoption within the Saudi hospitality context. Addressing this unresolved relationship provides an important theoretical contribution by explaining *why* organizations initiate CE implementation under conditions of increasing energy uncertainty.

H1: *Perceived global energy threats are positively associated with the adoption of CE practices in Saudi hotels.*

2.3. Circular Economy Practices in the Hotel Context

Rather than converging toward a unified understanding of circularity in hospitality, the existing literature reveals three important debates that remain unresolved. First, scholars disagree on whether CE initiatives should be viewed primarily as environmental practices aimed at waste reduction or as strategic capabilities capable of improving organizational resilience and competitiveness. While several studies report reductions in waste generation, energy consumption, and operating costs following CE adoption [35–37], others argue that many hotel initiatives remain fragmented and operationally isolated, thereby limiting their strategic value [20,38,39]. Second, considerable disagreement exists regarding the organizational conditions required for successful CE implementation. Some studies emphasize technological capabilities and digitalization as the primary drivers of circular transformation [6,37], whereas others identify managerial commitment, employee engagement, and institutional support as the decisive determinants of implementation success [20]. These competing explanations suggest that CE outcomes are highly context-dependent and cannot be explained solely by the presence of circular practices themselves.

Third, previous studies have predominantly examined direct sustainability outcomes such as waste reduction, environmental performance, or customer perceptions while paying comparatively limited attention to organizational resilience outcomes. Consequently, the mechanisms through which CE practices enhance a hotel's ability to absorb external shocks, adapt to uncertainty, and maintain operational continuity remain insufficiently understood. This limitation is particularly evident in emerging tourism economies where institutional environments, regulatory frameworks, and resource constraints differ substantially from the mature European contexts that dominate current hospitality CE research [2,6].

The Saudi hospitality sector provides an especially valuable context for addressing these unresolved questions. Hotels operate within an environment characterized simultaneously by rapid tourism expansion, ambitious sustainability targets under Vision 2030, and increasing exposure to global energy uncertainty. These conditions create strong institutional pressures for circular transformation while also increasing the strategic importance of organizational resilience capabilities [12,29,30]. Consequently, the Saudi context offers an opportunity not only to examine whether CE practices improve resilience, but also to understand the organizational and institutional conditions under which these benefits materialize. A similar study in 2023 examined the barriers faced when transitioning to a CE and found that emerging economies faced problems of poor infrastructure, an inability to handle large quantities, lack of circular market mechanisms and support, weak legislative backing and issues with product design, manufacturing and the collection of waste. Developing countries, however, were held back by prioritising better customer service (high-quality service), consumer awareness (lack of consumer engagement) and data access and sharing (information gaps) [37]. According to 2022 research, companies can adopt circular models to add value, driven by institutional pressure and other stakeholders' desires. This can prevent their CE strategy from being a greenwashing tactic rather than a

fundamental change. A 2022 article indicated that it is crucial for companies, especially from the management side, to commit to sustainable values and drive this change to become truly circular [20]. The focus sharpened on identifying which strategies are truly effective, with studies examining management of single-use plastics, food, and water [38]. Furthermore, research began to explicitly link CE practices to the creation of economic, environmental, and social value through mechanisms like enhanced resource efficiency and reduced greenhouse gas emissions [39].

Studies conducted specifically within Saudi Arabia have begun to assess the current state of CE practices in green hotels, confirming a significant correlation between CE strategies, such as redesign, reuse, and recovery, and overall hotel performance [6]. Research in the region also establishes a clear link between CE adoption, the promotion of low-carbon behaviors among professionals, and improved environmental outcomes [40]. This context-specific analysis is further enriched by a broader strategic push within Saudi Arabia towards a CCE, signaling regional leadership ambitions [41,42]. This body of work synthesizes findings on technology as a crucial facilitator and examines how the CE transition unfolds within the unique policy and socio-economic landscape of Saudi Arabia, providing a highly relevant evidence base for developing practical, context-aware recommendations [43].

In hospitality, CE models replace the traditional “take–make–dispose” logic with closed-loop systems that redesign services, reduce resource use, reuse assets, recycle materials, recover value from waste and rethink purchasing towards regenerative options. Empirical and industry evidence shows that hotels implementing CE-aligned measures, such as circular building design, high-efficiency lighting and HVAC, digital monitoring, on-site composting, waste-to-energy and repair/reuse of furnishings, achieve significant reductions in energy and resource consumption alongside cost savings and brand differentiation [44,45].

Energy management has been explicitly framed as a CE principle in hotel studies, with work in Kenyan star-rated hotels finding that higher levels of energy management adoption (e.g., efficient appliances, renewable energy, behavioural controls) significantly improve customer satisfaction and operational performance. Zero-waste and CE programmes in international hotel groups similarly document reduced energy and waste costs when reduce–reuse–recycle principles are embedded into daily operations [46–48].

From an RBV perspective, CE practices represent strategic capabilities that improve resource utilization while reducing dependence on scarce energy resources. Organizational Resilience Theory further suggests that organizations possessing adaptive resource management capabilities are better equipped to absorb external shocks and recover from disruptions. Consequently, hotels that systematically implement the 6R CE framework should exhibit greater energy resilience because they reduce resource dependency, diversify operational processes, and strengthen adaptive capacity under conditions of energy uncertainty. This theoretical reasoning extends beyond previous empirical observations by explaining the underlying mechanism through which CE contributes to resilience [36].

H2: *Based on the Saudi context, the implementation of CE practices (Redesign, Reduce, Reuse, Recycle, Recover, Rethink/Purchase) is positively connected with hotels’ energy resilience.*

The present study specifically selects top management commitment, policy clarity, stakeholder collaboration, and employee awareness as moderating variables because they collectively represent the principal organizational and institutional conditions emphasized by RBV, Institutional Theory, and CE implementation research. Top management commitment reflects the strategic allocation of organizational resources, policy clarity captures institutional support and regulatory certainty, stakeholder collaboration represents external resource integration across the CE ecosystem, and employee awareness reflects the

operational capability required to embed CE practices into everyday organizational routines. Unlike technological readiness or organizational size, these four moderators directly influence the effectiveness with which CE capabilities are translated into organizational resilience, thereby providing stronger theoretical alignment with the proposed conceptual framework [18,34,47–55].

2.4. Circular Economy Enabling Factors

Indeed, there is substantial research on Saudi Arabia. The Kingdom is increasingly looking towards sustainability and national policies as sustainability enablers for the region. As the authors posit, one of the key institutional drivers reshaping the hospitality sector in Saudi Arabia is its Vision 2030 alongside the CCE strategy framework that aligns with such vision [34]. Another paper also explored these relationships for Saudi Arabian hotels using PLS-SEM. Their results indicated that CE practices such as redesigning, purchasing, production and recovery have positive and significant influences on overall hotel performance, thus corroborating the hypotheses for the sustainability links from an Arabic geographical location. Interestingly, there is another problem called Circularity Paradox, meaning that there is still a wide gap between sustainability intentions and actions. Circularity strategies are generally practiced at a superficial level. Their study proposed moderator variables such as strong government policies, staff awareness of sustainability, cooperation of stakeholders and technological innovations from Industry 4.0 to reinforce CE's beneficial impacts on performance. There is also an overarching need for system-level change that includes effective policy and strong collaboration between industry and academics, among others, in the latest studies looking at Saudi Arabia [36].

CE implementation strengthens organizational resilience by improving resource efficiency, creating redundancy through closed-loop flows, and developing adaptive routines that support absorption, adaptation, and transformation, while top management commitment (TMC) amplifies this effect through strategic prioritization, resource allocation, and cross-functional orchestration, bolstering dynamic capabilities that enable CE and performance [49]. Meta-analytic and firm-level evidence (including studies from Saudi Arabia) show positive CE-performance links, contextual moderators, and identify TMC as a significant driver of CE adoption and financial outcomes, suggesting it as a leverage point. Previous empirical studies have operationalized CE implementation as a multidimensional construct capturing resource efficiency, loop-closing activities, and product life extension, while organizational resilience has been conceptualized as a multidimensional adaptive capability. Building upon this literature, the present study examines whether top management commitment strengthens the translation of CE capabilities into resilience outcomes within Saudi hotels. Although TMC's role in CE adoption is established, its moderation of CE to resilience, particularly in Saudi contexts under Vision 2030, remains under-tested, so quantifying this interaction responds to calls for large-sample tests of resilience antecedents [50].

TMC is consistently identified as a critical driver of CE adoption and green operational practices, as leaders allocate resources, set policies and integrate circularity into corporate strategy. In both manufacturing and hotel contexts, strong TMC amplifies the impact of external pressures on CE adoption and enhances the translation of CE principles into competitive and sustainability performance [20,51,52].

H3: *In Saudi Arabian firms, TMC positively moderates the relationship between CE implementation and organizational resilience, such that the CE-resilience effect is significantly stronger at higher levels of TMC.*

Policy clarity reduces environmental uncertainty, transaction costs, and compliance ambiguity, thereby enabling firms to undertake longer-term CE investments, coordinate more effectively with ecosystem partners, and translate organizational capabilities into resilience outcomes. Existing evidence from Saudi Arabia suggests that the quality of regulation, particularly clarity and stability, may be more important than regulatory intensity itself in facilitating successful CE implementation [53].

Institutional studies in tourism show that policy frameworks, incentives and clear regulations significantly influence the implementation of CE initiatives, with government backing and sectoral standards increasing the likelihood of sustainable practices being adopted and maintained. In Saudi Arabia, Vision 2030, SGI and the CCE programme provide coherent narratives and targets for emissions reduction, waste diversion and resource efficiency, supported by sector-specific ESG expectations for tourism and hospitality projects [54].

H4: *Perceived clarity of Saudi circular economy–relevant policy positively moderates the relationship between CE implementation and organizational resilience, such that the CE-resilience effect is significantly stronger when policy clarity is high.*

CE in hospitality is increasingly framed as a system-wide transition requiring collaboration across supply chains, destinations and communities, with multi-stakeholder partnerships identified as key enablers of CE projects in tourism ecosystems. Empirical work on institutional factors in emerging tourism destinations finds that stakeholder collaboration among government, employees, local communities, investors and suppliers supports the implementation of circular initiatives and enhances their environmental and social benefits. However, stakeholder collaboration is theoretically relevant in this study not because it directly increases CE adoption, but because it changes the effectiveness with which CE practices are translated into resilience outcomes. Many CE initiatives in hospitality extend beyond the organizational boundary of a single hotel and depend on external actors to close material and energy loops. For example, recycling systems require coordination with waste processors, food recovery initiatives depend on local redistribution partners, and circular procurement relies on suppliers capable of supporting take-back arrangements and product life extension. Consequently, hotels implementing identical CE practices may experience substantially different resilience outcomes depending on the quality and intensity of stakeholder collaboration supporting these initiatives.

From an RBV perspective, stakeholder networks provide access to complementary resources and capabilities unavailable within the focal organization. Organizational Resilience Theory further suggests that interorganizational collaboration creates adaptive capacity by increasing redundancy, improving information flows, and enabling alternative resource pathways during periods of disruption. Therefore, stakeholder collaboration strengthens the extent to which CE practices reduce operational vulnerability to energy shocks and supply interruptions.

At the same time, recent resilience research suggests that collaboration may exhibit non-linear effects because excessive coordination requirements can increase administrative complexity, slow decision-making, and create dependency on external actors. Consequently, collaboration should be viewed as a contingent capability that strengthens the CE-resilience relationship up to an optimal level rather than as an unconditionally positive influence. The effectiveness of stakeholder collaboration depends not only on the number of participating actors but also on the quality of information exchange, joint problem solving, and coordination mechanisms that support circular resource flows across organizational boundaries [55].

H5: *Stakeholder collaboration intensity in CE activities positively moderates the relationship between CE implementation and organizational resilience in Saudi firms, such that the CE-resilience effect increases with higher collaboration intensity.*

Operational studies of resource optimisation in hotels underscore the importance of staff awareness, training and engagement for achieving energy and water savings, as many CE measures depend on frontline behaviours and routine decisions. Research on Saudi luxury hotels indicates that limited awareness and training among staff contribute to low implementation rates of identified energy conservation opportunities, despite clear technical potential [56,57].

Nevertheless, employee awareness is theoretically important in this study not because it independently generates resilience, but because it influences the extent to which formal CE initiatives become embedded within everyday organizational routines. Many circular practices, including waste separation, energy conservation, water reuse programs, preventive maintenance, and circular procurement procedures, depend heavily on discretionary employee behaviors rather than solely on managerial policies or technological investments.

Organizational Resilience Theory suggests that resilience emerges through adaptive behaviors distributed throughout the organization rather than through centralized decision-making alone. Employees with stronger awareness of circular principles are more likely to recognize resource inefficiencies, identify opportunities for process improvements, respond effectively during operational disruptions, and support organizational learning following external shocks. Consequently, employee awareness strengthens the ability of hotels to transform formal CE initiatives into adaptive organizational capabilities capable of maintaining service continuity during periods of energy uncertainty.

From an RBV perspective, employee awareness represents an intangible organizational resource that increases the effectiveness of existing CE capabilities by reducing implementation gaps between formal strategy and operational practice. Therefore, hotels exhibiting higher levels of employee awareness are expected to realize stronger resilience benefits from comparable levels of CE implementation than hotels where sustainability remains confined to managerial intentions or isolated technical initiatives [18,57].

H6: *Employee awareness of CE culture positively moderates the relationship between CE implementation and energy resilience in Saudi firms, such that the CE-resilience effect increases with higher staff awareness.*

2.5. Energy Resilience and Strength of CE Implementation

Energy resilience refers to an organization's capability to anticipate, absorb, adapt to, and recover from energy-related disturbances while maintaining essential operational functions and service quality. Within the hospitality industry, energy resilience extends beyond simple reductions in energy consumption to encompass the organizational capacity to sustain uninterrupted hotel operations despite fluctuations in energy prices, supply disruptions, infrastructure failures, or broader environmental uncertainties. Accordingly, energy-resilient hotel systems integrate technological solutions with organizational capabilities such as strategic planning, adaptive learning, operational flexibility, and continuous improvement [15,16]. Consequently, energy resilience should be viewed as a dynamic organizational capability rather than merely an operational outcome.

Although CE practices contribute to improving resource efficiency, the adoption of individual 6R practices does not necessarily imply that these practices become embedded within an organization's routines or decision-making processes. This distinction is particularly important from the perspectives of the RBV and Organizational Resilience Theory, both of which argue that sustainable competitive advantages emerge not merely from

possessing valuable practices but from developing organizational capabilities that enable these practices to be effectively coordinated, continuously improved, and consistently deployed across the organization.

Accordingly, the present study distinguishes between the adoption of the 6R CE framework and the Strength of CE Implementation. The 6R framework represents the portfolio of CE practices adopted by hotels, including redesigning, reducing, reusing, recycling, recovering, and rethinking activities. These dimensions describe what organizations implement to improve environmental sustainability and resource efficiency. In contrast, the Strength of CE Implementation represents how these practices become institutionalized throughout the organization. It reflects the degree to which CE initiatives are systematically embedded into managerial routines, operational procedures, organizational culture, strategic planning, cross-functional coordination, performance monitoring, and continuous organizational learning. Consequently, two hotels may report implementing similar CE practices while exhibiting substantially different implementation strength depending on how consistently and comprehensively these initiatives are integrated into everyday organizational activities.

This distinction is consistent with recent resilience research demonstrating that resilience is generated not solely through the adoption of sustainable practices but through the institutional capacity to coordinate, integrate, and continuously adapt and refine those practices under changing environmental conditions. Recent urban resilience studies similarly emphasize that sustainability initiatives create resilient systems only when they evolve from isolated technical interventions into integrated governance and management capabilities that support long-term adaptive capacity. Such findings reinforce the argument that implementation maturity, rather than the mere presence of sustainability initiatives, constitutes the critical mechanism through which sustainability practices generate resilience outcomes [58].

Within the hospitality context, hotels that introduce isolated CE initiatives may achieve incremental improvements in waste reduction or resource efficiency. However, hotels exhibiting strong implementation capabilities are more likely to coordinate CE activities across departments, align managerial decisions with sustainability objectives, continuously monitor performance, allocate appropriate organizational resources, and refine CE initiatives over time. Such organizational routinization transforms individual CE practices into dynamic organizational capabilities capable of enhancing operational flexibility and strengthening energy resilience during periods of external uncertainty. This reasoning explains why the Strength of CE Implementation functions as a mediating organizational capability linking CE practices to superior resilience outcomes [9,48].

H7: *The strength of CE implementation mediates the relationship between CE practices and energy resilience, such that hotels with stronger implementation realise greater resilience gains from their CE practices.*

Overall, the literature suggests that circular economy practices can contribute to resilience and sustainability outcomes; however, important theoretical questions remain unresolved regarding the mechanisms through which these benefits emerge, and the organizational conditions required for their realization. Existing hospitality studies rarely distinguish between the adoption of circular practices and the organizational capability required to institutionalize those practices over time. Similarly, the moderating roles of managerial support, stakeholder collaboration, policy clarity, and employee awareness remain underexplored within Middle Eastern hospitality contexts. Addressing these gaps provides the theoretical motivation for the present study and directly informs the development of hypotheses H1–H7.

3. Methodology

3.1. Sample

The target population comprised environmentally sustainable hotels operating within Saudi Arabia. These organizations were considered the most appropriate empirical setting because they are actively engaged in resource management, environmental sustainability, and energy-efficiency initiatives, making them well positioned to evaluate CE implementation and organizational responses to global energy threats. In contrast to conventional hotels, environmentally sustainable hotels have already established sustainability-related operational practices and managerial systems, thereby providing a more suitable context for examining the proposed relationships among CE practices, organizational resilience, and energy-related challenges. This sampling strategy also aligns with Saudi Arabia's Vision 2030, which encourages sustainable tourism development and environmental transformation throughout the hospitality sector.

A purposive sampling technique was employed because the proposed conceptual model required respondents possessing specialized knowledge of their organizations' sustainability practices, resource management policies, and strategic operational decisions. Probability sampling was considered inappropriate because not all hotels possess comparable levels of CE implementation or managerial expertise regarding sustainability and energy management. Purposive sampling therefore enabled the selection of information-rich organizations capable of providing reliable evaluations of the investigated constructs, consistent with recommendations for organizational sustainability and hospitality management research. The sampling frame consisted of approximately 60 environmentally sustainable hotels operating primarily within the Eastern Region of Saudi Arabia [59]. Hotels were identified based on their demonstrated commitment to environmental sustainability through the adoption of resource-efficiency initiatives, energy conservation programs, waste management systems, or broader sustainability practices. This region was selected because it contains a substantial concentration of hotels participating in Saudi Arabia's expanding sustainable tourism sector while simultaneously experiencing increasing pressures associated with energy management and environmental performance.

To ensure consistency across participating organizations, hotels were required to satisfy three inclusion criteria. First, they had to operate as registered hospitality establishments within Saudi Arabia. Second, they needed to demonstrate active implementation of CE-related practices relevant to hotel operations. Third, participating hotels were required to employ managers or department heads directly involved in operational, environmental, engineering, procurement, facilities management, or sustainability-related decision-making. Hotels that could not identify qualified managerial respondents or that lacked evidence of sustainability-related operational practices were excluded from the sampling frame. Within each participating hotel, questionnaires were distributed to managerial employees possessing direct responsibility for resource management, sustainability implementation, operational planning, engineering, procurement, or executive decision-making. Eligible respondents therefore included general managers, operations managers, sustainability or corporate social responsibility (CSR) managers, engineering and facilities managers, procurement managers, and other senior personnel with comprehensive knowledge of their hotel's CE initiatives and energy management practices. Restricting participation to managerial respondents enhanced the accuracy of organizational-level information while reducing the likelihood of uninformed responses.

Following institutional approval from participating in hotels, the research team established direct communication with hotel management to explain the objectives of the study, request organizational participation, and coordinate questionnaire distribution. Questionnaires were subsequently administered to eligible respondents through designated

organizational contacts within each participating hotel. Participation remained entirely voluntary, and respondents were informed that all responses would remain anonymous and be used exclusively for academic research purposes.

A total of 590 questionnaires were distributed across the participating hotels, with approximately ten questionnaires allocated to each organization according to managerial staff availability. Of these, 379 questionnaires were returned, corresponding to an initial response rate of approximately 64.2%. After data screening, nineteen questionnaires were excluded because of substantial missing information, incomplete responses, or inconsistent response patterns. Consequently, 360 valid questionnaires were retained for the final analysis, yielding an effective response rate of approximately 61.0%. This response rate compares favorably with previous organizational and hospitality management studies employing managerial surveys and provides an adequate basis for robust multivariate statistical analysis.

Potential non-response bias was minimized through several procedural approaches. Multiple follow-up reminders were sent to participating hotels during the data collection period to encourage questionnaire completion. In addition, anonymity and confidentiality were emphasized throughout the survey process to reduce respondents' concerns regarding organizational disclosure. Early and late responses were also compared as a commonly accepted proxy for assessing non-response bias, and no meaningful differences were observed across the principal demographic characteristics or study constructs, suggesting that non-response bias was unlikely to materially affect the findings. Furthermore, the final sample size of 360 respondents substantially exceeded the minimum sample recommendations for Partial Least Squares Structural Equation Modeling (PLS-SEM), thereby providing sufficient statistical power for estimating the proposed moderated mediation model.

The demographic characteristics of the respondents are presented in Table 1. The final sample represents a diverse cross-section of Saudi Arabian sustainable hotels with respect to hotel category, organizational size, and managerial position, thereby enhancing the generalizability and practical relevance of the study findings within the Saudi hospitality sector.

Table 1. Respondents' profile.

Attributes	Category	Frequency	Percentage
Hospitality establishment	Luxury hotel	90	25.0
	Upscale	100	27.8
	Mid-range	85	23.6
	Resort	85	23.6
No. full-time employees	1–49	70	19.4
	50–99	85	23.6
	100–249	110	30.6
	250 or more	95	26.4
Current role	Owner/General manager	80	22.2
	Operations manager	95	26.4
	Sustainability/CSR manager	45	12.5
	Facilities manager/Engineering	60	16.7
	Procurement manager	50	13.9
	Other (Please specify)	30	8.3
Total		360	100.0

3.2. Measures

All constructs included in this study were measured using previously validated scales adapted from established literature to ensure content validity while reflecting the operational characteristics of the Saudi Arabian hospitality sector. The questionnaire was developed following an extensive review of the CE, sustainability management, organizational resilience, and hospitality literature. Minor wording modifications were introduced to improve contextual relevance without altering the original conceptual meaning of the measurement items. The complete measurement instrument is presented in Table 2 and Appendix A.

All questionnaire items were assessed using a five-point Likert scale ranging from 1 = “Strongly disagree” to 5 = “Strongly agree.” This response format has been widely adopted in hospitality, sustainability, and organizational management research because it provides an appropriate balance between measurement sensitivity and respondent consistency while facilitating multivariate analysis using Partial Least Squares Structural Equation Modeling (PLS-SEM). Prior to the main survey, the questionnaire was reviewed by three academic experts specializing in hospitality sustainability and pilot-tested with 25 hotel managers to evaluate wording clarity, content relevance, and overall questionnaire comprehensibility. Minor linguistic refinements were subsequently incorporated based on participants’ feedback before full-scale data collection commenced.

Global Energy Threats (GET) were operationalized as managers’ perceptions of external energy-related uncertainties affecting hotel operations, including oil price volatility, rising energy costs, and instability within international energy markets. Rather than measuring objective energy market conditions, the construct captures organizational perceptions of energy-related risks that may influence strategic decision-making regarding sustainability investments and resource management. Accordingly, three first-order dimensions, which are oil price volatility, high energy cost, and market instability were employed to comprehensively represent the multidimensional nature of global energy threats.

Energy Resilience (ER) was conceptualized as the organizational capability to anticipate, withstand, adapt to, and recover from energy-related disruptions while maintaining continuous hotel operations and service quality. Consistent with Organizational Resilience Theory, the measurement emphasizes adaptive organizational capacity rather than merely reflecting historical operational performance. Consequently, the measurement items evaluate renewable energy utilization, operational continuity, energy supply stability, mitigation of energy price volatility, and the organization’s capability to sustain uninterrupted guest services during energy-related disruptions.

CE practices were operationalized using the expanded 6R framework comprising Redesign, Reduce, Reuse, Recycle, Recover, and Rethink. Each dimension was measured using three reflective indicators capturing the extent to which hotels have integrated circular principles into their operational activities, strategic planning, procurement systems, waste management practices, resource recovery initiatives, and long-term organizational decision-making. Compared with traditional three-dimensional CE frameworks, the expanded 6R model provides a more comprehensive representation of circular resource management and aligns closely with Saudi Arabia’s sustainability transition under Vision 2030.

Four moderating variables were incorporated to examine the organizational and institutional conditions under which CE practices contribute to enhanced energy resilience. Policy Clarity and Regulations (PC) assessed managers’ perceptions regarding the clarity, consistency, and practical applicability of CE-related governmental regulations together with the extent to which these external regulatory requirements are effectively translated into clear internal organizational guidelines, implementation procedures, and managerial responsibilities. Accordingly, the construct captures the organizational alignment between

the external regulatory environment and internal policy implementation rather than treating these as separate organizational phenomena. Stakeholder Collaboration (SC) measured the intensity of collaborative relationships with suppliers, business partners, governmental agencies, and other external stakeholders involved in CE initiatives. Management Commitment (MC) evaluated the extent of strategic leadership support through resource allocation, managerial involvement, sustainability-oriented decision-making, and the monitoring of CE performance indicators. Staff Awareness (SA) assessed employees' knowledge, training participation, sustainability awareness, and organizational engagement regarding CE implementation. These moderators were selected because they represent the principal institutional and organizational conditions identified by RBV, Institutional Theory, and Organizational Resilience Theory as facilitating the successful translation of organizational capabilities into resilience outcomes.

The mediating construct, Strength of Circular Economy Implementation (SCI), was operationalized to the extent to which CE principles have been systematically embedded into hotels' daily operational activities, managerial routines, and long-term strategic decision-making. Unlike the measurement of individual CE practices, this construct captures the maturity, comprehensiveness, and institutionalization of CE implementation throughout the organization. Accordingly, the measurement evaluates the degree to which CE initiatives extend beyond isolated environmental projects to become fully integrated organizational capabilities that continuously improve resource efficiency, waste reduction, environmental performance, and organizational resilience.

Overall, all measurement scales were adapted from previously validated instruments reported in the existing literature while being carefully contextualized for Saudi Arabian hotels. The psychometric properties of each construct, including indicator reliability, internal consistency reliability, convergent validity, discriminant validity, and multicollinearity, were subsequently evaluated during the measurement model assessment, with the results presented in Section 4 and summarized in Table 2.

3.3. Data Collection Instruments

Primary data were collected using a structured self-administered questionnaire developed from previously validated measurement scales reported in the CE, sustainability, organizational resilience, and hospitality management literature [57,58,60]. The questionnaire comprised four sections covering respondents' demographic characteristics, CE practices, Global Energy Threats, Energy Resilience, and the organizational enabling factors included in the proposed conceptual framework. All measurement items employed a five-point Likert scale ranging from 1 ("Strongly disagree") to 5 ("Strongly agree"). Prior to full-scale administration, the questionnaire underwent expert review and pilot testing to ensure linguistic clarity, contextual appropriateness, and content validity within the Saudi hospitality sector.

To minimize the possibility of common method bias (CMB), data collection followed a four-wave temporal research design between June 2025 and February 2026. Rather than collecting all study variables simultaneously, the measurement of the principal constructs was temporally separated, thereby reducing respondents' ability to infer the conceptual relationships among variables and limiting consistency motifs and common rater effects. Temporal separation has been widely recommended as one of the most effective procedural remedies for minimizing CMB in organizational survey research.

During Study 1 (June–July 2025), respondents provided information regarding their hotels' implementation of the 6R CE practices together with organizational demographic characteristics. Measuring the independent construct separately reduced respondents' tendency to cognitively associate subsequent organizational outcomes with their initial evaluations.

Study 2 (August–September 2025) focused on collecting data relating to the organizational enabling conditions, including Policy Clarity and Regulations, Stakeholder Collaboration, Management Commitment, and Staff Awareness. Measuring these contextual variables during a separate wave reduced respondents' inclination to provide internally consistent responses across conceptually related constructs.

Study 3 (October–November 2025) collected responses relating to the mediating construct, namely the Strength of Circular Economy Implementation. Separating the mediator from both the predictor and outcome variables strengthened the temporal ordering of the conceptual framework and reduced potential inflation of indirect effects arising from single-source measurement.

Finally, Study 4 (January–February 2026) measured the dependent construct, Energy Resilience, together with respondents' perceptions of Global Energy Threats. Collecting the outcome variables during the final stage reduced respondents' ability to establish direct cognitive links between organizational practices and perceived resilience outcomes, thereby improving the internal validity of the proposed causal model.

Several additional procedural remedies were implemented to minimize common method bias. Respondents were assured that participation was entirely voluntary, responses would remain anonymous, and the collected information would be used exclusively for academic research purposes. Questionnaire instructions emphasized that there were no right or wrong answers, thereby reducing evaluation apprehension and social desirability bias. Furthermore, construct definitions were carefully separated throughout the questionnaire to minimize respondents' ability to identify the proposed causal relationships. Collectively, these procedural safeguards substantially reduced the likelihood that common method variance would systematically influence the observed relationships.

The sequential measurement design therefore followed the theoretical ordering of the proposed conceptual model by first measuring CE practices, subsequently capturing organizational enabling conditions, then evaluating the strength of Circular Economy implementation, and finally assessing Energy Resilience under conditions of Global Energy Threats. Although this temporally separated multi-wave design cannot establish definitive causal relationships because the study remains perceptual, self-reported, and non-experimental in nature, it strengthens confidence in the temporal ordering of the proposed relationships and substantially reduces the likelihood of common method bias influencing the observed associations. This approach is consistent with recommended procedural remedies in organizational survey research.

3.4. Data Analysis

The proposed research model was analyzed using PLS-SEM implemented in SmartPLS 4. The selection of PLS-SEM was based on several methodological considerations consistent with [61]. First, the primary objective of this study is predictive rather than purely confirmatory, as the proposed framework seeks to explain and predict how CE practices contribute to Energy Resilience under conditions of Global Energy Threats while extending existing theoretical knowledge within sustainable hospitality research. Consequently, variance-based structural modeling is more appropriate than covariance-based approaches when maximizing the explained variance (R^2) of endogenous constructs constitutes a principal research objective.

Second, the proposed conceptual framework represents a relatively complex structural model incorporating multiple latent constructs, a multidimensional 6R CE framework, a mediating mechanism (Strength of Circular Economy Implementation), and four moderating variables (Policy Clarity and Regulations, Stakeholder Collaboration, Management Commitment, and Staff Awareness). Estimating such moderated mediation relationships

simultaneously is particularly well suited to PLS-SEM because of its ability to efficiently estimate complex structural models while maintaining robust parameter estimation.

Third, although the final sample comprised 360 valid managerial responses, organizational survey data frequently deviates from multivariate normality owing to the ordinal nature of Likert-scale measurements and the presence of perceptual constructs. Unlike covariance-based SEM, PLS-SEM does not require strict multivariate normality assumptions and therefore provides more robust parameter estimates under non-normal data conditions. Moreover, the available sample size substantially exceeded the minimum statistical requirements for estimating the proposed structural model, thereby ensuring adequate statistical power for hypothesis testing.

The empirical analysis proceeded using the recommended two-stage analytical procedure. The first stage evaluated the measurement model by examining indicator reliability, internal consistency reliability using Cronbach's alpha and Composite Reliability (CR), convergent validity using Average Variance Extracted (AVE), discriminant validity through the Heterotrait-Monotrait Ratio (HTMT), and potential multicollinearity using the Variance Inflation Factor (VIF). The second stage assessed the structural model by estimating standardized path coefficients, coefficients of determination (R^2), effect sizes (f^2), predictive relevance (Q^2), and the statistical significance of the proposed direct, indirect, mediating, and moderating relationships.

Hypothesis testing was performed using the non-parametric bootstrapping procedure with 5000 resamples and bias-corrected confidence intervals, as recommended for PLS-SEM applications. Bootstrapping provides robust estimates of standard errors and confidence intervals without relying on distributional assumptions, thereby enhancing the reliability of statistical inference. The predictive capability of the proposed model was further evaluated by examining (R^2) of the endogenous constructs together with the overall pattern of significant structural relationships, allowing a comprehensive assessment of the proposed theoretical framework. Consistent with recent PLS-SEM guidelines, the predictive performance of the proposed model was additionally assessed using the PLSpredict procedure implemented in SmartPLS 4. The predictive assessment compared the root mean squared prediction errors (RMSE) generated by the PLS model against those obtained from a benchmark linear model. Lower prediction errors produced by the PLS model relative to the benchmark indicate superior out-of-sample predictive capability and provide additional evidence regarding the practical usefulness of the proposed framework beyond explanatory model evaluation.

Table 2. Summary of measurement model evaluation.

Model Constructs		Dimensions/Indicators	α	CR	AVE	VIF
Global energy threats [62,63]	Oil price volatility	3 items	0.816	0.939	0.836	2.98
	High energy cost	3 items	0.884	0.936	0.829	2.14
	Market instability	3 items	0.979	0.939	0.837	2.40
Energy resilience [64,65]		5 items	0.899	0.954	0.807	1.88
6R Framework of CE	Redesign [34,66–68]	3 items	0.877	0.892	0.735	2.40
	Reduce [6,48,69]	3 items	0.899	0.917	0.786	3.12
	Reuse [37,70,71]	3 items	0.992	0.903	0.757	3.21

Table 2. *Cont.*

Model Constructs	Dimensions/Indicators	α	CR	AVE	VIF	
6R Framework of CE	Recycle [69,72,73]	3 items	0.993	0.914	0.780	3.14
	Recover [6,22,74]	3 items	0.995	0.951	0.866	2.94
	Rethink [34,66,68,74]	3 items	0.996	0.903	0.757	2.20
Policy clarity & regulations [75,76]	3 items	0.894	0.884	0.718	2.75	
Stakeholder collaboration [77,78]	3 items	0.991	0.909	0.769	2.20	
Management commitment [79,80]	3 items	0.892	0.912	0.774	2.00	
Staff Awareness [81,82]	3 items	0.882	0.895	0.740	2.01	
Strength of CE implementations [20,83–85]	5 items	0.901	0.933	0.737	2.14	

Note: The complete list of measurement items, standardized factor loadings, item sources, and item-level psychometric statistics are provided in (Appendix A) to improve readability of the main manuscript while ensuring full transparency regarding construct operationalization and measurement quality assessment.

4. Results

4.1. Measurement Model Assessment

The reflective measurement model was assessed by examining indicator reliability, internal consistency reliability, convergent validity, and multicollinearity using indicator loadings (λ), Cronbach's alpha (α), composite reliability (CR), average variance extracted (AVE), and variance inflation factor (VIF), following the recommended PLS-SEM evaluation procedure. As reported in Table 2, all constructs satisfy the recommended psychometric criteria. Indicator loadings exceeded the recommended threshold of 0.70, confirming that the observed indicators adequately represented their respective latent constructs. Likewise, Cronbach's alpha and composite reliability values consistently surpassed the accepted cut-off values, demonstrating strong internal consistency across all study constructs. Furthermore, all AVE values exceeded the recommended threshold of 0.50, confirming satisfactory convergent validity and indicating that each construct explained more than half of the variance in its corresponding indicators. Notably, the Energy Resilience, Recover, and Strength of CE Implementation constructs exhibited particularly strong reliability and convergent validity, suggesting that respondents demonstrated highly consistent perceptions regarding organizational resilience capabilities and the institutionalization of CE practices. Collectively, these findings provide strong evidence that the measurement instrument reliably captures the underlying theoretical constructs and establishes a robust foundation for subsequent structural model analysis.

Collinearity diagnostics further demonstrated that all VIF values remained well below the conservative threshold of 5.0, indicating the absence of problematic multicollinearity among the indicators. This finding confirms that each construct contributes unique explanatory information to the proposed model without introducing estimation bias arising from redundant predictors. Overall, the measurement model demonstrates excellent reliability, satisfactory convergent validity, and acceptable collinearity diagnostics, thereby providing

sufficient statistical support for evaluating the hypothesized relationships among global energy threats, CE practices, organizational enablers, and hotel energy resilience.

Discriminant validity was assessed using the heterotrait–monotrait ratio (HTMT), which is widely recommended as a more rigorous criterion than the traditional Fornell–Larcker approach for evaluating discriminant validity in PLS-SEM. As presented in Table 3, all HTMT values remained below the conservative threshold of 0.85, confirming that the latent constructs are empirically distinct and capture different theoretical dimensions of the proposed research model. This finding demonstrates that global energy threats, CE practices, organizational enabling factors, strength of CE implementation, and energy resilience represent conceptually independent constructs, thereby reducing the possibility of construct redundancy and providing further support for the validity of the measurement model.

Table 3. Discriminant validity by HTMT calculation.

	Global Energy Threats	Energy Resilience	6R Framework of CE	Policy Clarity	Stakeholder Collaboration	Management Commitment	Staff Awareness	Strength of CE Implementation
Global energy threats	—							
Energy resilience	0.42	—						
6R framework of CE	0.39	0.42	—					
Policy clarity	0.47	0.45	0.37	—				
Stakeholder collaboration	0.44	0.42	0.49	0.52	—			
Management commitment	0.36	0.39	0.41	0.34	0.38	—		
Staff awareness	0.72	0.69	0.63	0.71	0.68	0.58	—	
Strength of CE implementation	0.58	0.55	0.49	0.53	0.51	0.46	0.70	—

Overall, the combined evidence from the reliability, convergent validity, discriminant validity, and common method bias assessments confirms that the measurement model satisfies the recommended quality criteria, thereby providing a robust basis for evaluating the hypothesized structural relationships.

Given that all data were collected through a self-administered survey, potential common method bias (CMB) was further examined using multiple complementary procedures. First, Harman’s single-factor test showed that the first unrotated factor explained only 36.9% of the total variance, remaining substantially below the commonly accepted 50% threshold. Second, the full collinearity assessment indicated that all VIF values were below the conservative cut-off value of 3.3, providing additional evidence that neither common method variance nor multicollinearity posed a serious threat to the model estimates. The convergence of these diagnostic tests provides strong support for the robustness of the measurement model and increases confidence that the observed structural relationships primarily reflect the underlying theoretical constructs rather than measurement artefacts or systematic response bias.

4.2. Structural Model Assessment

Following confirmation of the adequacy of the measurement model, the structural model was evaluated to examine the proposed hypothesized relationships among the latent constructs. The structural model was evaluated following contemporary PLS-SEM guidelines through the assessment of path coefficients, coefficients of determination (R^2), effect sizes (f^2), predictive relevance (Q^2), and out-of-sample predictive capability using PLSpredict. The endogenous constructs exhibited substantial explanatory power, while the positive Q^2 values confirmed the model’s predictive relevance. Furthermore, the PLSpredict

analysis indicated that most prediction errors generated by the PLS model were lower than those obtained from the benchmark linear model, demonstrating satisfactory out-of-sample predictive performance and supporting the predictive validity of the proposed framework. Beyond the overall model fit, the structural model exhibited substantial explanatory and predictive capability. Specifically, the model explained 55% of the variance in the adoption of the 6R CE framework ($R^2 = 0.55$), indicating that global energy threats constitute an important antecedent of CE implementation among sustainable hotels. Overall, the model demonstrates substantial explanatory and predictive capability. The endogenous constructs achieved satisfactory levels of explained variance, while the positive Q^2 value (0.43) confirmed strong predictive relevance. Moreover, the PLS predict assessment showed that the PLS model outperformed the benchmark linear model for most indicators, providing additional evidence of medium-to-high out-of-sample predictive power and supporting the practical applicability of the proposed framework within the Saudi hospitality sector. Collectively, these findings indicate that the proposed research model possesses adequate explanatory power and predictive relevance, providing a robust foundation for evaluating the hypothesized direct, mediating, and moderating relationships.

4.3. Structural Relationships and Hypotheses Testing

The structural model results provide strong empirical support for the proposed theoretical framework. As presented in Table 4, both direct hypotheses were statistically supported, indicating that global energy threats stimulate the adoption of CE practices, which subsequently enhance hotel energy resilience.

Table 4. Structural model assessment and hypothesis testing results.

Direct Effects								
Hypothesis	Path Direction	β	p -Value	t-Value	f^2	R^2	Q^2	Decision
H1	GET $\rightarrow$ 6R of CE	0.848	0.000	18.84	0.062	0.55	0.43	Support
H2	6R of CE $\rightarrow$ ER	0.719	0.000	15.91	0.054			Support
Indirect Effects (Mediation via Strength of CE implementation) 95% Bias-Corrected Confidence Interval								
	Path	β	p -value	t-value	CI (LL)	CI (UL)		Decision
H7	6R of CE $\rightarrow$ Strength of CE $\rightarrow$ ER	0.813	0.001	18.90	0.064	0.179		Support
Moderation Effects (MC; PCR, SC; EA)								
	Interaction	β	p -value	t-value	CI (LL)	CI (UL)		Decision
H3	6R of CE $\times$ MC $\rightarrow$ ER (Low MC)	0.850	0.000	12.92	−0.007	−0.005		Support
	(High MC)	0.859	0.000	12.79	−0.060	−0.020		Support
H4	6R of CE $\times$ PCR $\rightarrow$ ER (Low PCR)	0.750	0.043	12.80	−0.002	−0.011		Support
	(High PCR)	0.840	0.000	12.28	−0.010	−0.040		Support
H5	6R of CE $\times$ SC $\rightarrow$ ER (Low SC)	0.852	0.000	12.85	−0.006	−0.032		Support
	(High SC)	0.753	0.000	12.74	−0.070	−0.021		Support
H6	6R of CE $\times$ EA $\rightarrow$ ER (Low EA)	0.830	0.042	12.82	−0.001	−0.014		Support
	(High EA)	0.810	0.000	12.29	−0.022	−0.044		Support

Specifically, perceived global energy threats exerted a strong positive influence on the adoption of the 6R CE framework (H1: $\beta = 0.848$, $t = 18.84$, $p < 0.001$). This finding suggests that increasing exposure to volatile energy prices, supply uncertainty, and market instability encourages hotels to adopt more resource-efficient and circular operating practices rather than maintaining conventional linear business models. From a managerial perspective, external energy uncertainty appears to function as a strategic catalyst that accelerates organizational transformation toward CE implementation.

Furthermore, the adoption of the 6R CE framework significantly improved hotel energy resilience (H2: $\beta = 0.719$, $t = 15.91$, $p < 0.001$). This result indicates that hotels implementing comprehensive CE practices are better positioned to withstand energy-related disruptions while maintaining operational continuity. Rather than merely reducing resource consumption, the 6R framework appears to strengthen organizational adaptive capacity by improving resource efficiency, reducing dependence on volatile energy markets, and increasing operational flexibility. Although the individual effect sizes (f^2) are relatively modest, the strong standardized path coefficients demonstrate that CE practices constitute an important strategic capability for enhancing long-term organizational resilience within sustainable hotels.

4.4. Mediating and Moderating Effects

The mediation analysis further revealed that the Strength of CE Implementation significantly mediates the relationship between the 6R CE framework and hotel energy resilience (H7: indirect $\beta = 0.813$, $t = 18.90$, $p = 0.001$). This finding demonstrates that the successful translation of CE initiatives into resilience outcomes depends not merely on adopting isolated 6R practices but on the extent to which these practices become embedded within organizational routines, operational procedures, and continuous improvement processes. Consequently, hotels exhibiting stronger institutionalization of CE practices realize substantially greater resilience benefits than organizations implementing similar initiatives on a fragmented or project-based basis. This result empirically supports the theoretical distinction developed in the literature between the adoption of CE practices and the organizational capability to institutionalize those practices over time.

The moderation analysis further demonstrates that the effectiveness of CE practices is contingent upon organizational and institutional conditions (Figure 2). First, management commitment significantly strengthened the positive effect of CE practices on energy resilience (H3), indicating that active leadership support, strategic resource allocation, and continuous managerial involvement amplify the organizational benefits derived from CE implementation. Likewise, policy clarity and regulatory support (H4) further enhanced this relationship, suggesting that clearly communicated governmental regulations and internal implementation guidelines reduce organizational uncertainty and facilitate more effective execution of CE initiatives.

Stakeholder collaboration (H5) also produced a statistically significant moderating effect. Interestingly, the relationship between CE practices and energy resilience was marginally stronger under lower collaboration conditions ($\beta = 0.852$) than under very high collaboration ($\beta = 0.753$). Rather than contradicting the hypothesized positive moderation, this pattern suggests the existence of diminishing marginal returns. Once extensive collaborative networks with suppliers, governmental agencies, and external stakeholders have been established, additional collaboration generates progressively smaller improvements in organizational resilience because many of the readily attainable coordination, knowledge-sharing, and resource-integration benefits have already been realized. Consequently, stakeholder collaboration remains an important enabling condition for CE

implementation, but its incremental contribution becomes less pronounced as collaboration reaches higher levels of organizational maturity.

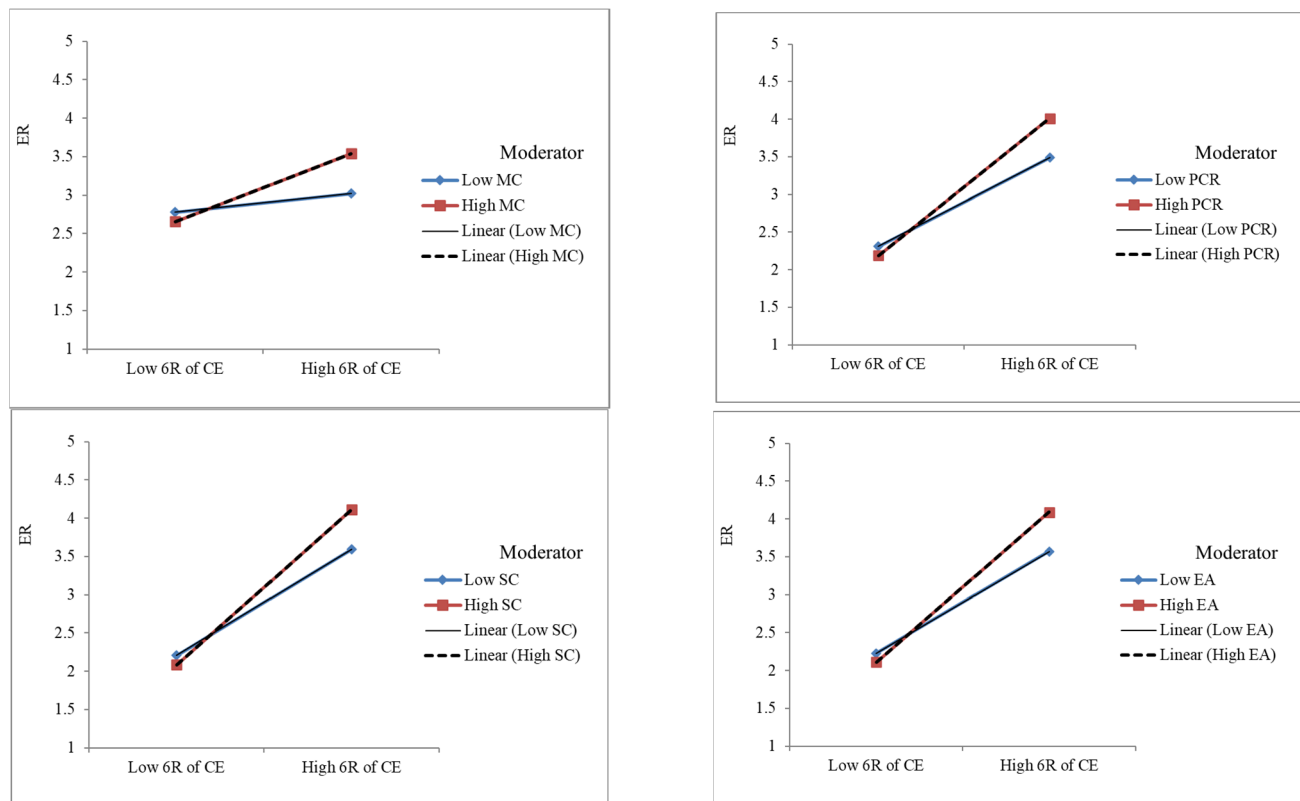


Figure 2. Moderation effects mechanisms.

Finally, staff environmental awareness (H6) consistently reinforced the positive influence of CE practices on hotel energy resilience. Although the moderation effect was relatively stable across both groups, the findings suggest that environmentally aware employees facilitate the effective translation of CE initiatives into day-to-day operational behaviour, thereby strengthening organizational resilience under conditions of global energy uncertainty. Collectively, these findings demonstrate that organizational leadership, supportive institutional environments, stakeholder engagement, and employee awareness function as complementary enabling conditions that maximize the resilience benefits associated with CE implementation.

4.5. Robustness Tests and Multi-Group Analysis

To further evaluate the stability of the proposed model, a Multi-Group Analysis (MGA) was conducted across hotel categories, organizational size and managerial conditions. As reported in Table 5, the overall pattern of relationships remained highly consistent across the comparison groups, providing additional evidence of the robustness and generalizability of the proposed conceptual framework.

The MGA revealed that the positive influence of global energy threats on CE adoption was significantly stronger among luxury hotels than among mid-range establishments ($\Delta\beta = 0.072$, $p = 0.031$). Luxury hotels typically operate with greater financial resources, higher service standards and stronger sustainability expectations from international guests, making them more responsive to external energy pressures through investments in CE initiatives. Likewise, larger hotels (≥ 100 employees) exhibited significantly stronger adoption responses than smaller establishments ($\Delta\beta = 0.065$, $p = 0.044$), suggesting that organiza-

tional resources and implementation capacity facilitate more comprehensive responses to energy uncertainty.

Table 5. MGA results.

Hypothesized Path	Group Comparison	Path Difference ($\Delta\beta$)	<i>p</i> Value	Significance	Interpretation
GET $\rightarrow$ 6R of CE	Luxury vs. Mid-range	0.072	0.031	Significant	Stronger effect in luxury hotels, implying greater energy threats level
GET $\rightarrow$ 6R of CE	Large (≥ 100 emp.) vs. Small (< 100 emp.)	0.065	0.044	Significant	Larger hotels are more capable of adopting CE practices under energy pressure
6R of CE $\rightarrow$ ER	Luxury vs. Resort	0.041	0.118	Not significant	Similar impact of CE on resilience across hotel types
6R of CE $\rightarrow$ ER	Managers vs. Operational staff	0.058	0.067	Marginal	Slightly stronger perception among managerial roles
6R $\rightarrow$ Strength $\rightarrow$ ER	Large vs. small hotels	0.084	0.022	Significant	Stronger mediation in large hotels due to better implementation capacity
6R $\rightarrow$ Strength $\rightarrow$ ER	Upscale vs. Mid-range	0.049	0.091	Not significant	Mediation effect consistent across segments
6R $\times$ MC $\rightarrow$ ER	High vs. Low management commitment	0.109	0.015	Significant	Managerial support significantly strengthens CE impact
6R $\times$ PCR $\rightarrow$ ER	High vs. Low policy clarity	0.090	0.024	Significant	Clear regulations enhance CE effectiveness
6R $\times$ SC $\rightarrow$ ER	High vs. Low stakeholder collaboration	−0.081	0.038	Significant	Diminishing returns at very high collaboration levels
6R $\times$ EA $\rightarrow$ ER	High vs. Low environmental awareness	−0.063	0.052	Marginal	Slightly reduced marginal gains at high awareness levels

The direct relationship between CE practices and energy resilience remained remarkably stable across hotel categories. No statistically significant differences were observed between luxury hotels and resorts ($\Delta\beta = 0.041$, $p = 0.118$), indicating that the beneficial impact of CE practices is broadly applicable regardless of hotel type. Similarly, only marginal differences emerged between managerial and operational respondents ($\Delta\beta = 0.058$, $p = 0.067$), suggesting a high degree of agreement across organizational roles regarding the resilience benefits of CE implementation.

The mediation analysis remained robust across organizational segments. The indirect effect through Strength of CE Implementation was significantly stronger among larger hotels ($\Delta\beta = 0.084$, $p = 0.022$), reflecting their greater ability to institutionalize circular initiatives through formal management systems, dedicated sustainability resources and continuous performance monitoring. Conversely, no significant mediation differences were observed between upscale and mid-range hotels, indicating that the mediating mechanism operates consistently across different market segments.

The MGA findings also reinforce the moderation results. High levels of management commitment ($\Delta\beta = 0.109$, $p = 0.015$) and policy clarity ($\Delta\beta = 0.090$, $p = 0.024$) significantly strengthened the positive influence of CE practices on energy resilience, confirming that

organizational leadership and supportive institutional environments remain important enabling conditions for successful CE implementation.

Consistent with the moderation analysis, stakeholder collaboration exhibited a significant but negative path difference ($\Delta\beta = -0.081$, $p = 0.038$), providing additional evidence of diminishing marginal returns under conditions of very high collaboration. Rather than indicating a detrimental effect, this finding suggests that once extensive collaborative mechanisms have been established, further increases in collaboration generate progressively smaller resilience improvements because many coordination benefits have already been captured. Likewise, environmental awareness demonstrated only marginal group differences ($\Delta\beta = -0.063$, $p = 0.052$), indicating that employee awareness contributes relatively uniformly across organizations.

Overall, the MGA confirms that the proposed structural relationships remain stable across different organizational contexts while identifying several meaningful sources of heterogeneity. These robustness analyses strengthen confidence in the generalizability of the proposed model and demonstrate that the observed relationships are not driven by a particular hotel category, organizational size or respondent group.

5. Discussions

The present study advances the growing body of knowledge on the CE by providing empirical evidence of how global energy threats stimulate circular transformation and strengthen organizational energy resilience within the Saudi hospitality sector. Rather than treating energy volatility merely as an operational constraint, the findings demonstrate that external energy disruptions can function as strategic catalysts that encourage hotels to redesign their resource management systems through comprehensive implementation of the 6R CE framework. This perspective extends previous hospitality research, which has predominantly examined CE practices as mechanisms for improving environmental performance or reducing operational costs, by demonstrating that circularity also constitutes a strategic organizational capability for enhancing resilience under conditions of energy uncertainty [36,70].

The significant positive relationship between global energy threats and CE adoption suggests that hotels increasingly perceive energy insecurity, volatile prices, and supply uncertainty as strategic risks requiring structural organizational responses rather than short-term cost-control measures. This finding aligns with recent sustainability literature arguing that environmental disturbances often accelerate organizational innovation and strategic adaptation [2,6], yet it also extends previous studies by showing that, within Saudi Arabia's rapidly expanding hospitality sector, external energy pressures encourage firms to move beyond isolated environmental initiatives toward integrated circular business models. Unlike much of the existing hospitality literature, which has largely focused on food waste reduction or energy efficiency as independent sustainability practices, the present findings indicate that hotels respond more effectively to energy uncertainty when multiple circular principles are implemented simultaneously across operational activities [1].

The Saudi Arabian context provides an important explanation for these findings. Under Vision 2030, sustainability has evolved from a voluntary environmental initiative into a strategic national development priority, encouraging hospitality organizations to align environmental responsibility with long-term competitiveness. Consequently, hotels experience both market-driven pressures associated with volatile global energy conditions and institutional pressures created by national sustainability policies. This combination of external market uncertainty and supportive institutional guidance appears to accelerate organizational commitment toward circular transformation, thereby reinforcing previous evidence that coherent policy environments facilitate sustainability transitions while

extending Institutional Theory by illustrating how regulatory frameworks can actively stimulate organizational resilience rather than merely ensuring regulatory compliance [8].

A second important contribution concerns the relationship between CE implementation and organizational energy resilience. Consistent with previous hospitality research, the findings confirm that CE practices significantly improve hotels' capacity to maintain operational continuity during periods of energy disruption capacity [9,34]. However, the present study moves beyond earlier investigations by demonstrating that resilience emerges not simply because hotels adopt environmentally friendly practices, but because circular principles fundamentally alter how organizations manage resources, reduce operational dependencies, and improve adaptive capacity. Through redesigning operational processes, reducing unnecessary resource consumption, extending material life cycles, recovering valuable resources, and rethinking procurement decisions, hotels become less vulnerable to fluctuations in energy availability and market instability. These findings therefore support Organizational Resilience Theory by suggesting that resilience should be viewed as a proactive organizational capability developed through continuous investments in circular resource management rather than solely as a reactive response following external disruptions [15,16].

Perhaps the most important theoretical contribution of this study lies in distinguishing between adoption of CE practices and the strength of CE implementation. While previous hospitality studies have generally assumed that introducing circular initiatives automatically generates sustainability benefits, the present findings demonstrate that the organizational value of circularity depends largely on the degree to which these practices become institutionalized throughout the organization. The significant mediating effect observed in this study indicates that resilience is substantially enhanced only when CE principles evolve from isolated environmental projects into standardized organizational routines supported by formal governance structures, performance monitoring systems, employee engagement, and continuous improvement mechanisms [46]. This distinction represents an important extension of the RBV because it suggests that circular practices themselves constitute valuable organizational resources, whereas sustained implementation transforms these resources into higher-order organizational capabilities capable of generating long-term competitive advantage. In other words, resilience is created not simply through doing the 6R practices but through embedding those practices within the organizational fabric, thereby making them difficult for competitors to imitate and more effective in supporting long-term adaptive performance [58].

The findings additionally reveal meaningful differences across hotel segments. Larger hotels demonstrated stronger implementation of CE practices and greater resilience benefits than smaller establishments. This result may be explained by differences in organizational resource availability, investment capacity, and managerial infrastructure. Larger hospitality organizations generally possess greater financial flexibility to invest in renewable energy technologies, waste recovery systems, advanced environmental monitoring, and dedicated sustainability personnel, allowing them to institutionalize circular practices more comprehensively than smaller and resource-constrained establishments. This observation supports arguments derived from resource bricolage and organizational capability perspectives, which suggest that successful sustainability transformation depends not only on managerial intention but also on the availability of complementary organizational resources [86]. Consequently, although CE principles are applicable across hospitality organizations of different sizes, their implementation effectiveness appears to increase substantially when supported by sufficient financial, technological, and managerial capabilities [87,88]. These findings further suggest that resource availability functions as an important boundary

condition influencing the extent to which circular initiatives can be translated into tangible resilience outcomes within hospitality organizations.

6. Conclusions

The CE is crucial for mitigating global energy challenges and securing long-term energy resilience within the Saudi Arabian hospitality sector, as it facilitates a transition from traditional linear resource consumption models toward regenerative and closed-loop systems in response to external pressures such as volatile commodity prices and rising energy costs. This move to circularity addresses global energy threats, especially in luxury resorts, where guest expectations and service requirements generate particularly high levels of energy consumption. By integrating the principles of the 6R framework—reduce, reuse, recycle, recover and rethink—into their business models, hotels will simultaneously strengthen environmental stewardship and economic competitiveness, thereby bridging sustainability objectives with commercial priorities. Furthermore, Saudi Vision 2030, alongside the overarching CCE initiative, provides the strategic stage for promoting sustainability as an ingrained practice throughout the Kingdom's vast tourism industry. The regulatory clarity provided through national policies, together with ambitious initiatives such as the Saudi Green Initiative, reduces environmental uncertainty and encourages hotels to undertake long-term investments in green technologies and circular infrastructure. This coherence between environmental policy and business strategy is vital as Saudi Arabia aims to become a premier global tourist destination for 150 million travelers by 2030, all while diligently working toward its net-zero emission goals. The effectiveness of CE implementation in improving organizational resilience hinges on the thoroughness of its implementation, supported by top management commitment and high levels of employee sustainability awareness. Whilst mere symbolic gestures or isolated environmental initiatives may generate limited benefits, the systematic integration of these principles into day-to-day work processes and the establishment of large-scale recycling systems can lead to substantial improvements in resource use efficiency. Moreover, collaborative efforts among stakeholders can facilitate industrial symbiosis and resource sharing across hospitality value chains, provided that such collaborations are managed carefully to avoid excessive bureaucratic overhead, coordination complexity, and diminishing operational returns. Circularity has therefore evolved beyond its origins as a niche environmental concept to become a strategic imperative shaping Saudi Arabia's future economic landscape and strengthening its position within global tourism markets. As the Saudi Arabian hospitality market continues to grow, the adoption of CE solutions, projected to increase dramatically by 2034, will play a vital role in both economic diversification and climate change adaptation initiatives, future research should explore a deeper institutionalization of the 6R principles to ensure a sustainable and resilient pathway for the entire hospitality industry. As the Saudi hospitality sector continues to expand, the adoption of CE solutions is expected to play an increasingly important role in economic diversification, climate adaptation, and long-term competitiveness. Future research should therefore explore deeper institutionalization of the 6R principles and investigate mechanisms capable of accelerating their diffusion across different hotel segments to ensure a sustainable and resilient development pathway for the hospitality industry.

6.1. Theoretical Contributions

The present study makes several important theoretical contributions to the literature on the CE, organizational resilience, and sustainable hospitality management. First, it extends CE scholarship by demonstrating that the effectiveness of the 6R framework depends not only on the adoption of circular practices but also on the degree to which these practices

become institutionalized throughout organizational routines. By distinguishing between the implementation of individual 6R practices and the strength of CE implementation, the study introduces a process-oriented perspective that explains how operational circularity evolves into organizational resilience rather than whether the adoption of CE practices automatically generates superior performance.

Second, the study contributes to Organizational Resilience Theory by conceptualizing energy resilience as a dynamic organizational capability that develops through the systematic integration of CE principles into hotel operations. Rather than viewing resilience solely as an outcome of technological investment or resource availability, the findings demonstrate that resilience emerges from organizational learning, managerial commitment, policy alignment, and continuous capability development. This perspective extends previous resilience research by identifying the organizational mechanisms through which hotels transform external energy threats into opportunities for long-term adaptation.

Third, the findings enrich the RBV by showing that CE capabilities represent valuable organization-specific strategic resources that strengthen hotels' ability to respond to volatile energy markets. The mediating role of the strength of CE implementation further demonstrates that competitive advantage arises not simply from possessing circular initiatives but from embedding them into organizational routines, managerial decision-making, and operational processes.

Fourth, the study advances Institutional Theory by illustrating how policy clarity and regulatory support enhance the effectiveness of CE implementation. The results suggest that institutional environments do not merely encourage sustainability adoption; they also determine the extent to which circular initiatives generate resilience outcomes, thereby highlighting the complementary roles of organizational capabilities and institutional pressures.

Finally, by focusing on Saudi Arabia, the study contributes important empirical evidence from an emerging economy that remains underrepresented in the CE and hospitality literature. The findings demonstrate that the relationships among global energy threats, CE practices, implementation capability, and organizational resilience differ from those typically reported in developed economies, thereby improving the contextual generalizability of existing theories while supporting future comparative research across different institutional environments.

6.2. Practical Contributions

The findings provide clear and actionable implications for hotel managers, policy-makers, tourism authorities, and other stakeholders seeking to improve organizational resilience under increasing global energy uncertainty.

For hotel executives and senior managers, the results indicate that investments in isolated sustainability initiatives are unlikely to generate substantial resilience benefits unless CE principles become embedded within daily organizational routines. Managers should therefore prioritize the institutionalization of the 6R framework through standardized operating procedures, performance measurement systems, continuous monitoring, and long-term strategic planning instead of relying on individual environmental projects. Attention should be devoted to integrating circular principles into procurement policies, facility management, waste recovery systems, water conservation strategies, and energy-efficient building operations.

The findings also demonstrate that management commitment and staff awareness are critical organizational enablers. Consequently, hotel leaders should allocate dedicated budgets for CE initiatives, establish sustainability-related key performance indicators, incorporate CE objectives into strategic planning, and provide continuous employee train-

ing to strengthen organizational capabilities and encourage behavioral change across all operational departments.

For policymakers and tourism authorities, the results emphasize that regulatory support should extend beyond promoting sustainability objectives toward providing clear implementation guidelines that reduce uncertainty during the transition toward circular business models. Governments can accelerate sector-wide adoption by developing standardized CE frameworks for hospitality businesses, introducing targeted financial incentives for resource-efficient technologies, facilitating knowledge-sharing platforms, and encouraging public–private partnerships that promote innovation and best practices. Such initiatives would directly support Saudi Vision 2030 while strengthening the resilience of one of the Kingdom’s fastest-growing economic sectors.

The findings further suggest that stakeholder collaboration should be strategically coordinated rather than maximized indiscriminately. While collaboration with suppliers, technology providers, recycling companies, and local communities contributes positively to circular implementation, excessive coordination may create administrative complexity and reduce organizational agility. Managers should therefore establish focused partnerships with clearly defined objectives, governance mechanisms, and performance indicators to maximize collaborative benefits while avoiding diminishing returns.

Finally, the validated measurement framework developed in this study provides practitioners with a practical diagnostic tool for assessing their organization’s CE maturity and energy resilience capabilities. Hotels can use the proposed indicators to benchmark current performance, identify implementation gaps, prioritize strategic investments, and monitor continuous improvement toward more resilient and sustainable hospitality operations.

6.3. Limitations and Future Research Directions

Regardless, the study presents several limitations and indicates the following avenues for future research on the CE and energy resilience in the hospitality sector. First, although the study employed a four-wave temporally separated survey design, the research remains based on perceptual, self-reported, and non-experimental data, which limits the ability to draw definitive causal conclusions regarding the relationships among global energy threats, circular practices, and resilience outcomes. Temporal separation improves temporal ordering and reduces common method concerns, but it does not fully eliminate endogeneity or reverse-causality risks. Therefore, it is recommended that future studies employ longitudinal panel designs, quasi-experimental approaches, or objective operational performance indicators to investigate how circular practices evolve over time and influence organizational resilience during different phases of external shocks.

Second, the study relied primarily on self-reported perceptual data collected from managerial respondents. While this approach is common in hospitality management research and appropriate for measuring organizational capabilities and strategic orientations, perceptual responses may be influenced by social desirability, respondent subjectivity, or common source bias. Although several procedural remedies and statistical assessments—including temporal separation of measurements, anonymity assurances, Harman’s single-factor test, and full collinearity diagnostics—indicated that common method bias was unlikely to threaten the validity of the findings, future studies would benefit from combining survey data with objective operational indicators, such as actual energy consumption records, waste generation statistics, renewable energy utilization, carbon emission metrics, or financial performance data. Mixed-method research incorporating qualitative case studies or interviews would also provide deeper insights into the organizational processes underlying CE implementation.

Third, the empirical investigation focused exclusively on environmentally sustainable hotels operating in Saudi Arabia. While this context provides an important setting for examining the interaction between CE adoption and national sustainability initiatives under Vision 2030, the findings may not be directly generalized to other institutional, economic, or cultural environments. Differences in regulatory frameworks, energy market structures, environmental policies, and organizational maturity across countries may influence both CE adoption and organizational resilience. Future comparative research should therefore examine diverse geographical contexts, compare emerging and developed economies, and investigate whether the proposed conceptual model remains stable across different hospitality segments, including independent hotels, international chains, resorts, and small- and medium-sized enterprises (SMEs).

Fourth, although the proposed conceptual framework incorporates several important organizational enablers, other theoretically relevant factors were intentionally excluded to maintain model parsimony. Variables such as organizational culture, environmental leadership, digital transformation capabilities, environmental accounting practices, green human resource management, innovation capability, and absorptive capacity may further explain how hotels convert CE initiatives into resilient operational capabilities. Future studies should investigate these constructs as additional mediators, moderators, or higher-order organizational capabilities to develop a more comprehensive understanding of resilience formation.

Finally, the present study primarily evaluates operational CE practices based on the 6R framework, reflecting the current stage of circular transition within the hospitality industry. Consequently, the findings mainly capture what is often described as “operational” or “incremental” circularity rather than more transformative forms of regenerative business models. Future research should therefore investigate advanced CE strategies, including product-service systems, adaptive reuse of hospitality infrastructure, industrial symbiosis, digital circular platforms, AI-enabled resource optimization, and closed-loop supply chains. Consideration should also be devoted to identifying financing mechanisms, collaborative business models, and policy interventions capable of reducing the implementation barriers faced by small and medium-sized hospitality enterprises, thereby facilitating a broader transition toward resilient and regenerative tourism systems.

Taken together, these future research directions provide opportunities to validate, refine, and extend the proposed framework across different institutional contexts while contributing to a deeper understanding of how CE capabilities enhance organizational resilience under increasing global energy uncertainty.

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Appendix A

Table A1. Measurement model evaluations.

Model Constructs	Code	Statements	λ
Global energy threats	Oil price volatility	O1 The fluctuation in global oil prices creates challenges for our energy planning	0.98
		O2 Volatile oil prices negatively impact the hospitality sector's energy costs	0.88
		O3 Unpredictable oil market trends affect operational budgets in our hotel.	0.88
	High energy cost	H1 High cost of energy is a significant concern for our hotel operations.	0.89
		H2 Rising energy prices limit investment in sustainable technologies.	0.89
		H3 Energy expenses account for a large portion of our operational costs.	0.95
	Market instability	M1 Global energy market instability affects the reliability of energy supply.	0.87
		M2 Economic and geopolitical uncertainties in energy markets disrupt our energy procurement.	0.99
		M3 Volatile energy markets increase the risk in strategic energy decisions.	0.88
Energy resilience	ER1	We ensure our entire electricity needs are generated using renewable resources such as solar or wind.	0.88
	ER2	We maintain grid-level energy stability to avoid any interruptions for hotel operations or guest services.	0.87
	ER3	Our hotel has established capabilities to maintain stable operations despite fluctuations in global energy prices.	0.96
	ER4	We've been able to hedge and mitigate exposure to these price shocks.	0.89
	ER5	Energy resilience will assist in keeping hotel services consistent in the face of outages.	0.89
6R Framework of CE	Redesign	R1 When services or new facilities need to be built, we attempt to build out as little resource usage as possible from day one.	0.86
		R2 We try to take the circular design of services into consideration during long-range hotel development.	0.89
		R3 Our company redesigns its value proposition to provide guests with alternatives that don't damage the environment.	0.82

Table A1. Cont.

Model Constructs	Code	Statements	λ
6R Framework of CE	Reduce	R4 We've had several systems formalize this down to reduce waste of energy and water throughout the property.	0.89
		R5 We minimize single-use plastics and non-recyclable waste throughout our operations.	0.89
		R6 We use data-driven monitoring to reduce total waste generation and operational litter.	0.88
	Reuse	R7 We've several reuse programs for our used linens, towels and furniture.	0.88
		R8 Products that are no longer in use are reprocessed into new ones or are donated to local institutions for extended use.	0.85
		R9 Our hotel aims to encourage hotel guests to practice reuse.	0.88
	Recycle	R10 We've established systems in place to handle our food waste, glass recycling, paper recycling and metal recycling needs.	0.87
		R11 Waste recycling initiatives include working with other companies that valorize our waste and engage in symbiosis.	0.89
		R12 Our hotel works with either an in-house recycling department or uses smart waste sorting devices to sort waste streams.	0.89
	Recover	R13 Our hotel aims to reuse all its waste streams into an energy or material source, even if those waste streams can't be recycled.	0.92
		R14 Grey water is extracted from our used waste streams to be reused as nonpotable water for irrigation purposes.	0.89
		R15 Energy is recovered and used as hot water or steam, all while preserving material extraction.	0.98
	Rethink	R16 The hotel has signed an eco-label with vendors that are participating in take-back programs.	0.89
		R17 We're working to shift our buying patterns toward a CE model.	0.86
		R18 We evaluate our current purchasing practices with our vendors. When feasible, our purchasing departments work to move away from linear thinking and to replace those with circular practices. For example, when buying new uniforms, we look for a vendor that'll either take back our used ones or reuse them or recycle them into new ones.	0.86
Policy clarity & regulations	PC1	Our hotel has clear internal CE guidelines that are aligned with national CE regulations.	0.89
	PC2	We find regulations from government institutions concerning the CE simple to understand	0.85
	PC3	We've been provided with detailed guidelines on how our hotel can apply for the CE.	0.80

Table A1. Cont.

Model Constructs	Code	Statements	λ
Stakeholder collaboration	SC1	We've active engagement with our suppliers about their application of CE principles	0.88
	SC2	We try to work with local partners that try to reduce waste as well.	0.89
	SC3	Ongoing talks with the different partners of our circular systems maintain communication and exchange on how to keep those partnerships going and what would be suitable measures to support circular resource management.	0.86
Management commitment	MC1	Top management actively supports CE initiatives.	0.88
	MC2	CE' budget is allocated annually by management.	0.87
	MC3	Key performance indicators related to sustainability are regularly monitored.	0.89
Staff Awareness	SA1	Staff members attend training sessions on the CE.	0.85
	SA2	You can see Go Green signs and reminders all around hotel offices.	0.89
	SA3	The numbers on staff involvement show a great consciousness of sustainability.	0.84
Strength of CE implementations	S1	Beyond isolated projects, our company has effectively included CE ideas into its everyday operational practices.	0.82
	S2	Through circular projects, we have attained notable and quantifiable cuts in resource use, including materials, water, and electricity.	0.83
	S3	Top management shows a great deal of will track, assess, and raise our circular performance over time.	0.89
	S4	To lower our environmental impact and waste output, we give reuse, repair, and recycling of materials top priority.	0.88
	S5	Our firm has clearly and decisively transitioned toward a circular business model compared to previous years.	0.87

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