Resource Efficiency and Emission Reduction in Hotels: The Role of Supply Chains – A Systematic Literature Review

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Abstract: This study conducts a Systematic Literature Review (SLR) to examine resource efficiency and emission reduction in the hotel sector, with a particular focus on the neglected role of supply chain–related emission linkages. Drawing on 41 peer-reviewed publications from 2005 to 2024 indexed in Scopus, the review integrates the Greenhouse Gas (GHG) Protocol framework with Stakeholder Theory to analyse how hotel–stakeholder interactions shape emission management across Scopes 1, 2, and 3. Despite growing attention to hotel sustainability, findings reveal that the existing body of research remains heavily concentrated on operational emissions mainly energy, water, and waste while indirect, supply chain–based (Scope 3) emissions are conceptually underdeveloped and methodologically fragmented. The review identifies three dominant thematic clusters: (1) Measurement and Monitoring, which highlights the absence of standardized methodologies and fragmented reporting across emission scopes; (2) Sustainability Practices and Strategies, which documents managerial and operational initiatives such as energy conservation, water efficiency, and waste minimisation, yet finds limited integration with supply chain collaboration; and (3) Barriers and Governance Challenges, which point to financial, informational, and institutional constraints that hinder systematic emission management. Collectively, these patterns underscore a persistent imbalance between hotels' internal sustainability actions and their external supply chain relationships, limiting progress toward holistic carbon accountability. Building on these insights, this paper develops a theory-informed conceptual framework linking stakeholder pressures—regulatory, normative, and voluntary to hotels' operational and supply chain practices that collectively determine environmental performance outcomes. The model positions hotels as intermediaries between external and internal actors who shape the adoption, measurement, and governance of emission practices. By embedding Stakeholder Theory within the GHG Protocol's three-scope architecture, the framework advances an integrated understanding of how accountability and resource interdependence operate across hotel value chains. This review contributes to sustainability and hospitality management scholarship in three key ways: first, by offering the first Stakeholder Theory–informed synthesis of hotel emission management across Scopes 1–3; second, by conceptualising multi-stakeholder pathways for improving resource efficiency and emission governance; and third, by proposing a research agenda that emphasises supply chain collaboration, digital monitoring tools, and cross-country policy benchmarking. The study concludes that achieving net-zero targets in hospitality requires the extension of emission measurement beyond hotel premises to encompass suppliers, logistics, and post-consumption processes transforming sustainability from a property-level initiative into a value-chain-wide governance system.

Keywords: Sustainable Hotels, Hotel Supply Chain Management, Hotel Greenhouse Gas Emissions

1. Introduction

In the last two decades, tourism-related activities and the hospitality industry have had a negative impact on the environment (Khan *et al.*,2021). Tourism industry accounts for almost 8% of global carbon emissions (Lenzen *et al.*,2018) and hospitality industry not only represents 1% of global emissions but also contributes to water consumption, which is reaching up to 5% (Khan *et al.*,2021). Furthermore, hotels account for a large amount of waste production and food consumption. GHG emissions is a key factor in global climate change and reducing emissions has emerged as the world's most important task (Mikhaylov *et al.*,2020).The hospitality industry is a significant contributor to global environmental impacts, including greenhouse gas (GHG) emissions, waste generation, and resource consumption (Huang *et al.*,2015; Lai,2015; Odeku,2018). Hotels, in particular, are energy-intensive operations with complex supply chains (Huang *et al.*,2015). The growing awareness of environmental issues has led to increased research on sustainability within the hotel sector (Al-Aomar and Hussain,2017; Al-Aomar and Hussain,2018; Hussain *et al.*,2019).

In consideration of all the research on sustainable tourism, the issue of hotel emissions has received considerable critical attention and UNWTO targeted to reduce tourism greenhouse gas emission by 50% by 2030 and achieve net zero by 2050 (UNWTO,2021) which is needed to involve supply chain management to achieve it. Currently, hotels hold a share of 21% of the carbon footprint of the tourism industry (UNWTO,2021), but it is projected that, until 2035, it will increase to 25% (de Grosbois and Fennell,2022)

Contrary to the significant role of hotels in GHG emissions, there is currently a lack of an integrated approach for comprehensive measurement and monitoring of emissions in the hotel industry. To effectively measure and

monitor resource efficiency and emissions in hotels, it is crucial to explore existing studies and identify the gaps in knowledge in the role of supply chain management and improve hotel green performance.

Based on the identified gaps, several guidelines and recommendations can be proposed for future research in this area. To frame this study conceptually, Stakeholder Theory (Freeman, 1984) provides a useful lens for understanding the interconnectedness between hotels and their external and internal actors in achieving sustainability. Hotels operate within a complex web of stakeholders including suppliers, contractors, guests, employees, regulators, and local communities whose expectations and actions shape the environmental outcomes of hotel operations. In the context of emissions and resource efficiency, Stakeholder Theory underscores the idea that sustainable performance cannot be achieved through isolated managerial actions, but rather through collaborative alignment and shared accountability across the supply chain. This theoretical lens allows the study to go beyond descriptive mapping and examine how stakeholder pressures influence the evolution of sustainability research in hotels. By doing so, it bridges the gap between environmental performance measurement and stakeholder accountability a connection largely absents from prior systematic reviews.

This study contributes to sustainability and hospitality management scholarship in three ways: (1) it provides the first Stakeholder Theory informed synthesis of hotel emission management research across Scopes 1-3; (2) it introduces a conceptual framework linking stakeholder influence to emission reduction practices; and (3) it outlines a future research agenda for integrating supply chain collaboration and stakeholder accountability into emission measurement systems.

This study set out to clarify the most important aspects of measuring emissions of hotels in academic papers and the role of supply chain management. This study builds on Systematic Literature Review (SLR) and future research direction on hotels' emissions and resource efficiency to answer following research questions:

Q1: What is the current state of academic publications related to the role of supply chain management in carbon emissions in hotels?

Q2: What practices have been identified in hotels to reduce emissions and increase resource efficiency?

Q3: What are the barriers to adopting green practices and strategies to reduce emissions in hotels and through supply chain management?

Q4: What gaps have been identified within the area of green hotel supply chain management?

To explore these research inquiries, the study utilizes SLR of data extracted from the Scopus database, focusing on resource efficiency and emission reduction in hotels.

Hotels can effectively reduce their Scope 3 emissions by implementing a variety of green practices and strategies. These initiatives not only enhance supply chain management but also contribute to the overall sustainability performance of the hotels.

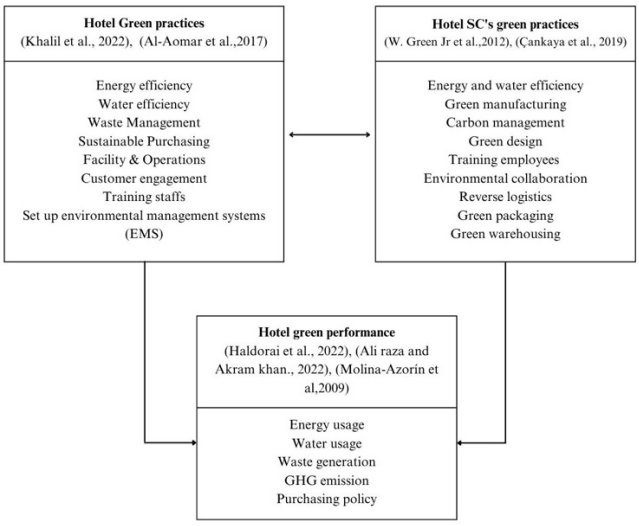

Figure 1: Conceptual framework of Interactions Between Hotel practices and Supply Chain Green Practices and Their Impact on Hotel Green Performance

This paper contributes to the literature by offering the first systematic and theory-informed synthesis of how stakeholder relationships influence hotel emission management across Scopes 1–3. It integrates the Greenhouse Gas (GHG) Protocol framework with Stakeholder Theory to identify where hotels and their supply chain partners interact, where accountability gaps persist, and how collaborative strategies can enhance sustainability performance. In doing so, it advances both theoretical understanding and practical approaches to managing Scope 3 emissions within the hospitality industry.

The remaining sections of this paper are structured as follows: Section 2 outlines the research methodology employed. Section 3 presents the findings and corresponding discussion. Lastly, Section 4 is conclusion and outlines potential avenues for future research.

This study contributes to hospitality sustainability scholarship by clarifying conceptual fragmentation, integrating stakeholder perspectives into emission classification, and proposing a theory-driven framework for aligning operational and supply chain sustainability practices.

2. Method

This study is classified as applied because of its descriptive goals and qualitative methodology. The SLR was utilised for the technical processes. When compared to alternative review techniques, the SLR approach has a few benefits. First, SLR techniques minimise bias while facilitating a simple, observable, and trustworthy search and identification of pertinent material (Littell, 2006; Reim et al., 2015). Second, it makes it simple to find gaps to further future lines of inquiry (Sharma et al., 2020).

The systematic review begins with the data collecting phase. This process should identify the different documents and publications that will be examined and evaluated. This study's data sample was obtained by querying the Scopus core databases for publications from 2005 to 2025. “A systematic search was conducted in the Scopus database on 12 July 2025 using the following keyword combinations: “*hotel*” AND “energy” OR “water” OR “food*” OR “plastic” OR “waste” OR “Resource efficiency” OR “Fuel efficacy” OR “electricity” OR “oil” AND “*emissions*” OR “measuring emissions” OR “monitoring emissions” OR “GHG emission” OR “Net zero carbon emission” OR “carbon footprint” OR “carbon indicator” OR “carbon audit” OR “carbon density” OR “supply chain*” OR “Green supply chain”.

Results from Web of Science and Scopus overlaps have been manually eliminated. The following standards were used to manually assess the chosen articles' relevance: eliminate the articles related to (a) cruise ships, (b) guest perception, and (c) cost and finance. We found 200 studies on Scopus and 186 studies on WoS. In the filtering articles, 175 studies were duplicated, and through manually assessing articles, 41 studies were chosen for thoroughly analysing.

A PRISMA-style protocol guided the systematic review process, ensuring transparency in study identification, screening, eligibility, and inclusion. Each study was coded based on publication year, geographic focus, emission scope (1–3), and stakeholder category (internal, external, or supply chain actor). This coding framework allowed for thematic synthesis aligned with Stakeholder Theory, highlighting how different stakeholder groups contribute to or hinder emission management.

The SLR approach is particularly appropriate for this research as it enables a structured synthesis of fragmented studies across multiple stakeholder groups and emission categories. Integrating Stakeholder Theory into the review process allows for a theoretically grounded coding and interpretation of evidence, rather than a purely descriptive aggregation of findings. This approach enabled the synthesis of empirical and conceptual patterns in how stakeholder relationships condition emission measurement and mitigation practices.

3. Results and Findings

The chart illustrates the annual distribution of articles published from 2005 to 2024, showcasing the evolving focus on sustainability research in the hospitality sector over the years.

The increase in publications after 2015 aligns with global policy developments such as the Paris Agreement and the UN Sustainable Development Goals, reflecting rising institutional pressure on hotels to disclose and mitigate emissions. This trend illustrates how external stakeholder expectations particularly from regulators and investors are shaping the research and managerial focus on sustainability in the hospitality sector.

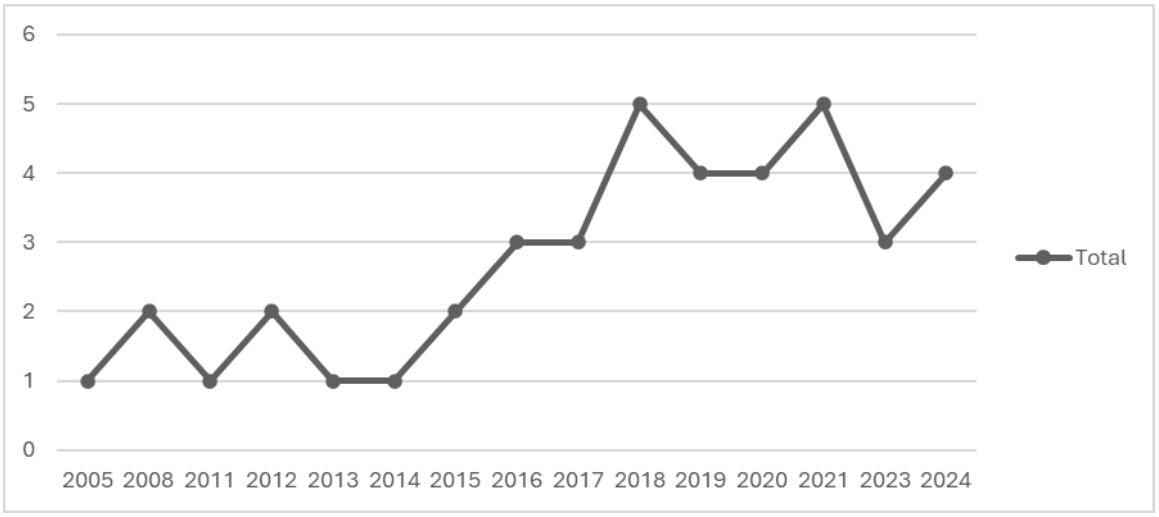

Figure 2: Annual publications of the selected studies

In reviewing the selected studies, the following journals emerged prominently. World Leisure Journal published a total of 4 articles, reflecting a strong focus on leisure studies. Following closely, the Tourism Management journal also featured 4 articles, indicating its relevance in the field of tourism research. Lastly, Sustainable Development contributed 3 articles, highlighting the journal's emphasis on sustainability issues within various contexts.

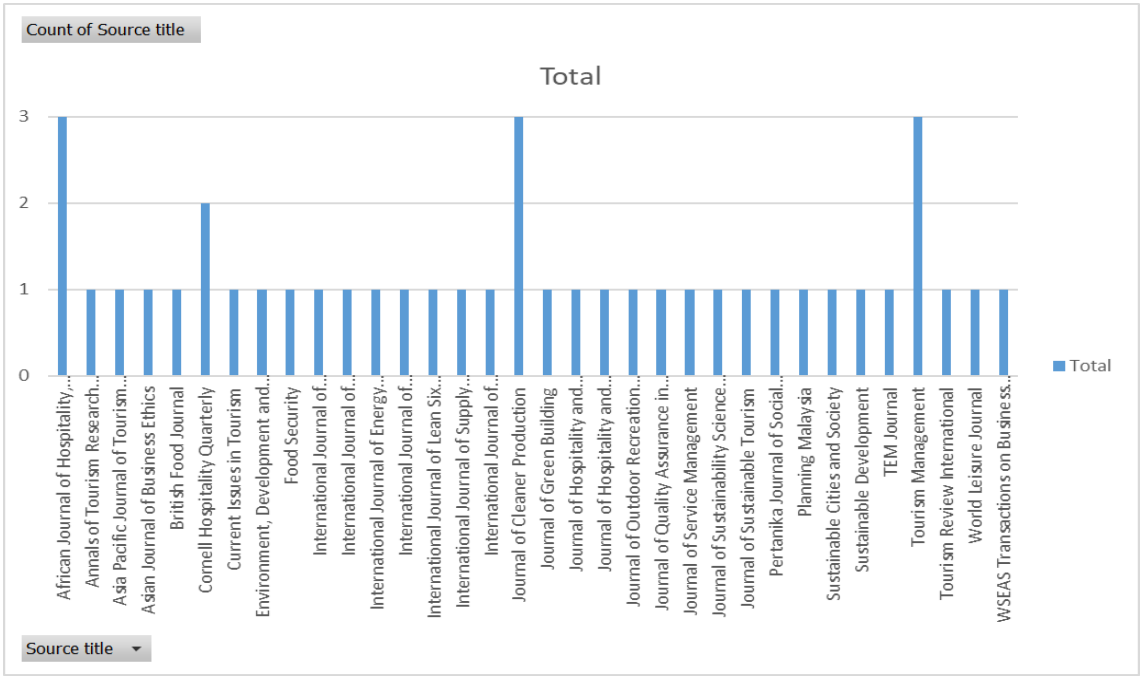

Figure 3: Publications in journals of the selected studies

The chart presents the distribution of articles reviewed based on their country of origin. This analysis highlights the contributions of various countries to the sustainability research in the hospitality sector.

The United Arab Emirates (UAE) leads with five publications, reflecting its investments in sustainable tourism. The U.S., Spain, and Kenya each contributed four articles, influenced by Spain's tourism industry and Kenya's eco-tourism focus. Collaborative research across multiple countries indicates a trend toward international partnerships in addressing sustainability. Overall, these findings highlight a growing emphasis on sustainability in the tourism sector.

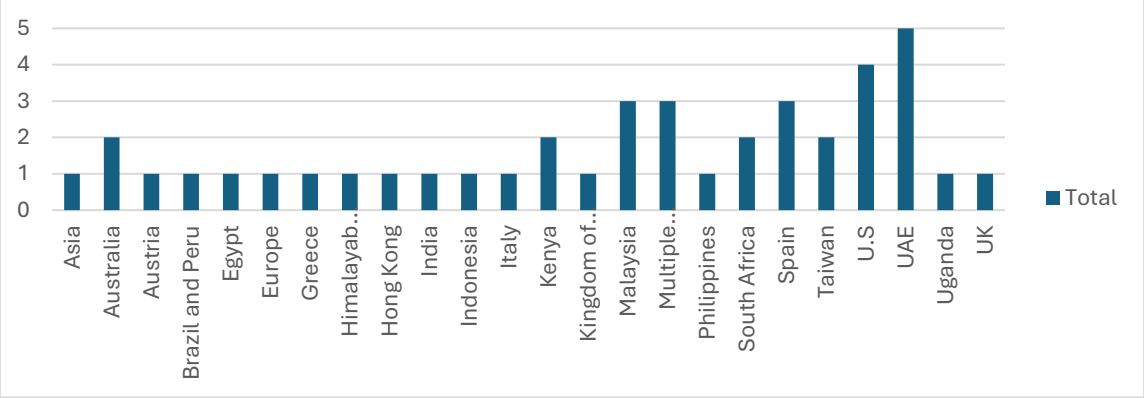

Figure 4: Countries with the most publications

A qualitative analysis was conducted to systematically explore and identify major trends and research gaps within the existing literature. This analysis revealed several key areas where research is lacking, particularly in the context of emerging topics.

In this study, research articles were categorized into three focus areas to better understand their contributions to sustainability in the hospitality sector and hotel supply chain management.

Synthesizing across the 41 studies reveals that the evolution of sustainability research in hotels has been driven by shifting stakeholder pressures from regulatory compliance to voluntary environmental management. However, the literature still portrays fragmented engagement among key actors, with limited integration between hotels and their suppliers in addressing indirect emissions.

Measurement: This category includes studies that quantify environmental impacts, such as greenhouse gas (GHG) emissions and energy consumption (Huang *et al.*,2015; Filimonau *et al.*,2021). It's about establishing metrics and using them to understand the scale and sources of environmental issues. These studies measure energy consumption (Maleviti *et al.*,2012), water usage (Alonso,2008) and waste generation (Chalak *et al.*,2018; Filimonau and De Coteau,2019; Diaz-Farina *et al.*,2023; Chawla *et al.*,2024).

Due to comprehensively identify the gaps in MMRE in hotels, it is necessary to thoroughly understand the aspects of measuring and monitoring emissions. The calculation methodology of the GHG Protocol involves adding up the life-cycle emissions of all a company's products, as obtained by combining scopes (scope 1, scope 2, and scope 3). These "scopes" help to distinguish between direct and indirect emission sources, increase transparency, and provide utility for various organizational types.

Scope 1 is covered direct GHG emissions are from sources that the company owns or controls. Scope 2 accounts for the greenhouse gas emissions produced when the company generates the electricity it purchases and uses (Green House Gas Protocol,2010).

All other indirect emissions may be treated under Scope 3, Despite coming from sources that are not under the company's ownership or control. Scope 3 actions include things like using producing resources that were purchased, transporting fuel that was purchased, and so on (Green House Gas Protocol,2010). While scope 3 emissions from hotel's supply chain are an important consideration for management of climate impacts, measurement of these emissions is particularly complex.

Table 1: Types of Emissions and Their Classification in Hotels

Emissions type	Definition	Scope	Source	Degree of measuring difficulty	Example
Direct emissions	Emissions from operations that are owned or controlled by the reporting company	1	Combustion of primary fuels onsite	Low	the natural gas consumed, fuels combustion
		1	Fugitive emissions from refrigerant leakages	Medium	Purchase of ongoing consumables

Emissions type	Definition	Scope	Source	Degree of measuring difficulty	Example
		1	Transportation of guests arranged by the hotel within the destination	Medium	hotels may organize charter planes, private jets, boats, helicopters, or other means required to transport the guest
Indirect emissions	Emissions from the generation of purchased or acquired electricity, steam, heating, or cooling consumed by the reporting company	2	Purchased heating and cooling	Low	Use of purchased electricity, steam, heating, or cooling
	All indirect emissions (not included in scope 2) that occur in the value chain of the reporting company, including both upstream and downstream emissions	3	Upstream emissions from ongoing consumable F&B (food and beverage) and OS&E (Operating Supplies & Equipment)	High	The purchase of ongoing consumables can number in the hundreds or thousands.
		3	Emissions from outsourced laundry wash	Medium	outsource laundry wash to offsite facilities not owned or operated by the same entity
		3	Emissions from downstream waste disposal	High	quantity of waste disposed, disposal method, and waste composition due to upstream purchases
		3	Embodied carbon emissions of the building, land use change, and upstream FF&E (Furniture, fixtures & equipment)	High	
		3	Employee commuting	Medium	employee commuting of hotel property staff
		3	T&D (Transition & Distribution Losses) losses from purchased electricity	Low	
		3	Business travel	Low	Company employee's business travel

Source: adapted and modified from (protocol,2011; view,2023)

This table provides a comprehensive overview of the activities in hotels that contribute to GHG emissions. By knowing the activities, measuring and monitoring resource efficiency and emissions would be more accessible and it helps to identify practices to impact green supply chain practices.

A significant focus of measurement-oriented studies is on Scope 1 and 2 emissions, which encompass direct emissions and indirect emissions from purchased electricity (Huang *et al.*,2015; Lai,2015; Migdadi,2023) which often the predominant contributors to a hotel's carbon footprint (Huang *et al.*,2015; Lai,2015). However, there is a marked gap in the literature regarding Scope 3 emissions, which represent all other indirect emissions occurring throughout the supply chain. These emissions include those from supplier activities, food and beverage, staff commuting, and embodied emissions in goods and services (Migdadi,2023). While some studies briefly address waste and materials, a systematic analysis of Scope 3 emissions including both indirect and embodied impacts remains largely unexplored (Filimonau *et al.*,2021; Migdadi,2023). This oversight underscores the need for further research in this critical area. There is a pressing need for standardized methodologies to accurately measure Scope 3 emissions in the hotel sector. Future research should examine the entire life cycle

of hotel operations and the impact of green practices across supply chain. The fragmentation in emission measurement across Scopes 1–3 reflects weak institutional coordination among stakeholders, supporting Stakeholder Theory's premise that sustainability outcomes depend on shared standards and mutual accountability across interconnected actors.

Practices and Strategies: This group encompasses studies that explore practices and specific sustainability initiatives and management approaches like implementation of Environmental Management Systems (EMS) and environmental certifications (Al-Aomar and Hussain,2018; John Nyide,2019). In addressing the second question, practices can be effectively categorized into several key areas: energy efficiency measures (Omune *et al.*,2021), water conservation practices (Barakagira and Paapa,2024), waste management strategies (Ahn and Pearce,2013), green purchasing policies (Migdadi,2023), sustainable site development (Hastuti and Assriyani,2020) and adopting green technologies (Al-Aomar and Hussain,2017). adoption of lean and green practices (Al-Aomar and Hussain,2018; Hussain *et al.*,2019; John Nyide,2019), employee training and engagement in environmental management (Barakagira and Paapa,2024), customer involvement in green initiatives (Ahn and Pearce,2013), use of and development of environmental policies and programs (Omune *et al.*,2021) and exploring green supply chain management (Al-Aomar and Hussain,2017; Migdadi,2023). The dominance of managerial and internal initiatives over collaborative efforts indicates that environmental progress in hotels remains constrained by limited stakeholder engagement, reinforcing Stakeholder Theory's assertion that enduring sustainability requires alignment between internal managerial actions and external stakeholder expectations.

Impact Assessment: Here, studies evaluate the effects of environmental management practices on hotel performance and overall sustainability (Hussain *et al.*,2019; Migdadi,2023). This category focuses on evaluating hotel performance, measuring environmental impact, and assessing overall sustainability.

To answer the third question regarding the barriers to adopting green practices and strategies for reducing emissions in hotels and their supply chains, the following challenges are identified: 1. High implementation and maintenance costs (Aripin *et al.*,2018), 2. Lack of knowledge and awareness (Omune *et al.*,2021), 3. Cultural challenges (Al-Aomar and Hussain,2017; Al-Aomar and Hussain,2018), 4. Lack of government support (Odeku,2018; John Nyide,2019), 5. Lack of cooperation from suppliers (Al-Aomar and Hussain,2017), 6. Technological issues (Odeku,2018; Omune *et al.*,2021), and 7. Infrastructure issues (Osiako and Reddy,2020) . These barriers highlight the urgent need for effective frameworks and methodologies to facilitate the transition toward greener practices. The absence of cohesive partnerships between hotels, suppliers, and policymakers' underscores Stakeholder Theory's insight that environmental innovation emerges from interdependent relationships where stakeholder trust, communication, and shared incentives determine the success of emission reduction strategies.

On the other hand, while there are studies evaluating the green practices within hotel supply chains and lean techniques (Al-Aomar and Hussain,2017; Al-Aomar and Hussain,2018; Al-Aomar and Hussain,2019; Migdadi,2023), a comprehensive theoretical and analytical framework for assessing these green practices across the entire hotel supply chain is still lacking. Addressing this gap is essential for developing actionable strategies that can effectively mitigate the identified barriers and promote sustainability in the industry.

4. Discussion

Building on the synthesized findings and informed by Stakeholder Theory, this study proposes a conceptual framework illustrating how hotel sustainability outcomes are shaped by multi-stakeholder interactions across operational and supply chain boundaries. The model links key stakeholder pressures (regulatory, market, internal) to the adoption of emission management practices (energy, waste, procurement) and their resulting environmental outcomes across Scopes 1-3.

In the proposed model, stakeholder influence is categorized into three domains:

1. Coercive pressures (regulators, certification agencies) (Gunarathne and Lee,2019).
2. Normative pressures (customers, investors, associations) (Durand *et al.*,2019).
3. Voluntary pressures (internal leadership, sustainability advocates)(Rivera,2004; Hyatt and Berente,2017) .

These forces drive hotels to adopt both operational practices (energy and waste reduction) (Ahn and Pearce,2013; Omune *et al.*,2021; Barakagira and Paapa,2024) and supply chain practices (green procurement, collaboration, circularity) (Al-Aomar and Hussain,2017; Al-Aomar and Hussain,2018; Al-Aomar and

Hussain,2019; Migdadi,2023) . The alignment between these practices determines the extent of emission reduction across Scopes 1–3, reinforcing the central tenet of Stakeholder Theory that sustainability performance emerges from interdependent relationships rather than isolated actions. Building on these findings, this study develops a conceptual framework (Figure 2) illustrating the interactions between hotel operational practices, supply chain collaboration, and stakeholder pressures in determining green performance outcomes. The framework integrates insights from the GHG Protocol and Stakeholder Theory, positioning hotels as intermediaries that mediate between regulatory, normative, and voluntary stakeholder forces across the value chain.

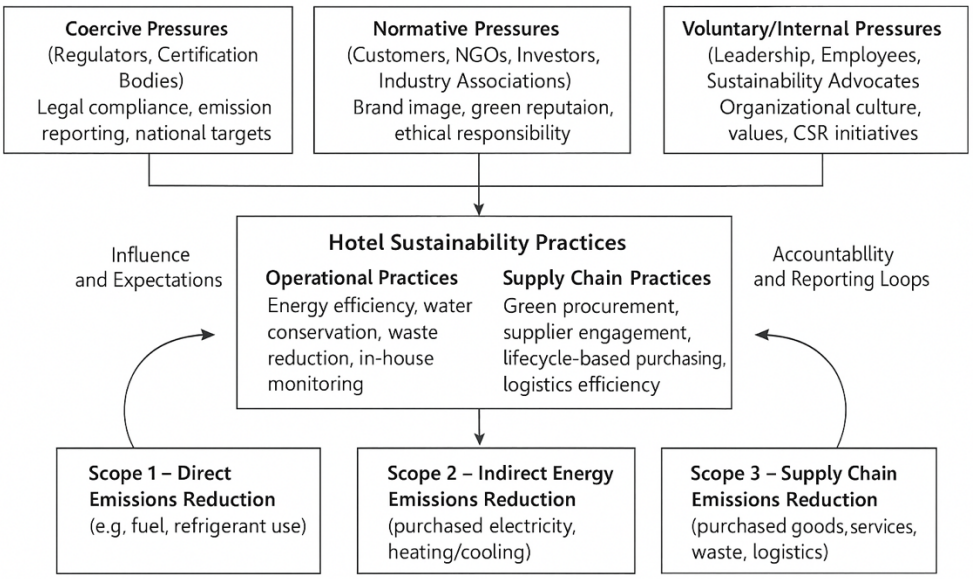

Figure 5: Conceptual Framework: Stakeholder Influence and Emission Management Across Hotel Operations and Supply Chains.

5. Conclusion

This systematic review underscores the theoretical and methodological fragmentation that continues to constrain emission measurement in the hotel sector. Current studies primarily focus on operational impacts (Scope 1 and 2), neglecting critical environmental effects within the supply chain (Scope 3). To achieve green hotel, the hotel sector must adopt a more comprehensive approach that encompasses the entire value chain and all emission types. Additionally, there is a gap in understanding how hotels can effectively collaborate with suppliers to implement green practices. There needs to be more research on how to develop green procurement strategies and ensure that suppliers meet environmental standards.

Looking ahead, five research priorities emerge to advance sustainability understanding and practice in the hotel sector. First, there is an urgent need to standardize Scope 3 emission accounting frameworks tailored for hotels, enabling consistent measurement of indirect supply chain impacts. Second, future studies should explore how supplier sustainability metrics can be systematically integrated into hotel performance management systems, aligning procurement and environmental goals. Third, cross-country comparative analyses are required to examine how varying regulatory contexts, such as the EU CSRD and other disclosure regimes, influence environmental reporting and accountability. Fourth, researchers should investigate the adoption and effectiveness of digital tools and real-time emission monitoring technologies, assessing their role in improving accuracy, transparency, and decision-making. Finally, empirical studies should test the causal relationships between supply chain collaboration and emission reductions, offering evidence-based strategies for hotels to achieve net-zero ambitions. Together, these directions establish a forward-looking research agenda that connects theory, policy, and managerial practice in pursuit of a low-carbon hospitality industry. By linking the GHG Protocol with Stakeholder Theory, this study offers a conceptual foundation for future empirical and comparative work on multi-scope emission governance in hospitality.

Acknowledgments

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Ethics Declaration

This research did not involve human participants, animals, or primary data collection. The study is based entirely on secondary data obtained from publicly available academic sources. Therefore, formal ethical approval was not required.

AI Declaration

AI tools were employed only for surface-level linguistic improvements (grammar, syntax, clarity). Substantive academic content, interpretation, and argumentation were developed independently by the author.

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