

Public Policy Research Funding Scheme

公共政策研究資助計劃

Project Number :

項目編號 :

2023.A6.220.23A

Project Title :

項目名稱 :

Developing a Hotel Environmental Sustainability Management Index (HESMI) for Hotels in Hong Kong
構建香港酒店業環境可持續發展管理指標

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Project Duration (Month):

推行期 (月) :

15

Funding (HK\$) :

總金額 (HK\$) :

530,378.85

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Developing a Hotel Environmental Sustainability Management Index (HESMI) for Hotels in Hong Kong

構建香港酒店業環境可持續發展管理指標

Final Report

(Project No. 2023.A6.220.23A)

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Acknowledgments

This research project (Project Number: 2023.A6.220.23A) is funded by the Public Policy Research Funding Scheme from the Chief Executive's Policy Unit of the Government of the Hong Kong Special Administrative Region. The successful completion of this project would not have been possible without the support and contributions of numerous individuals and organizations.

We are thankful to all the participating hotel owners, including Sun Hung Kai Properties, China Chem, Regal, and Dorsett, and hotel managers, environmental officers, and staff members who participated in interviews and shared their experiences and perspectives on environmental management implementation. Their practical insights have been invaluable in ensuring the relevance and applicability of our research findings. We are particularly grateful to all the participating hotels for their generous commitment of time and resources to this research. Their willingness to share information, participate in surveys, and provide access to environmental management assessment has been crucial in developing and validating the HESMI framework. The insights provided by their management teams and staff have significantly enriched our understanding of environmental management practices in the hotel industry. We would also like to acknowledge the expert panel members who contributed their valuable time and expertise in the AHP evaluation process. Their professional insights were essential in establishing the weighted criteria for the HESMI framework.

We sincerely thank the Hong Kong Hotel Association (HKHA) for their invaluable partnership and support throughout the project. Their assistance in facilitating industry connections and encouraging hotel participation was instrumental in achieving our research objectives.

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Executive Summary

Hong Kong faces increasingly severe environmental challenges, including rising temperatures, extreme weather events, air pollution, and waste management issues. The city's dense urban environment and heavy reliance on energy-intensive buildings make it particularly vulnerable to climate change impacts. In response, the Hong Kong government has committed to achieving carbon neutrality by 2050, with an interim target of reducing carbon emissions by 50% before 2035 compared to 2005 levels. This ambitious goal requires substantial contributions from all sectors, particularly the hospitality industry, which accounts for a significant portion of the city's energy consumption and carbon emissions.

Hong Kong's hotel industry has been experiencing substantial growth and increasing environmental pressures, and the need for systematic environmental management has become paramount. The hospitality sector, as a significant contributor to environmental impacts through energy consumption, waste generation, and resource utilization, faces mounting pressure to adopt sustainable practices. However, the absence of practical assessment tools and frameworks has historically hindered the industry's progress toward environmental sustainability goals. This innovative initiative responds to these challenges while aligning with Hong Kong's commitment to sustainable development and its positioning as a leading global tourism destination.

The project's primary aim encompasses the development of a comprehensive environmental management assessment framework - the Hotel Environmental Sustainability Management Index (HESMI). This aim supports the broader goal of facilitating industry-wide adoption of environmental management best practices and enabling evidence-based decision-making in hotel environmental management. The research methodology followed a rigorous three-phase approach. The foundational research phase involved a comprehensive literature review, in-depth interviews with hotel managers, and hotel on-site visits leading to the identification of key environmental management dimensions and specific indicators. The framework development phase engaged expert panels and employed the Analytic Hierarchy Process (AHP) to develop weighted assessment criteria. The implementation phase focused on creating a HESMI website in collaboration with the Hong Kong Hotel Association (HKHA) to facilitate data collection from their member hotels and apply the AHP method for benchmarking.

The project has delivered several significant outcomes. A comprehensive assessment toolkit has been established, incorporating nine-dimensional evaluation criteria, including

environmental sustainability governance, staff training on environmental sustainability, waste management, energy saving & carbon emission, water resource management, indoor air quality management, customer engagement, local community involvement, and green technology adoption. This project thus contributes by integrating actionable indicators into key environmental management dimensions to develop a comprehensive toolkit for hotel environment management. Additionally, the development of the HESMI website as a digital infrastructure provides user-friendly data collection capabilities and automated reporting systems. Furthermore, the research has generated valuable industry insights regarding current environmental practices, implementation barriers, and best practice examples. Based on the research findings, several key recommendations have emerged.

行政摘要

香港正面臨日益嚴峻的環境挑戰，包括氣溫上升、極端天氣事件、空氣污染和廢物管理問題。本港密集的城市環境和對高能耗建築的依賴，使其特別容易受到氣候變化的影響。為應對這些挑戰，香港特區政府承諾在 2050 年前實現碳中和，並設定了在 2035 年前將碳排放量較 2005 年水平減少 50% 的中期目標。這個宏大的目標需要各個行業的大力支持，特別是酒店業，因為該行業佔據了本市能源消耗和碳排放的重要部分。

隨著香港酒店業的顯著發展和日益增加的環境壓力，建立系統化的環境管理變得尤為重要。酒店業通過能源消耗、廢物產生和資源使用等方面對環境造成重大影響，面臨著越來越大的採用可持續發展實踐的壓力。然而，由於缺乏實用的評估工具和框架，一直以來都阻礙了業界在環境可持續發展目標方面的進展。這個創新項目正是回應這些挑戰，同時配合香港致力於可持續發展的承諾，以及鞏固其作為全球領先旅遊目的地的地位。

本項目的主要目標是開發一個全面的環境管理評估框架——酒店環境可持續管理指數（HESMI）。這個目標支持更廣泛的願景，即推動業界廣泛採用環境管理最佳實踐，並促進酒店環境管理中的循證決策。研究方法遵循嚴謹的三階段方式進行。基礎研究階段包括全面的文獻綜述、與酒店管理人員的深入訪談，以及實地考察，從而確定關鍵的環境管理維度和具體指標。框架開發階段邀請專家小組參與，並採用層次分析法（AHP）制定加權評估標準。實施階段則專注於開發 HESMI 網站，並與香港酒店業協會（HKHA）合作，收集其會員酒店的數據並運用 AHP 方法進行基準評估。

本項目已取得多項重要成果。首先建立了一個全面的評估工具包，結合多維度評估標準、經科學驗證的加權系統和標準化測量規程。本項目通過整合可行的指標到關鍵環境管理維度，為酒店環境管理開發了一個全面的工具包，從而作出了重要貢獻。此外，HESMI 網站的開發作為數碼基礎設施，提供了便於使用的數據收集功能和自動報告系統。研究還就當前的環境實踐、實施障礙和最佳實踐案例產生了寶貴的行業見解。基於研究結果，提出了幾項重要建議。

Abstract of the research

This research project addresses the critical need for standardized environmental management assessment in Hong Kong's hotel industry through the development and implementation of the Hotel Environmental Sustainability Management Index (HESMI). As environmental sustainability becomes increasingly crucial in the hospitality sector, hotels face growing pressure to implement effective environmental management practices. However, the lack of standardized measurement tools and systematic assessment frameworks has hindered the industry's progress toward environmental sustainability goals.

The research employed a mixed-methods approach across multiple phases to develop a comprehensive and practical environmental management assessment framework. The first phase involved an extensive literature review and qualitative interviews with hotel managers to identify key environmental management dimensions and practices. The second phase utilized the Analytic Hierarchy Process (AHP) methodology, engaging industry experts to determine the relative importance of different environmental management aspects and establish weighted criteria for the index. The final phase focused on implementing the HESMI framework through a digital platform, facilitating data collection and analysis across participating hotels.

The resulting HESMI framework encompasses multiple dimensions of hotel environmental management, including energy management, waste management, water conservation, green procurement, stakeholder engagement, and environmental governance. Each dimension is supported by specific indicators and measurement criteria, providing a structured approach to assessing environmental management performance. The index calculation methodology incorporates weighted criteria derived from expert evaluations, ensuring that the assessment reflects both the breadth and depth of environmental management implementation.

A significant innovation of this research is the development of a dedicated digital platform for HESMI implementation. Through collaboration with the Hong Kong Hotel Association (HKHA), the platform enables systematic data collection, analysis, and knowledge sharing among participating hotels. This digital infrastructure supports longitudinal tracking of environmental performance, facilitates benchmarking, and promotes the dissemination of best practices across the industry. The research findings reveal varying levels of environmental management implementation across Hong Kong hotels, with challenges in areas such as staff engagement, technology adoption, and stakeholder collaboration. Based on these findings, the study provides targeted recommendations for both the hotel industry and relevant government

departments, addressing aspects such as green governance, stakeholder engagement, technology implementation, and standardization of environmental practices.

This research makes several significant contributions to both academic knowledge and industry practice. It provides a scientifically robust framework for assessing hotel environmental management, establishes a sustainable mechanism for industry-wide data collection and analysis, and offers practical guidelines for advancing environmental sustainability in the hospitality sector. The HESMI framework's potential extends beyond Hong Kong, offering possibilities for adaptation and implementation in other regions.

The project's outcomes support Hong Kong's broader environmental objectives and tourism development strategies, particularly aligning with the Tourism Industry Blueprint 2.0 and the government's emphasis on sustainable tourism development. Through systematic implementation of HESMI, the hotel industry can enhance its environmental performance while contributing to Hong Kong's positioning as a leading sustainable tourism destination.

Keywords: *Environment management, Sustainability index, Analysis hierarchy process (AHP), Hotel industry, Environmental performance assessment, environmental governance, Hong Kong hotel industry.*

研究摘要

本研究項目通過開發和實施酒店環境可持續管理指數（HESMI），致力解決香港酒店業在環境管理評估標準化方面的迫切需求。隨著環境可持續性在酒店業變得日益重要，酒店面臨著實施有效環境管理實踐的巨大壓力。然而，標準化測量工具和系統性評估框架的缺乏，阻礙了行業實現環境可持續發展目標的進程。

研究採用混合研究方法，分多個階段開發全面且實用的環境管理評估框架。第一階段包括廣泛的文獻綜述和與酒店管理人員的定性訪談，以確定關鍵的環境管理維度和實踐。第二階段運用層次分析法（AHP），邀請行業專家參與確定不同環境管理方面的相對重要性，並為指數建立加權標準。最後階段則專注於通過數碼平台實施 HESMI 框架，促進參與酒店的數據收集和分析。HESMI 框架涵蓋酒店環境管理的多個維度，包括能源管理、廢物管理、節水、綠色採購、持份者參與和環境管治。每個維度都有具體的指標和測量標準支持，為評估環境管理績效提供了結構化方法。指數計算方法納入了源自專家評估的加權標準，確保評估能反映環境管理實施的廣度和深度。

本研究的一項重要創新是開發專門的 HESMI 網站平台。通過與香港酒店業協會（HKHA）的合作邀請其會員酒店參與問卷調查，該平台實現了參與酒店之間的系統化數據收集、分析和知識共享。這個數碼基礎設施支持環境績效的縱向追蹤，促進基準比較，並推動業界最佳實踐的傳播。

研究結果顯示，香港酒店在環境管理實施方面存在不同水平，特別是在員工參與、技術採用和持份者合作等領域面臨挑戰。基於這些發現，研究為酒店業和相關政府部門提供了針對性建議，涉及綠色管治、持份者參與、技術實施和環境實踐標準化等方面。本研究對學術知識和行業實踐都作出了重要貢獻。它提供了一個科學嚴謹的酒店環境管理評估框架，建立了全行業數據收集和分析的可持續機制，並為推進酒店業環境可持續性提供了實用指南。HESMI 框架的潛力超越香港，為其他地區的採用和實施提供了可能性。

項目成果支持香港更廣泛的環境目標和旅遊發展策略，特別是配合《旅遊業發展藍圖 2.0》和政府對可持續旅遊發展的重視。通過系統實施 HESMI，酒店業可以提升其環境績效，同時為香港鞏固其作為領先可持續旅遊目的地的地位作出貢獻。

關鍵詞：環境管理、可持續性指數、層次分析法（AHP）、酒店業、環境績效評估、環境管治、香港酒店業。

Layman Summary on Policy Implications and Recommendations

This research introduces HESMI (Hotel Environmental Sustainability Management Index), a comprehensive environmental management toolkit for Hong Kong's hotel industry. The project delivers significant policy implications across several key areas. First, it directly contributes to Hong Kong's Climate Action Plan 2050 by providing specific, measurable targets for hotels' environmental performance and establishing a framework to track progress toward carbon neutrality goals. The index is a practical tool for translating broad climate objectives into actionable metrics for the hotel sector. Second, HESMI provides policymakers a data-driven framework to assess industry-wide environmental performance and identify areas requiring additional support or intervention. This evidence-based approach enables more informed decision-making in environmental policy development and regulation. The standardized measurement system allows for consistently evaluating environmental initiatives' effectiveness across the industry. Third, the research may contribute to developing Tourism Blueprint 2.0, particularly in developing sustainable tourism products and experiences that appeal to environmentally conscious travelers. By providing a framework for measuring and promoting Eco-tourism initiatives, HESMI helps position Hong Kong as the region's leading sustainable tourism destination.

Several key actions for the hotel industry are recommended: (1) Hotels should implement comprehensive environmental training programs beyond basic education to foster a genuine sustainability mindset across all staff levels. This cultural shift is essential for successful environmental initiatives. Hotels must strengthen their governance structure by establishing dedicated environmental committees with representation from various departments and management levels, ensuring clear accountability and coordination of environmental efforts; (2) Stakeholder engagement should be prioritized through active collaboration with suppliers, guests, and community partners. Hotels should actively participate in industry environmental initiatives and share best practices with peers to elevate the sector's overall performance. Technology adoption is crucial, with hotels needing to invest in smart monitoring systems, data analytic tools, and energy-efficient equipment to optimize their environmental performance; (3) Standardizing environmental management practices through HESMI integration into standard operating procedures is essential. Hotels should develop consistent measurement protocols and maintain regular environmental performance reviews to ensure continuous improvement and accountability.

For government departments, several coordinated actions are recommended: (1) The Environmental Protection Department should develop comprehensive hotel sustainability guidelines based on HESMI indicators and create industry-specific environmental standards. These standards should be accompanied by regular monitoring and reporting mechanisms to track industry progress; (2) The Hong Kong Tourism Board should focus on promoting the city's eco-friendly hotel sector through targeted marketing campaigns that highlight environmental achievements to potential visitors. This promotion will help differentiate Hong Kong as a sustainable tourism destination and attract environmentally conscious travelers; (3) Government support should include financial incentives and funding schemes, particularly for smaller hotels that may face resource constraints in implementing environmental initiatives. This could include grants or subsidies for green technology upgrades and environmental management systems implementation; (4) Cross-departmental coordination is crucial for success. Government agencies need to strengthen policy alignment, create unified environmental reporting standards, and coordinate the implementation of environmental initiatives. This coordinated approach will ensure policy coherence and maximize the effectiveness of environmental programs across the hotel sector.

研究項目對政策影響和政策建議的摘要

本研究推出酒店環境可持續管理指數（HESMI），為香港酒店業提供全面的環境管理工具套件。該項目在多個關鍵領域帶來重要的政策意涵。首先，通過為酒店的環境表現提供具體、可衡量的目標，並建立追蹤邁向碳中和目標進展的框架，直接促進香港《氣候行動藍圖 2050》的實現。該指數作為一個實用工具，有助於將廣泛的氣候目標轉化為酒店業可執行的指標。其次，HESMI 為政策制定者提供數據驅動的框架，以評估行業整體的環境表現，並識別需要額外支持或干預的領域。這種循證方法有助於在環境政策制定和監管方面作出更明智的決策。標準化的測量系統使整個行業能夠一致地評估環境倡議的成效。第三，本研究有助於發展《旅遊業發展藍圖 2.0》，特別是在開發吸引環保意識旅客的可持續旅遊產品和體驗方面。通過提供衡量和推廣生態旅遊倡議的框架，HESMI 有助於確立香港作為區內領先可持續旅遊目的地的地位。

對於酒店業，建議採取以下幾個關鍵行動：（1）酒店應實施全面的環境培訓計劃，超越基礎教育範疇，在所有員工層面培養真正的可持續發展思維。這種文化轉變對環境倡議的成功至關重要。酒店需要通過建立由各部門和管理層代表組成的專門環境委員會來加強其管治結構，確保環境工作的明確問責制和協調；（2）應優先考慮通過與供應商、賓客和社區夥伴的積極合作來推動持份者參與。酒店應積極參與行業環境倡議，並與同業分享最佳實踐，以提升整個行業的整體表現。技術採用至關重要，酒店需要投資智能監控系統、數據分析工具和節能設備，以優化其環境表現；（3）通過將 HESMI 納入標準營運程序，實現環境管理實踐的標準化至關重要。酒店應制定一致的測量協議，並保持定期的環境績效審查，以確保持續改進和問責。

對於政府部門，建議採取以下協調行動：（1）環境保護署應根據 HESMI 指標制定全面的酒店可持續發展指引，並創建行業特定的環境標準。這些標準應配合定期監測和報告機制，以追蹤行業進展；（2）香港旅遊發展局應通過針對性的營銷活動，重點推廣本市的環保酒店業，突出環境成就以吸引潛在訪客。這種推廣將有助於彰顯香港作為可持續旅遊目的地的特色，吸引具環保意識的旅客；（3）政府支持應包括財務激勵和資助計劃，特別是針對在實施環境倡議時可能面臨資源限制的中小型酒店。這可包括綠色技術升級和環境管理系統實施的補助金或津貼；（4）跨部門協調對成功至關重要。政府機構需要加強政策協調，建立統一的環境報告標準，並協調環境倡議的實施。這種協調方法將確保政策的連貫性，並最大限度地提高整個酒店業環境計劃的效益。

1. Introduction

1.1 Environmental Sustainability Challenges in Hong Kong

Hong Kong's small but complex physical environment contains many environmental challenges. The city's environmental challenges have increased in recent years as the effects of climate warming loom larger. The most glaring environmental issue in Hong Kong is carbon emissions, with 66% of which come from electricity generation, 18% from transport, 7% from waste, and the rest generated from industrial processes or product use (Environmental Protection Department, 2021). The Hong Kong government has responded to these environmental concerns through various initiatives and policies. The *Climate Action Plan 2050* sets ambitious targets for carbon neutrality, focusing on the decarbonization of buildings, promotion of green transport, and waste reduction. For the hotel sector specifically, the government has introduced building energy codes, waste reduction guidelines, and green building certification schemes. These regulatory measures, combined with increasing public awareness of environmental issues, have created mounting pressure on hotels to adopt more sustainable practices to face various pressing environmental issues in Hong Kong.

Electricity consumption is the first resulting source of Hong Kong's total carbon emissions. Hong Kong has been heavily relying on fossil fuels for electricity generation to meet its high demand, for both public and private use. Approximately 90% of total electricity consumption is attributable to commercial buildings such as hotels and offices, which generate over 60% of carbon emissions through their use of air conditioning, lighting, electrical installations, elevators, etc. (Council for Carbon Neutrality and Sustainable Development, 2021). While transport is the second largest contributor to Hong Kong's carbon emissions, the city has a well-developed public transport system. Therefore, the growth of transport-related carbon emissions in Hong Kong remains relatively low compared with that of other major cities. The third largest and most glaring source of carbon emissions in Hong Kong is waste. Specifically, food waste is one of the major concerns. According to the Environment Protection Department (2021), 1,067 tonnes of food waste were produced from commercial and industrial sources such as restaurants and hotels in 2019 in Hong Kong. The amount of food waste has been increasing, especially in the food and beverage sector, which grew from 800 tonnes per day in 2012 to 1,000 tonnes per day in 2019. Another issue is solid waste. In 2020, plastics made up 21% of the city's total municipal solid waste (MSW), accounting for the third-largest share of MSW after food waste and paper (Environmental Protection

Department, 2021). The city's beaches and waterways are drowning in plastic, and micro-plastic levels in coastal waters are 40% higher than the global average. Even before the COVID-19 pandemic, Hong Kong generated about yearly. This amounts to 170 takeaway meals and 180 disposable drinks for every Hong Kong citizen. According to the Environmental Protection Department (2022), approximately 4.15 million tonnes of solid waste end up in Hong Kong's landfills each year, and during the global coronavirus pandemic, the amount of local waste has grown exponentially due to the increased use of food takeout boxes, plastic cutlery, and single-use masks.

The environmental crises faced by Hong Kong are pressing. As a densely populated metropolis of over 7.5 million people (Census and Statistics Department, 2024), Hong Kong faces additional environmental pressures from its urban development, limited land resources, and intense commercial activities. The city's hospitality sector, comprising over 300 hotels and numerous food and beverage establishments, contributes significantly to these environmental challenges. Hotels are major consumers of energy and resources, with round-the-clock operations requiring continuous air conditioning, lighting, and water usage. Moreover, Hong Kong's unique geographical location and subtropical climate present additional challenges. The city experiences hot, humid summers that drive high energy consumption for cooling, while its coastal location makes it vulnerable to extreme weather events and rising sea levels associated with climate change. These factors underscore the urgency for businesses, particularly in the hospitality sector, to implement effective environmental technologies and sustainable practices.

1.2 The Impact of Hotel Operations on the Environment

The hotel industry plays a pivotal role in Hong Kong's economy while presenting significant environmental challenges. As a cornerstone of Hong Kong's tourism sector, which contributed approximately 4.5% to the city's GDP before the pandemic (Tourism Commission, 2020), hotels serve as essential infrastructure supporting Hong Kong's position as a global financial center and premier tourist destination in Asia. The industry's economic significance extends beyond direct revenue generation, creating substantial employment opportunities and stimulating related sectors such as retail, food and beverage, and transportation. However, this economic success comes with considerable environmental costs. Hotels are among the city's most resource-intensive commercial operations, consuming substantial amounts of energy for 24/7 air conditioning, lighting, and guest amenities. A typical Hong Kong hotel generates significant quantities of waste, from food waste in restaurants to single-use toiletries and

packaging materials, while maintaining high water consumption for guest rooms, laundry services, and food preparation. This operational footprint places hotels at the center of Hong Kong's environmental challenges, particularly in energy consumption and waste generation. The industry thus faces the complex task of maintaining its crucial economic role while mitigating its environmental impact through sustainable practices and technological innovations.

Hotels have negatively impacted the environment due to the massive waste generation, energy production, and water consumption from hotel operations (Bani-Melhem et al., 2022). A hotel can release approximately 160–200 kg of carbon per square meter of room floor area annually, generating 1% of global carbon emissions (Green Hospitality, 2022). Hotels also create large amounts of food and solid waste (such as single-use plastic), leading to biodiversity loss, mainly in sun and beach holiday destinations (González & León, 2001). The Sustainable Hospitality Alliance (2022) has reported that global hotels produce around 35 million tons of food waste annually. Energy consumption is also a pressing environmental concern due to massive usage by hotel operations, with cooling and lighting the two most energy-consuming operations (CBRE, 2022). Hotels consume up to eight times more water than local communities in some areas (Sustainable Hospitality Alliance, 2022), and inappropriate management of hotel facilities, such as water distribution systems, can pollute local water systems. Overall, the hotel sector is responsible for 21% of the ecological footprint generated by tourism, and this proportion is expected to grow by 25% by 2035 (Santos et al., 2020).

Up to 2019, around 300 hotels in Hong Kong provided 83,100 rooms, contributing to 4.5% of the GDP (Tourism Commission, 2020). Notwithstanding the hotel industry's enormous economic contributions, it is also a major contributor to environmental problems. The Hong Kong Environmental Protection Department (2021) reported that pollution produced by the hospitality industry has led to a severe waste crisis. The energy Hong Kong hotels consume for heating water, refrigeration, air conditioning, and lighting in daily operations is also significant (Statista, 2023). The quarantine policy in Hong Kong during the COVID-19 pandemic has also increased hotels' environmental impacts, leading to a huge increase in solid waste.

The adverse impacts of hotel operations on the environment are more pronounced than ever. However, hotels' pursuit of economic benefits and sustainability need not be at odds. On one hand, hotels are eager to generate greater financial benefits, which demand more consumption of goods and energy. On the other hand, given the rapid development of the hotel

industry and the urgent need for carbon neutrality, going green is not an optional strategy but a necessary one to strengthen hotels' competitiveness and market share (Singiai et al., 2018). Hoteliers understand how vital environmental sustainability is for influencing their hotels' economic and social impacts. The tension between material growth and sustainability has driven hotels to adopt green initiatives to protect the environment while simultaneously pursuing profits.

1.3 Environmental Sustainability Efforts Globally

Environmental sustainability, closely associated with economic and social factors, has become a guiding value of corporates' development (Duric & Potocnik Topler, 2021), and leading tourism and hotel organizations have developed corporate environmental sustainability programs. Since the 1980s, the United Nations World Tourism Organisation (UNWTO) has promoted environmental sustainability norms for tourism-related businesses. In response to climate imperatives 2011, UNWTO developed its Hotel Energy Solutions (HES) project to help small and medium enterprises bridge the gap between available energy technologies and their operational use. The WTTC later introduced several environmental sustainability initiatives, including *Climate & Environment Action* and *Rethinking Single-Use Plastic Products*. The SHA launched its Pathway to Net Positive Hospitality framework to guide global hotels towards positive environmental impacts.

The hotel industry has been forefront of green practices (Abdou et al., 2020). To keep pace with the targets of the Paris Agreement, the global hotel industry needs to reduce 66% of its annual carbon emissions by 2030 and 90% by 2050 (Sustainable Hospitality Alliance, 2017). Many hotel chains have adopted near-term targets to achieve carbon neutrality. Rosewood, for example, showcases its commitment to environmental sustainability, from pursuing carbon neutrality to eliminating waste to driving the evolution of circular hospitality through Rosewood Sustains. Mandarin Oriental Hotels pledged to phase out all single-use plastics by March 2021. Marriott International has opened 184 adaptive reuse projects globally since 2016 and aims to develop 250 by 2025 (Marriott, 2023). Hilton is committed to setting climate-based initiatives and aims to reduce carbon emissions by 30% by 2030 (Hilton, 2023). Companies including Accor, InterContinental Hotels Group, Hong Kong and Shanghai Hotels Limited, the Langham Hospitality Group, and many more hotel corporations have also committed to going carbon neutral by 2050 or earlier. They have introduced measurement terms, produced annual sustainability reports to reflect their sustainability journey, and proposed plans for adapting to future challenges.

In addition to industry efforts, researchers have long recognized the role of environmental sustainability. One stream of research focuses on energy use. Since the introduction of regulations on carbon emissions, the hotel industry has made more efforts to conserve energy, such as by introducing smart key cards, automatic air-conditioning systems, and solar thermal systems (Palani & Karatas, 2022). Benefiting from technological advancements, hoteliers are increasingly willing to use renewable energy, such as solar and wind power, digital key cards, and automatic air-conditioning systems with lower energy consumption (Singjai et al., 2018; Dhirasasna et al., 2020). Although instability is still an issue troubling the renewable energy supply and more assessments are needed to improve their functional reliance, an increase in the number of hotel operators adopting renewable energy is expected (Dhirasasna et al., 2020). A second stream of research focuses on waste reduction, which is an important issue because the hotel industry is highly consumptive (Kasavan et al., 2022). Hotel operators therefore encourage customers to participate in environmentally friendly practices (Trang et al., 2019; Yu et al., 2024). The third main research stream focuses on recycling. Due to increased awareness of resource usage, recycling rates have risen, and many countries enforce strict regulations that stipulate that hotel operators must effectively manage their resources and reuse material waste (Tansel et al., 2021).

1.4 Environmental Sustainability Management in Hotels in Hong Kong

Hong Kong's hotel industry has endeavored to implement green initiatives to improve its environmental performance in the past decade. Hotels are urged to adopt environmental practices in their daily operations by conserving energy and water, reducing food waste, and encouraging both customers and employees to be involved in green initiatives. Eaton, one of the pioneers of sustainability initiatives in the Hong Kong hotel industry, has made notable achievements in waste management. In 2021, the hotel released a 'Live Clean, Go Green' package to provide guests with plant-based meals, green guides, and vegan snacks to achieve a zero-footprint stay-cation. Rosewood Hong Kong has also implemented pro-environment measures since it opened in 2019. Its green initiatives include soap recycling, Nordaq water filtration, and vegan bathroom amenities. To further its sustainability commitment, Rosewood Hong Kong launched a quarterly 'Staycation for Good' program in 2021, promoting guests' understanding of the environmental issue of food waste.

Alongside hoteliers' continuous efforts to reduce the impact of hotels on the planet, joint efforts are also being made by governments and local associations to promote environmental sustainability values. For example, as a powerful leader in the tourism and hospitality

community, the Hong Kong Tourism Board (HKTb) promoted a soap recycling program in 2017 to save solid waste in the hotel industry. The Hong Kong Hotel Association (HKHA) holds environmental excellence, and green innovation awards every year to encourage hotels to participate in environmental initiatives, evaluate their performance, and share their green experiences. The local sustainability organization Green Hospitality (GH) acts as a catalyst to facilitate connections among Hong Kong hotels to work towards their sustainability goals. The organization has collaboratively launched environmental initiatives such as a waste reduction program, a water-wise campaign, and a recent program for the green recovery of the tourism and hospitality industries through technology innovation.

Notwithstanding the leadership of public organizations and the best practices among local hotels, the environmental sustainability practice varies substantially among different levels of hotels (Zhang et al., 2012). It also lacks a mechanism to leverage best practices and a tool for benchmarking and mapping out the areas for improvement. Comprehensive guidelines for environmental sustainability management for hotels in Hong Kong are therefore vital.

1.5 Existing Index Related to Hotel Environmental Sustainability

Business corporations have recognized the importance of reporting and disclosing standards to mitigate environmental issues. The use of a sustainability index or indicator-based method is increasingly recognized as an excellent tool for measuring business performance (Gani et al., 2022). The most well-established business index is the Dow Jones Sustainability Index (DJSI), which was developed in 1999. DJSI are family indices that evaluate companies' market capitalization and trading performance. The DJSI focuses on corporate economic, environmental, and social performance, assessing issues such as corporate governance, risk management, branding, climate change mitigation, supply chain standards, and labor practices. In a similar vein, the Greater China Business Sustainability Index (GCBSI) analyses corporate social responsibility values in Hong Kong and the neighboring regions, encompassing businesses' economic, social, and environmental impacts. While prior indexes provide a solid foundation to develop the HSEMI, arguably, these indexes lack rigorous indicators for monitoring hotel environmental sustainability efforts.

Regarding environmental sustainability in the hotel industry, the Cornell Hotel Sustainability Benchmarking (CHSB) index is a well-known tool that allows hotels to calculate carbon footprints through energy, water, and carbon emissions. The CHSB has been widely employed by hotels and tourism corporates to evaluate their environmental sustainability performance yet exists with some limits. First, from the environmental

sustainability perspective, the CHSB evaluates only efforts in managing energy, water, and carbon emissions. The CHSB neglects other important dimensions (e.g., waste, recycling, new technology adoption, or renewable energy) in hotel environmental sustainability assessment. Second, the CHSB only provides information on the outcome of environmental sustainability practices rather than information on the tools and processes to achieve the outcomes. Specifically, the CHSB focuses on calculating individual hotels' carbon footprints. Therefore, the measurements are constructed at an aggregate level (such as *"total energy usage of a property as a calendar year divided by its floor area"*) rather than considering specific environmental sustainability operational practices. Thus, it remains unknown for the practices that lead to a certain level of carbon footprints constrain the problem diagnostics and best practice identification. Third, from the data source point of view, the CHSB index is developed majorly based on hotel operation practices in the United States, which is substantially different from hotel operations in Hong Kong due to local regulations, human capital qualifications, and consumer base.

First, different from the CHSB, the HESMI provides a more comprehensive evaluation of hotel environmental sustainability management by covering energy, water, carbon emission, waste, and recycling aspects. Second, the research design enables the HESMI to capture not only sustainability outcomes but also the tools and processes leading to the outcomes. This study employed the analytic hierarchy process (AHP) method (Saaty, 2008) for index development. AHP allows a hierarchical analysis of environmental sustainability indicators and their sub-indicators. It also allows for obtaining the relative importance of each level of indicators through quantitative measurement. Third, the HESMI was developed based on an on-site investigation of Hong Kong hotels. Thus, the contextualized HESMI provided more local indicators than the CHSB. The HESMI offers practical implications for individual hotels (or hotel groups) in Hong Kong to benchmark their efforts with others. Government and accommodation-related associations/organizations could also use the HESMI as a basis for designing policies and campaigns for environmental sustainability. Fourth, the HESMI can be applied to annually evaluate hotels in Hong Kong, which will continuously accumulate data. It aims to serve as a valuable tool for the Hong Kong hotel industry (or even the Great Bay Area) to benchmark environmental performance for strategic planning, which is of great importance considering Hong Kong's ambitious goal of achieving carbon neutrality by 2050 and the current pressing environmental challenges.

2. Objectives of the Study

This research aims to develop a Hotel Environmental Sustainability Management Index (HESMI) based on hotel operations in HK. To address the identified research gaps and advance our understanding of hotel environmental sustainability, this study pursues the following key objectives:

1. To identify indicators of environmental sustainability management in hotels through a literature review and interviews with experts and hotel professionals.
2. To investigate the environmental sustainability management practices in different hotel groups in Hong Kong by conducting on-site evaluations.
3. To develop a hotel environmental sustainability management index (HESMI) and benchmark the environmental sustainability management performance of hotels in Hong Kong annually with the Hong Kong Hotel Association (HKHA).
4. To provide a self-evaluation tool that hotels can continuously use to monitor and inform their pathway to carbon neutrality.
5. To accumulate a data asset of hotel environmental sustainability management in the long run and provide policy implications in both short-term and long-term.

The following sub-sections establish the theoretical foundation for this study's research objectives. Through the review of extant literature, objectives emerged from identified research gaps and theoretical developments in the field. The discussion synthesizes key findings from previous studies, highlighting how current research questions build upon and extend existing knowledge.

2.1 Environment Management (EM) in the Hotel Industry

In a variety of business sectors, such as manufacturing, logistics, agriculture, etc., corporations widely recognize environment management (EM) as a crucial component of their strategic initiatives to generate economic value while minimizing negative environmental impacts (Hartmann & Vachon, 2018). The hotel industry has been facing pressing pressure to address environmental sustainability issues in the last several decades. This is due to the fact that The expansion of hotels has had a significant impact on local community economy and environmental degradation in certain areas. On the one hand, Hotel operations, characterized by high consumption of electricity and water for heating, cooling, lighting, and laundry systems, contribute to this negative environmental impact (Kuo et al., 2022). On the other hand, the rise of legislation and regulation on environmental issues, growing concerns about

shortages of natural resources, heightened awareness among shareholders regarding ethical corporate investments, as well as increased media coverage of anti-corporate and anti-capitalist groups (Jones et al., 2014).

EM in the hotel industry refers to the implementation of practices and policies that promote environmental conservation, resource efficiency, waste reduction, and sustainable operations (Ouyang et al., 2019). In general, EM practices in hotels are classified as operational/technical practices and organizational/system practices (Ouyang et al., 2019). Operational/technical practices involve energy and water conservation, waste management, green procurement, and implementation of renewable energy sources (Park et al., 2014). Organizational/ system practices include the development of environment management systems, the establishment of environmental policies and goals, employee training and engagement, stakeholder engagement, and sustainability reporting (El Dief & Font, 2012).

Integrating EM practices into hotel operations is therefore crucial for promoting environmental preservation and improving the quality of life for local communities (Butcher & Chomvilailuk, 2022). Given the diverse nature of hotels in terms of type, size, brand, regional location, and seasonal influences, strategies for EM were widely discussed and implemented in operational practices, considering energy, water, and gas consumption (e.g., Köseoglu et al., 2019). Specific initiatives such as energy savings, wastewater treatment, and towel and linen reuse programs can be launched to map out EM strategies (e.g., Chan et al., 2022; Gössling et al., 2019; Kim & Han, 2022). These green programs yield numerous benefits to hotel management, including improved operation efficiency, reduced costs, and enhanced financial benefits (Chen et al., 2022).

Concerning the environmental sustainability issues in the hotel industry, hospitality scholars have long been investigating effective ways to improve environmental management. This has led to a vast body of research on various aspects related to environmental sustainability management in the hotel industry, including the relationships between hotel's sustainability actions and business performance (e.g., Koseoglu et al., 2021), the actions to encourage guests' pro-environmental behaviors during their stays (e.g., Han & Yoon, 2015), internal governance of environmental sustainability (e.g., Oriade et al., 2021), green human resource management (HRM) (e.g., Aboramadan et al., 2021), and adoption of green technology for hotel's environment management.

Prior literature related to EM can be classified into three streams of research: 1) assessment of the current status of EM practices in the hotel industry, 2) identification of factors influencing the adoption and implementation of EM practices, and 3) evaluation of the

impacts and outcomes of EM practices in terms of economic performance and sustainability (Chan & Hsu, 2016; Molina-Collado et al., 2022). For example, DiPietro et al. (2013) investigated the green practices in upscale food service operations and identified the customers' preferences for those practices. Spanish scholars examined the contextual factors influencing the choice of environmental strategies and found that chain affiliation and hotel size are influential factors for EM in hotels in Spain (Carmona-Moreno et al., 2004). López-Gamero et al. (2023) provided empirical evidence to reveal the relationships between hotel EM and differentiation competitive advantage.

These diverse research streams have established a foundation for understanding environmental management in the hospitality sector. However, the evolving nature of environmental challenges and technological advancements demands a more integrated approach to examining EM practices in hotels. While existing studies have provided valuable insights into specific aspects of EM implementation and outcomes, there remains a need to understand how these elements interact within a comprehensive framework. Particularly, as hotels face increasing pressure to enhance their environmental performance while maintaining operational efficiency, the relationship between technological innovation, organizational capabilities, and environmental outcomes requires deeper investigation. The following section therefore examines key themes in hotel EM, focusing on how different aspects of environmental management intersect with operational practices, stakeholder expectations, and performance outcomes. This thematic analysis aims to provide a more nuanced understanding of the complexities and challenges in implementing effective environmental management strategies in the hotel industry.

2.2 Hotel Environment Management Research Domains and Perspectives

Research on EM in the hotel sector has seen continuous and prosperous growth over the last decade. Various sustainability studies have been conducted, examining financial performance (e.g., Chen et al., 2022), stakeholders' sustainable performance (e.g., Espino-Rodríguez & Taha, 2022), consumers' pro-environmental behaviors (e.g., Trang et al., 2019), and organizational strategies for sustainability (e.g., Jones et al., 2014). In terms of the environmental aspect, hotel EM studies primarily focus on five major streams: governance, green human resource management, EM practices such as energy conservation, water usage reduction, waste recycling, green consumers, and green marketing.

First, EM governance pertains to the set of organizational procedures and standards that hotels use to oversee and assess their environmental performance (Chan & Hawkins, 2012).

One prominent aspect of EM governance is ISO14001, an internationally acknowledged standard for environmental management. For example, Chan (2009) employed the ISO14001 standard to develop strategies supporting hotels in establishing EM governance. Other scholars consider governance as an outcome-oriented strategy for sustainability reporting. An instance of this is utilizing materiality as a means of showcasing a hotel's dedication to environmental sustainability to stakeholders while upholding brand reputation (Guix & Font, 2020). This underscores the importance for hotels to identify and prioritize significant environmental concerns to effectively manage and report on their sustainability endeavors.

Second, considerable research in the hospitality industry has focused on green human resource management (GHRM). It is widely acknowledged that encouraging employees' participation and dedication to environmentally friendly practices are key indicators of supporting a hotel's environmental management governance. Therefore, many studies in the hotel sector either explicitly or implicitly emphasize the significance of GHRM. Pham et al. (2019) define GHRM as a valuable resource, particularly aligned with the resource-based view of organizational capabilities for environmental sustainability. Recent research on hotel environmental management has highlighted GHRM as a competitive advantage for hotels (e.g. Kim et al., 2023), not only contributing to overall environmental performance but also increasing employees' job commitment and reducing turnover intention.

Third, hotels rely on environmental management practices to uphold eco-friendly policies and achieve long-term growth (Chan, 2021). Research in the hospitality industry emphasizes the need to address negative environmental impacts, especially carbon emissions. Efforts such as implementing automatic air-conditioning systems and solar thermal systems demonstrate a commitment to energy conservation despite challenges related to renewable energy stability (Palani & Karatas, 2022). As more hotel operators embrace renewable energy, it is anticipated that its adoption will increase further (Dhirasasna et al., 2020). Other sustainability measures include water conservation through low-flow fixtures, efficient laundry operations, and water recycling systems (Han et al., 2018). Waste management strategies involve segregating materials for recycling, composting food waste, and minimizing single-use plastics (Pirani & Arafat, 2014) – actions that not only benefit the environment but also reduce costs while enhancing the hotels' reputations as responsible entities (Nysveen et al., 2018).

Fourth, green consumerism has a significant impact on promoting environmental management practices in the hotel industry (Han & Yoon, 2015; Quan et al., 2022). According to Asghar et al. (2023), creating eco-friendly physical environments, also known as green servicescapes, is essential for attracting environmentally conscious consumers. Today, guests

are increasingly seeking accommodations that reflect their values and show a strong commitment to environmental sustainability (Park & Shin, 2024). Factors such as customers' awareness of environmental issues, such as food waste (e.g., Juvan et al., 2018), and their perception of the effectiveness of sustainable practices affect their decision-making when selecting green hotels (e.g., Quan et al., 2023). Furthermore, digital word-of-mouth through online platforms also positively influences consumers' willingness to choose green hotels (e.g., Han et al., 2018).

Last, and closely related to the aforementioned concepts, extensive scholarly research has investigated how literature explores the impact of green marketing on promoting environmental sustainability in the hotel industry (Chung, 2020; Yoon et al., 2020). According to experts in the field, this type of green marketing encompasses a wide range of activities, such as highlighting environmental certifications (Bernard & Nicolau, 2022; Chi et al., 2022), providing eco-friendly amenities and services to attract environmentally conscious guests, establishing partnerships with local environmental organizations for branding purposes and social responsibility. For instance, according to Kizanlikli et al. (2023), using eco-labels as a marketing strategy can effectively appeal to environmentally conscious consumers. Additionally, employing green message framing as discussed by Topcuoglu et al. (2022), is also seen as a way to engage environmentally conscious consumers. Furthermore, Papagiannakis et al. (2024) highlight that while popular green marketing strategies may garner attention, there is also potential for misleading claims known as “greenwashing.”

Despite this substantial body of research, several critical gaps remain in our understanding of hotel environmental management. First, while existing studies have extensively documented individual environmental practices and their outcomes, less attention has been paid to the holistic integration of environmental management systems within hotel operations. Second, the role of emerging technologies in advancing environmental management capabilities remains understudied, particularly in the context of rapidly evolving digital solutions. Third, there is limited research examining the dynamic interplay between environmental management practices and organizational change processes in hotels. These gaps are particularly significant given the increasing pressure on the hospitality industry to address environmental challenges while maintaining operational efficiency and service quality. Therefore, this study aims to contribute to the literature by examining these unexplored dimensions of hotel environmental management, with particular emphasis on the systematic implementation of environmental technologies and their organizational implications.

2.3 Existing Benchmarking Tools Relevant to the Hotel Industry

The current widely recognized tool for evaluating environmental performance in the hotel industry is the CHSB index. This tool primarily evaluates environmental sustainability outcomes solely in the areas of energy, water, and carbon, excluding other crucial dimensions such as waste management or the adoption of renewable energy technologies. The CHSB index's measurements are constructed at an aggregate level, providing a high-level overview of a hotel's environmental performance (Zhang et al., 2012). For instance, it measures the “total energy usage of a property as a calendar year divided by its floor area.” Consequently, the CHSB concentrates exclusively on outcome-based information rather than providing insights into the processes and measures employed to attain these sustainability outcomes. While CHSB offers a comprehensive metric, the disconnect between processes and outcomes poses limitations in achieving participatory organizational strategies that foster holistic EM (Dos Santos et al., 2020).

The WTTC and the Sustainability Hospitality Alliance (SHA), on the other hand, offer a sustainability toolkit to guide hotels in developing sustainable practices. Specifically, the WTTC toolkit (World Travel Tourism Council, 2021) incorporates three main aspects: management & efficiency, planet, and people, designed as a starting point for all stakeholders. Similarly, the SHA's “*Pathway to Net Positive Hospitality*” initiative (Sustainability Hospitality Alliance, 2023) provides guidance and resources for hotels to embrace sustainability and contribute positively to the environment, society, and economy. These toolkits are built on a macro-level perspective, providing general guidelines rather than detailed and specific recommendations for hotels to implement sustainable practices. Despite the availability of these tools and frameworks, there are many challenges that hotels face in implementing environmental sustainability practices. The existing tools and frameworks, while valuable, often lack the granularity and specificity required to translate broad sustainability principles into tangible operational practices tailored to the unique needs and constraints of individual hotels. Table 1 summarizes the existing hotel EM benchmarking tools.

Table 1. Summary of Existing Benchmarking Tools.

Tool Name	Scope
Cornell Hotel Sustainability Benchmarking (CHSB)	Carbon ● Measure carbon footprint divided by 1 room-night stay, number of rooms, square meters, square feet, etc.
	Energy ● Measure energy usage divided by number of occupied rooms, square meters, square feet, etc.
	Water

	● Measure water usage divided by square meters, square feet, etc.
World Travel & Tourism Council (WTTC) - Hotel Sustainability Basics: Toolkit	● Management & Efficiency ● Measure and reduce energy use ● Measure and reduce water use ● Identify and reduce waste ● Measure and reduce carbon emissions
Sustainability Hospitality Alliance (SHA) - Pathway to Net Positive Hospitality	Planet ● Linen reuse program ● No single use plastic straws or stirrers ● Replace single use plastic water bottles ● Replace single use plastic mini toiletry bottles ● Green cleaning products ● Vegetarian options People ● Community Benefit ● Reduce inequalities ● Greenhouse gas emissions and energy ● Waste ● Ecosystems & biodiversity protection & regeneration of global biodiversity ● Human rights ● Labor practices ● Equity, diversity, inclusion (EDI) ● Employee engagement ● Local sourcing and SMEs (small and medium enterprises) ● Community partnerships ● Customer welfare ● Stakeholder engagement ● Management and compliance ● Commitments and reporting

2.4 The Necessary for Developing HESMI

Given the aforementioned issues, it is imperative to integrate industry-specific best practices, operational metrics, and actionable strategies to develop comprehensive, transparent, and actionable indicators for hotel EM. This project amalgamates academic and practical insights to develop an indicators-based framework for hotel EM, the framework highlighting two crucial points: 1) diverging from existing sustainability evaluation tools constructed at the aggregate level to evaluate EM performance outcomes, the developed indicators-based framework acknowledges the dynamic characteristics of processes, measures, and evaluation components that form its scope of EM within hotels. Consequently, it can be adopted as a toolkit for facilitating hotel EM capability development; 2) the developed framework concentrates on environmental aspects across various domains, such as energy efficiency, water conservation, waste management, and customer and local community engagement. It can serve as a supplement to the existing sustainability evaluation tools, further constructing

their metrics and disseminating holistic and participatory values across hotel EM practices. The next section will present the process of developing the indicator-based HESMI framework.

3. Research Methodology

The methodology section presents the systematic process of developing the indicator-based Hotel Environmental Sustainability Measurement Index (HESMI) framework. This methodological framework was constructed through a rigorous multi-stage approach, incorporating 1) Desk research to identify and develop the initial HESMI framework, 2) Qualitative investigations to develop the HESMI hierarchy framework, and 3) Calculate HESMI for all hotels in each category. The development process addresses the need for a comprehensive yet practical measurement tool that captures the multifaceted nature of hotel environmental sustainability. By integrating both quantitative metrics and qualitative assessments, the HESMI framework aims to provide hotels with a robust mechanism for evaluating their environmental performance, identifying areas for improvement, and benchmarking against industry standards. The detailed methodology and framework components will be elaborated in the subsequent sections, demonstrating how various environmental indicators were selected, weighted, and validated to create a holistic measurement system applicable to the hotel industry context. Figure 1 visualizes the research process.

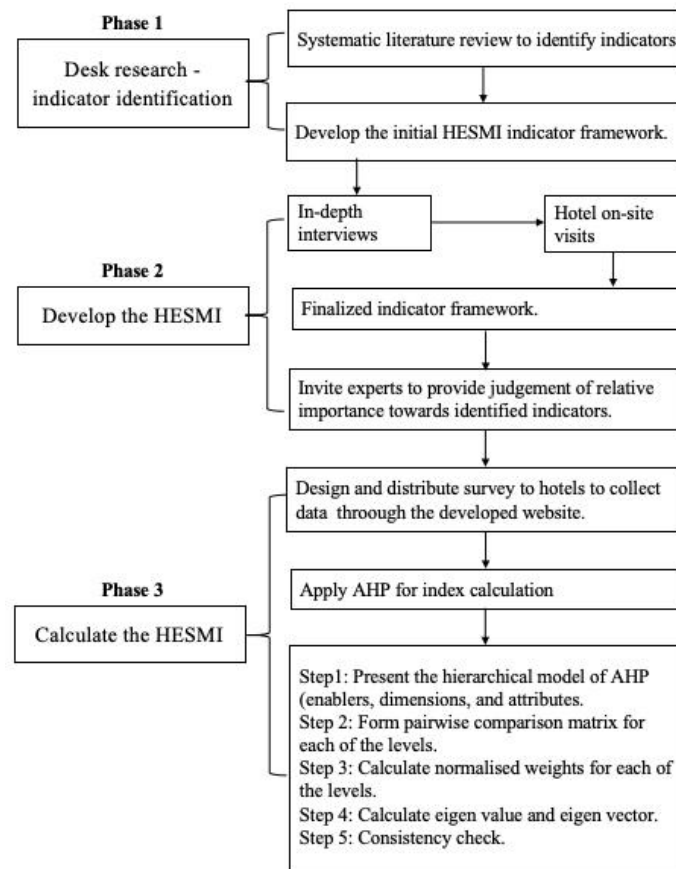


Figure. 1 Research design.

3.1 Phase One: Define the hierarchy of hotel environment management

3.1.1 Desk research

It is important to document what we know about examining environment management within the hospitality disciplines. Therefore, Phase 1 conducted a systematic literature review to identify key dimensions of hotel environment management indicators in academic journals. The systematic review process in this study followed the SPAR-4-SLR protocol by Paul et al., (2021), including three main steps: 1) assembling, 2) arranging, and 3) assessing.

In the **assembling stage**, we set the criteria for assembling the relevant literature based on our proposed research objectives. These criteria include a) EM in the research domain of hospitality, b) peer-reviewed journal articles, and d) only A or A* academic journals listed in the Academic Journal Guide 2022 by the Chartered Association of Business Schools (CABS) or the 2023 Australian Business Deans Council (ABDC). In addition, the objective of this research is to identify EM indicators rather than conducting a bibliometric review of prior EM literature. We drew upon Chan and Hsu's (2016) review, which identified the main themes of environmental management research in hospitality published between 1993 and 2014. In this study, we extend their review by selecting articles published from 2015 to Jan 2024 to update new themes and emerging trends in ESM within the hotel industry.

By utilizing these criteria, we aim to ensure the inclusion of articles that meet rigorous quality standards (Ki et al., 2024). We conducted a comprehensive search of two databases, including Scopus and Web of Science. Boolean research was adopted by using keywords "hotel environment management" OR "green hotel" OR "hotel energy AND water saving" OR "hotel carbon emission" OR "hotel footprint" OR "hotel waste management" OR "hotel sustainable practices" OR "hotel eco-friendly initiatives" OR "hotel environmental performance" OR "hotel environment indicators" OR "hotel stakeholder engagement AND sustainability" in titles, keywords, and abstracts. Google Scholar is used as the database for cross-checking and retrieving additional relevant articles. The comprehensive search yielded a total of 189 articles that met the criteria for inclusion.

In the arranging stage, we defined the organizing codes for further analysis. The articles' title, abstract, keywords, research questions, method, and key findings were extracted. Authors, journal names, publication years, and research types were also extracted for the descriptive record. Next, the research team purifies the articles by screening their relevance. As a result, 41 articles were selected for further analysis. In the assessing stage, we followed Mays et al. (2005) for analyzing the review, which includes three main steps. First, we used Excel to

synthesize the selected articles. Second, we use open coding to categorize the data into relevant parts (e.g., type of research, examined environmental issues, etc.) that allow comparison of similarities or overlaps. While we coding the data based on the objectiveness of articles, the data analysis process remains open to new and interesting content that would be of value to indicators identification. The last step is to ensure the robustness of the synthesized findings by assessing the quantity and quality of collected articles. The article collection and review process had already ensured the data that could inform significant quality. Figure 2 illustrates the procedure of our systematic literature review.

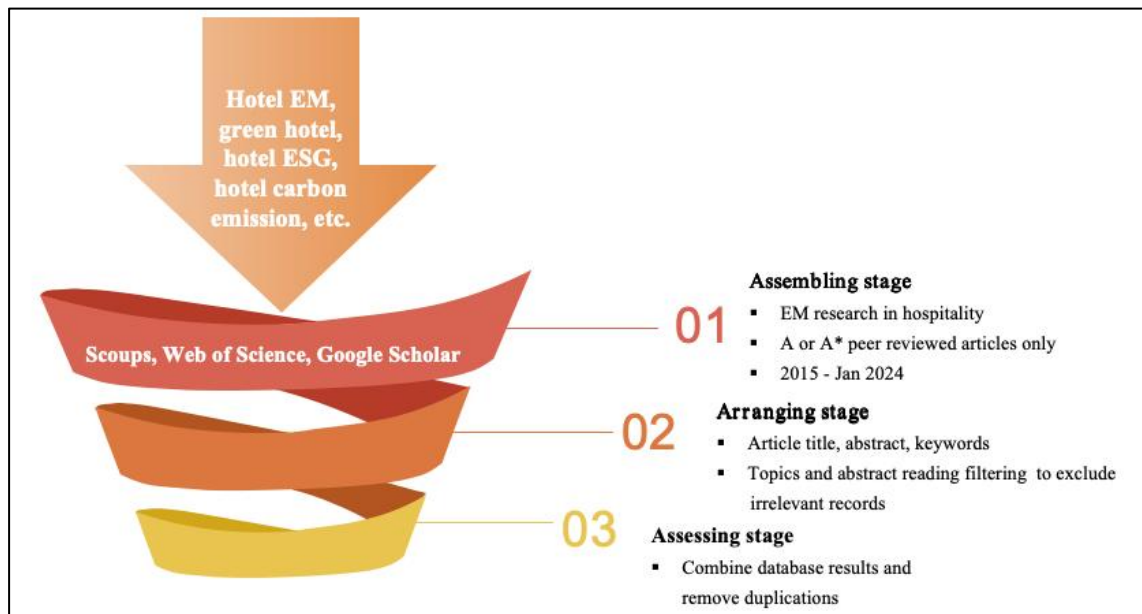


Figure 2. Systematic literature review process.

In addition to identifying hotel environmental management indicators from the literature, we also located indicators by examining websites associated with the Hong Kong hotel industry and relevant governmental regulations, as well as ESG reports from various hotel chains and groups. Table 2 lists the key additional resources.

Table 2. Key additional sources for identifying indicators.

Types of Sources	Resources
Local Hotel/tourism, environment organizations	Hong Kong Hotel Association website; Hong Kong Environment Protection Department website; Green Hospitality website; HK Green Council website.
International hotel chains/groups' ESG reports	Hilton, Marriott, Accor, Intercontinental Hotels Groups (IHG), Hong Kong and Shanghai hotels, Langham, and Hyatt, etc.

Data analysis. The analysis for this review follows Mays et al. (2005). First, we synthesized the literature as noted above, comparing and contrasting and thus categorizing the different articles according to the environmental themes they examined. Second, open coding was used to break down the data into relevant parts that allowed for similarities and overlaps, and the environmental initiatives examined by those studies for hotel sustainability management. While all data were coded according to the objectives of this study, we remained open to surprising and interesting content that would be of value to those in our field wanting to use a similar method. The final step (see Mays et al., 2005) included assessing the robustness of the synthesized findings. The blind-review peer process that each of the papers had already been subjected to, in addition to our quality selection of publication outlets, reassured us that the data used to inform the important findings are of significant quality. Through the desk research, an initial HESMI framework was developed.

3.1.2 In-depth interviews and hotel on-site visits

To gain a comprehensive understanding of hotel EM practices, we conducted a two-stage empirical exploration by combining in-depth interviews and hotel on-site visits. At the exploratory stage, we interviewed senior managers in hotels in Hong Kong. We select the participants based on their roles and responsibilities in EM within the hotels. When the interviews reached saturation (Creswell & Poth, 2016) (i.e., no more new information emerged regarding hotel EM), we moved to the second stage of the study. At the confirmatory stage, we formulated hotel EM indicators based on interviews and verified the measures by conducting on-site visits to the hotel EM best practices in Hong Kong. Specific demonstrations are as follows:

First, we conducted in-depth semi-structured interviews with senior managers from hotels in Hong Kong. We selected hotels based on theoretical sampling (Corbin & Strauss, 1990) and followed the criteria, including recognizing 1) “best practices” of sustainability rewards, such as Hong Kong Awards for Environmental Excellence (2022); 2) active participation of environmental sustainability initiatives to ensure each case has a certain degree of maturity; 3) their commitment to implementing environmental management practices; 4) the type, size, and administrative level of the hotel were considered to guarantee the degree of heterogeneity. Before the official interview, a screening questionnaire was administered to the hotels to assess their current environmental management practices. Guiding interview questions tailored to each hotel were then formulated based on the questionnaire results and the identified EM themes from the literature (Appendix 1). The primary focus of these

interviews centered on hotels' daily routines related to EM, as well as aspects of EM governance, staff training, engagement with key stakeholders (e.g., customers, local community), and the corresponding challenges or barriers encountered. Interviewees were also invited to share.

During the interview data collection process, we interviewed 37 management staff in 5-star and 4-star hotels. The data analysis suggests the saturation of opinions, which is a golden rule for determining the number of informants in a qualitative study (Saunders et al., 2018). That is, we identified that no more new opinions emerged from the informants. In the interviews, the senior management staff expressed concerns about hotel guests' cooperation and the residents' perceptions of the sustainability practices of hotels. For example, as a hotel manager said:

"....While we have implemented various environmental initiatives behind the scenes to operate our hotel sustainably, it is crucial to engage our guests and understand their perspectives on these practices."(P30)

Additionally, another manager emphasized:

"An important aspect we cannot overlook is that our hotel is deeply embedded in the Hong Kong local community. From our staff to the environmental initiatives we have implemented, we need to connect with residents and take responsibility for the community we are now a part of." (P25)

Therefore, our research team took the initiative to interview hotel guests and community residents using a different set of interview protocols (please refer to the attached interview protocols) to know how guests or residents expect the sustainability practices of hotels. The interviews of hotel guests and residents are extra efforts beyond the research activities in the proposal. The purpose is to provide more practical implications to hotel operators and owners in the final report. Our final sample consisted of 50 interviews. We tried to send our invitation to several 3-star hotels but only received 2 responses. The senior management staff in HKHA indicated that few sustainability practices had been implemented in those hotels. Therefore, the management chose not to be involved. Although we proposed 60 hotels in the original proposal, this was an estimation at the proposal stage. The data saturation (Malterud et al., 2016) determines the final number of interviews.

Second, to obtain specific and actionable environment management practices, the confirmatory stage assembling hotel on-site visits at selected hotels in Hong Kong. As a result, the researchers were able to gather valuable data and insights on the implementation of EM practices in the hotels as listed in Table 3. The two researchers and hotel staff members visited back-office operations, including kitchens, laundry rooms, and waste management areas to assess the integration of environmental management practices such as energy efficiency measures, waste reduction and recycling initiatives, food sourcing and waste reduction, and water conservation efforts. Additionally, they evaluated EM practices in guest-facing areas such as hotel lobbies, restaurant outlets, guest rooms, swimming pools, and fitness centers. Field notes and photos were taken during the visits.

Table 3. Information on hotel on-site visits.

Hotel	Visited areas	Related environmental initiatives
Hotel Icon	Kitchen	Water management Food waste & Oil recycling
	Laundry	Water management
	Waste management area	Food & Solid waste management
	Guest room	Energy management Water management Bathroom amenities management Customer engagement
	Restaurant outlets	Food waste Customer engagement
	Hotel lobby	Customer engagement Indoor air quality management
Nina Hotel Kowloon East	Rooftop	Energy management Water management
	Guest room	Energy management Water management Bathroom amenities management Customer engagement
	Restaurant outlets	Food waste Customer engagements
	Swimming pool	Water management
	Fitness centre	Electricity

Data analysis. Thematic content analysis involved analyzing the interview transcripts and field notes. Researchers familiarized themselves with the data and conducted open coding to identify key themes. The analysis process then advanced to a more abstract level, aggregating coding strategies into three main categories: 1) governance of hotel EM (general policies & human resources), 2) implementation of EM practices (energy conservation, waste management, water efficiency), and 3) communication and monitoring of EM stakeholders

(customers, local community). Field notes (textual notes and photos) were integrated into the interview data analysis process to inform relevant green practices. Finally, selective coding was used to develop the EM indicators. Cross-case analysis was performed to synthesize codes from individual cases into general findings to enhance analytic generalizability. The researchers independently conducted the data analysis at the open coding stage and constantly compared their codes to reconcile differences. By integrating the desk research and empirical investigations, the HESMI framework was established.

3.2 Phase Two: Evaluate the hierarchy by establishing priorities

After the HESMI framework was constructed, this project applied the analytic hierarchy process (AHP), a structured technique for organizing and analyzing complex decisions and quantifying the weights of different aspects of hotel environmental sustainability management. AHP uses the judgments of decision-makers to form a decomposition of problems into hierarchies. Problem complexity is represented by the number of levels in the hierarchy. The hierarchy is used to derive ratio-scaled measures for decision alternatives and the relative value that alternatives have against the goal. This method consists of four steps: 1) define the problem and state the goal; 2) define criteria and indicators that influence the goal and structure these indicators into homogeneous levels; 3) use paired comparisons of each indicator concerning each other that forms a comparison matrix with calculated weights, ranked eigenvalues, and consistency measures; 4) synthesize the ranks of alternatives until the final choice is made.

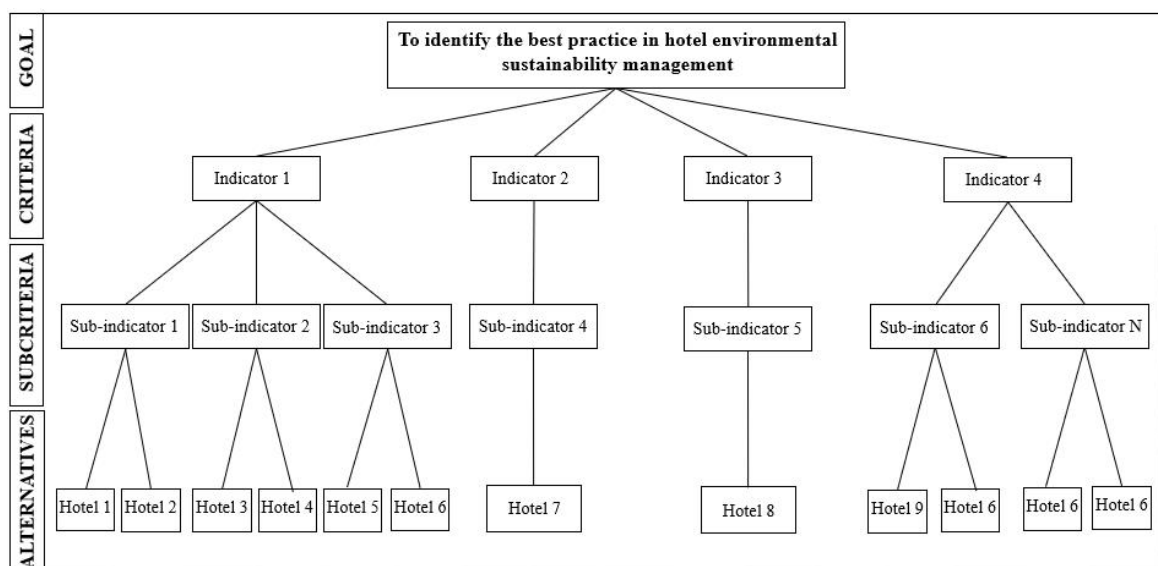


Figure 3. Illustration of HEMSI hierarchy diagram.

A pairwise comparison was conducted for each indicator (at the dimensional level) to

calculate the relative weight for each dimensional indicator, which was determined by using Saaty's 9-point scale, as presented in Table 4.

Table 4. Saaty's (2008) 1-9 scale for pairwise comparison.

Weight intensity	Definition	Explanation
1	Equally important	Two activities contribute equally to the objective.
3	Moderately important	Experience and judgement slightly favored one over another.
5	Strongly important	Experience and judgement strongly favored one over another.
7	Very strongly important	An activity is strongly favored and its dominance is demonstrated in practice.
9	Extremely important	The importance of one over another affirmed on the highest possible order.
2,4,6,8	Intermediate values	Used to express compromise between the priorities listed above.

An AHP questionnaire (see Appendix 5) was designed to understand the priority of HESMI criteria and was distributed to 4 industrial experts. The experts were invited to evaluate the relative importance of the dimensional level of indicators based on the weighting criteria of the AHP method. The expert's list is presented in Table 5.

Table 5. Experts List.

Expert #	Position	Organization
1	Director of Distribution Channels	International Hotel Chain
2	General Manager, Green Committee Captain	International Hotel Chain
3	General Manager	International Hotel Chain
4	Director of ESG, Asia Pacific	International Hotel Chain

After obtaining the relative weights for each dimensional level of indicator, we conducted the following steps to calculate the weights of the overall HESMI hierarchical framework:

Step 1: Calculate the maximum eigenvalue and eigenvector of the pairwise comparison matrix.

Assuming there are N number of criteria, denoted as $(C_1, \dots, C_i, \dots, C_n)$, its pairwise comparison matrix would be $A = (a_{ij})$, in which a_{ij} represents the relative significance of C_i to C_j . Then, using the row vector average normalization proposed by Saaty (1996), the approximate weight W_i of C_i is calculated as:

$$W_i = (\sum_{j=1}^n (a_{ij} / \sum_{i=1}^n a_{ij} = 1^{a_{ij}})) / n$$

Step 2. Constructing the fuzzy judgment matrix.

The fuzzy judgment matrix R can be defined as follows:

$$R = \begin{bmatrix} R1 & \cdots & R1m \\ \vdots & \ddots & \vdots \\ Rn & \cdots & Rnm \end{bmatrix}$$

Step 3: Consistency test.

The consistency test of AHP is designed to ensure the consistency of judgments by decision-makers throughout the decision-making process. The consistency ratio (CR) of a pairwise comparison matrix is the ratio of its consistency index to the corresponding random value. When inconsistencies exist in the pairwise comparison matrix A , the consistency index (CI) of matrix A is shown as:

$$CI = \frac{\lambda_{max} - n}{n - 1}$$

Then, the CR of the pairwise comparison matrix needs to be calculated as:

$$CR = \frac{CI}{RI}$$

According to Saaty (1980), a CR of less than 0.1 indicates that the consistency level of the pairwise comparison matrix is acceptable. If a CR is greater than 0.1, the decision maker should perform the pairwise comparison again.

Step 4: Calculate the weights of the overall hierarchy.

After obtaining the relative weights of all criteria, we multiply the scores of each criterion given by the expert evaluations by the total relative weights to obtain the weighting scores of the whole hierarchy. Eventually, a ranking order can be generated based on the scores obtained in the process of score integration.

3.3 Phase Three: Calculate HESMI for all hotels in each category

Phase Three involved HESMI survey data collection and calculation. We invited hotels, including 5-star, 4-star, and 3-star hotels to participate in the HESMI survey. In the original proposal, we stated in the proposal the sample hotels are members of HKHA ($N=274$), which are divided into high tariff A hotels (n39), high tariff B hotels (107), and medium tariff hotels (128) based on their facilities and services. However, the list of hotels with tariffs is inaccessible to the research team due to HKHA's responsibility to protect the confidentiality of the rental rate of each hotel property (as the reason offered by the management in HKHA). Therefore, we only have a list of members without any classification. Additionally, according

to the latest update from the HKHA on May 4th, 2024, there are 138 member hotels. For the data analysis purpose, we classified the member hotels based on their stars on Trip.com, one of the most popular OTAs for the distribution of hotels in Hong Kong. Thus, the 138 hotels are organized into three categories: 5 stars (59), 4 stars (66), and 3 stars and below (13).

In May 2024, we sent the survey invitation to the members through HKHA with two reminders. However, we only received a total of 50 responses (6 are non-HKHA hotels). 2 additional hotel responses from 5-star hotels were received in November 2024. Among these 52 responses, some of them were our interviewees in the first stage, and we called them to ask for their contributions one by one. Of the 52 hotels that filled out the survey, 19 are 5-star, 31 are 4-star, and 2 are 3-star. Similar to the interview results, very limited hotels at 3-star responded (only 2 responses). Statistically, this data can be generalized into hotels with 5 or 4-star. A power analysis was conducted for a one-tailed paired-samples t-test, indicating that the minimum sample size to yield a statistical power of at least .95 with an alpha of .05 and a medium effect size ($d = 0.5$) is 45. Assuming hotels at 3-star or below have limited environmental management practices, our current data is adequate to address research objectives 1, 2, 4, and 5. In addition, we are developing a collaboration with the China Hospitality Association to collect data from their members. We hope to compare the findings from hotels in Hong Kong and those in Mainland China. The comparison will provide more insights into environmental management in hotels.

The participating hotels are representative, including different levels of hotels from various hotel groups. Some of the participating hotels are considered “best practices” regarding their environmental sustainability management. Beyond its data collection function, the HESMI website serves as a dynamic knowledge repository and networking platform. It accumulates valuable datasets on hotel environmental management performance, creating a robust foundation for 1) Longitudinal analysis of industry trends; 2) Identification of best practices and areas for improvement; 3) Development of industry benchmarks and performance standards; 4) Evidence-based policy recommendations; 5) Recognition of environmental management excellence.

To calculate HESMI for all participating hotels, we applied the experts’ evaluation results and calculated relative weights derived from Phase Two of the research. The calculation process follows the AHP methodology to ensure scientific rigor and reliability in measuring hotel environmental management performance. First, we utilized the normalized weights obtained from expert evaluations through the AHP method. These weights reflect the relative importance of each dimension and indicator as determined by the panel of experts, whose

consistency in judgment was validated through Consistency Ratio (CR) tests (all CR values < 0.1). The primary dimensions' weights were derived from the aggregated pairwise comparison matrices, ensuring a comprehensive consideration of all environmental management aspects. Second, for each hotel's response to the HESMI survey, we assigned standardized scores to their reported practices and initiatives. The scoring system follows a uniform scale where Full implementation = 1.0, Partial implementation = 0.5, and No implementation = 0. Third, the HESMI score for each hotel was calculated using the following formula:

$$\text{HESMI} = \sum (W_i \times D_i)$$

Where W_i represents the weight of dimension i , D_i represents the standardized score for dimension i , i ranges across all dimensions and sub-dimensions. The calculation can be further broken down as:

$$\text{HESMI} = (W_1 \times D_1) + (W_2 \times D_2) + \dots + (W_n \times D_n)$$

For each dimension:

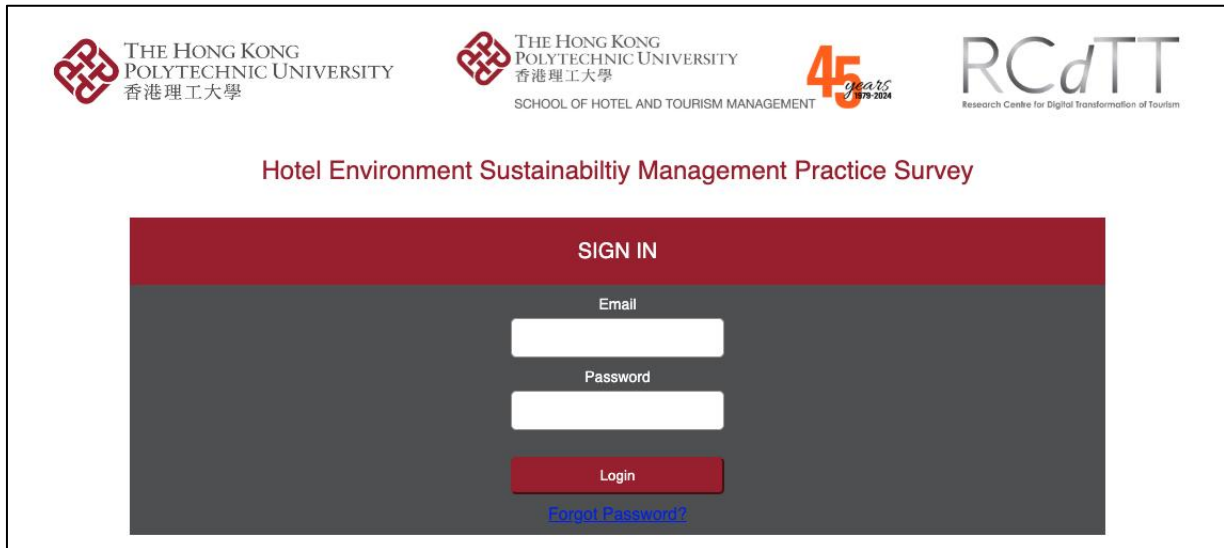
$$D_i = \sum (W_{si} \times S_i)$$

Where W_{si} represents the weight of sub-dimension i , S_i represents the standardized score for sub-dimension i . The resulting HESMI scores range from 0 to 100, where Scores > 80 indicate excellent environmental management implementation; Scores 60-80 indicate good implementation; Scores 0.4-0.6 indicate moderate implementation; Scores < 40 indicate need for significant improvement. The HESMI calculation methodology thus provides a robust framework for evaluating and comparing hotel environmental management practices, supporting evidence-based decision-making and continuous improvement in the sector.

3.4 Established the HESMI website

This project also developed a website and integrated a HESMI survey into the website for data collection and accumulation. The website can be accessed through [<https://polyu.client.vizualize.net/>] The website login page and main page can be seen in Figure 4 and Figure 5, respectively. The development of a dedicated HESMI website represents a significant step forward in systematizing hotel environmental management assessment in Hong Kong. Through strategic collaboration with the HKHA, the comprehensive website serves multiple critical functions in advancing hotel environmental sustainability. The primary objective of this website is to facilitate systematic data collection

through an annual HESMI survey participation from HKHA member hotels. It enables hotels to efficiently report their environmental management practices, track their performance over time, and benchmark against industry standards. The website's user-friendly interface and structured data collection mechanisms ensure consistent and reliable information gathering while maintaining data integrity and confidentiality.



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45 years
1979-2024

RCdTT
Research Centre for Digital Transformation of Tourism

Hotel Environment Sustainability Management Practice Survey

SIGN IN

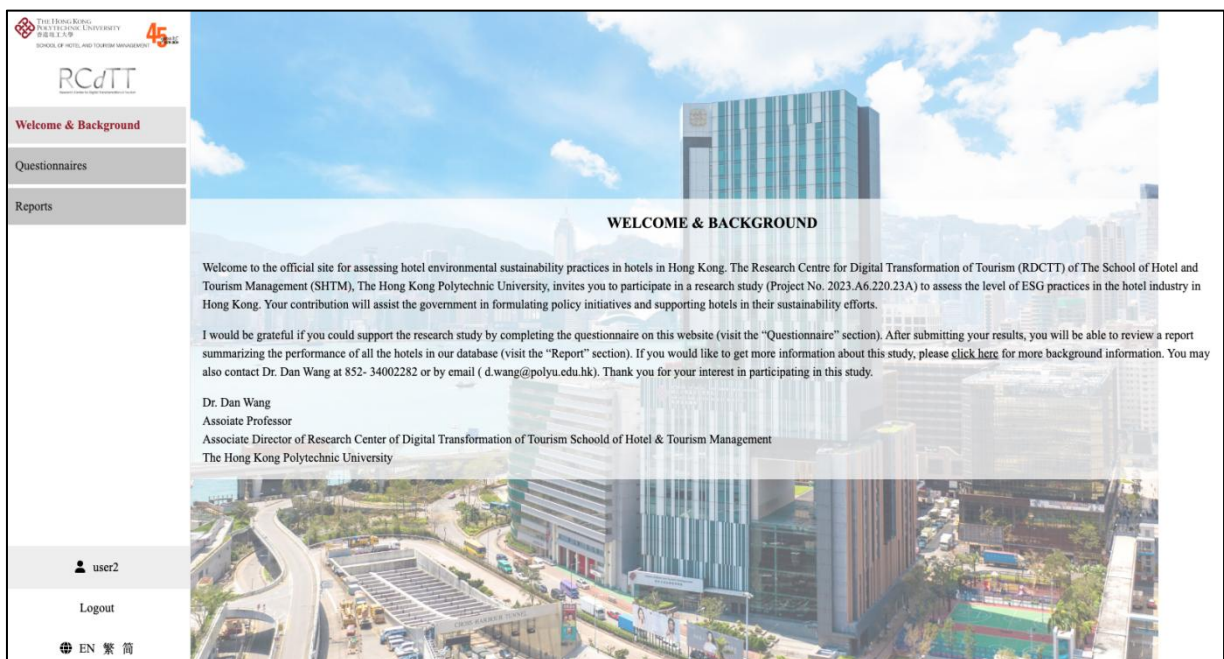
Email

Password

Login

[Forgot Password?](#)

Figure 4. Login page.



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45 years
1979-2024

RCdTT
Research Centre for Digital Transformation of Tourism

Welcome & Background

Questionnaires

Reports

WELCOME & BACKGROUND

Welcome to the official site for assessing hotel environmental sustainability practices in hotels in Hong Kong. The Research Centre for Digital Transformation of Tourism (RCdTT) of The School of Hotel and Tourism Management (SHTM), The Hong Kong Polytechnic University, invites you to participate in a research study (Project No. 2023.A6.220.23A) to assess the level of ESG practices in the hotel industry in Hong Kong. Your contribution will assist the government in formulating policy initiatives and supporting hotels in their sustainability efforts.

I would be grateful if you could support the research study by completing the questionnaire on this website (visit the "Questionnaire" section). After submitting your results, you will be able to review a report summarizing the performance of all the hotels in our database (visit the "Report" section). If you would like to get more information about this study, please [click here](#) for more background information. You may also contact Dr. Dan Wang at 852- 34002282 or by email (d.wang@polyu.edu.hk). Thank you for your interest in participating in this study.

Dr. Dan Wang
Associate Professor
Associate Director of Research Center of Digital Transformation of Tourism School of Hotel & Tourism Management
The Hong Kong Polytechnic University

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Logout

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Figure 5. HESMI website.

4. Research Results/Findings

The results/findings section reports in the comprehensive literature review of hotel environment management served as a starting point. Insights of interviews from multiple stakeholders within the hotel industry and the observations from hotel on-site visits will be presented, along with the process of developing the framework of HESMI. Subsequently, we delve into employing the AHP method for calculating the HESMI index.

4.1 Findings from Desk Research

4.1.1 Overview of Hospitality Literature on Environmental Sustainability

Table 6 synthesizes the multidimensional themes and initiatives in hotel environmental management, supported by seminal and contemporary studies from the literature. This comprehensive mapping of environmental management dimensions illustrates the breadth of sustainable practices in the hospitality sector while providing empirical evidence through representative research.

Table 6. Hotel environment management initiatives from the literature.

Dimensions	Initiatives	Relevant Literature
Energy conservation	● Eco-design by implementing engineering and/or technology solutions. ● Energy efficient air conditioning and other building management systems. ● Lighting retrofits to save electricity.	Kuo et al., 2022; Smitt et al., 2021; Periyannan et al., 2023.
Carbon emission reduction	● Set up carbon-neutral reduction goal. ● Seek opportunities to lower footprint. ● Mitigating climate-related risks.	Cheng, 2024; Wu et al., 2022; Chan, 2021; Filimonau et al., 2021; Gossling & Lund-Durlacher, 2021; Feliciano et al., 2022; Grosbois & Fennell, 2022.
Water conservation	● Water efficient shower heads, faucets and toilets. ● Water efficient tunnel washer. ● Water usage for laundry. ● Waste water treatment.	Nayak et al., 2023; McLaren et al., 2019; Ho et al., 2021; Estevez, Feijoo, & Moreira, 2022.
Food waste management	● Optimizing portion sizes within menu offering to minimize food waste. ● Excess food donated to local charities or food banks to support underprivileged Communities. ● Use cage free eggs.	Ravandi & Jovanovic, 2019; Giordano et al., 2022; Molina et al., 2021.

Products related waste management	● Upcycle retired linen products. ● Reduce single-use plastic. ● Recycle used soap and bottled amenities. ● Towel reuse.	Park & Shin, 2024; Al-Shihabi et al., 2024; Feo, Ferrara, & Minichini, 2022; Felix, Araujo, Pires, & Sousa, 2017; Kim & Han, 2022; Gossling, Arana, & Aguiar-Quintana, 2019.
Sustainable procurement	● Manage supply chain and buy from environmentally responsible suppliers. ● Work with suppliers to help identify environmentally sustainable sourcing options.	Aboelmaged, 2018; Molina et al., 2021.
Green management	● Form environmental sustainability goals. ● Environmental certification. ● Build up environmental sustainability leadership team or systems.	Leyva & Parra, 2021; Segarra-Ona et al., 2012; Bernard & Nicolau, 2022; Çop et al., 2021.
Sustainability assessment	● Implement technology to track energy consumption and waste.	Omar et al., 2024
Involvement in government regulation/organization	● Compliance of government environmental emission regulations. ● Participate in environmental sustainability championship.	Zhang, Luo, & Liu, 2022; Cooper & McCullough, 2021.
Policy communication	● Sharing environmental sustainability goals to public. ● Publish annual environmental sustainability report. ● Launch environmental sustainability programs.	Yadav et al., 2016; Hewa Heenipellage et al., 2022; Leyva & Parra, 2021.
Guests	● Encourage customers' pro-environmental behaviors. ● Monitor customers feedback on green practices. ● Engage corporate customers to reduce environmental footprint of business travel, meeting, and events.	Peng et al., 2023, 2024; Trang et al., 2019; Chen, 2015; Ban & Ramsuran, 2017; Vesal, Siahtiri, & O'Cass, 2021.
Staffs	● Environmental awareness training among staffs. ● Monitor staff feedback on green behaviors practices and initiatives.	Darvishmotevali & Altinay, 2022; Raza & Khan, 2022; Oriade et al., 2021; Masa'deh et al., 2017; Choi, Kim, Kim, & Agmapisarn, 2019.
Community	● Align community members' need with environmental innovations. ● Collaborate with industry peers to advance collective action on environmental issues.	Khair, Lee, & Mokhtar, 2021; Kuo et al., 2022; Leyva & Parra, 2021.

Figure 6 illustrates the major themes in hotel environmental management identified through our systematic literature review. The larger font size indicates a higher frequency of the specific theme. The thematic analysis reveals several distinct clusters of research focus that have emerged over the past decades (from 2015 to Jan 2024). Environmental, Social, and Governance (ESG) considerations, Corporate Social Responsibility (CSR) initiatives, green practices implementation, and employee ecological behaviors emerge as the most frequently studied topics in the hotel literature. The prevalence of these themes reflects the hotel industry's evolving understanding of environmental management, transitioning from isolated green practices to more comprehensive sustainability frameworks.

The visualization demonstrates the interconnected nature of these research themes, where ESG frameworks often serve as overarching guidelines for hotels' sustainability efforts, while CSR initiatives provide the strategic foundation for implementing specific environmental programs. Green practices, ranging from energy conservation to waste management, represent the operational manifestation of these broader sustainability commitments. Notably, employee ecological behaviors have gained increasing attention, highlighting the critical role of human factors in successful environmental management implementation.

The distribution of these themes also indicates shifting research priorities within the hospitality sector. While earlier studies predominantly focused on basic green practices and sustainability reporting, recent literature has expanded to encompass more sophisticated concepts such as circular economy principles, technological innovation in environmental management, and the integration of sustainability metrics into hotel performance evaluation systems. This evolution reflects the industry's growing maturity in addressing environmental challenges and the increasing sophistication of sustainability strategies in the hospitality sector.



Figure 6. Key hotel EM themes from the literature review.

4.1.2 Initiative Identified from ESG Reports and Government Regulations

Table 7 presents a comprehensive analysis of environmental initiatives and regulatory frameworks identified through an extensive review of global hotel industry reports and Hong Kong governmental documentation. This compilation encompasses both mandatory regulations and voluntary guidelines from leading international hotel groups, environmental certification bodies, and governmental agencies. The analysis draws from multiple sources, including the Hong Kong Environmental Protection Department's guidelines, the Hong Kong Climate Action Plan 2050, international sustainable tourism standards, and best practices from renowned hotel chains worldwide. The initiatives are systematically categorized into key environmental management domains, such as energy conservation, waste reduction, water management, green procurement, and carbon emissions control. Special attention is given to initiatives that align with Hong Kong's specific environmental challenges and regulatory context, while also incorporating successful international practices that could be adapted for

the local hotel industry. This comparative analysis serves as a crucial reference point for understanding the current regulatory landscape and identifying potential areas for policy development in Hong Kong's hotel sector.

Table 7. Environmental initiatives from the government and the hotel industry worldwide.

Dimension	Policy/Regulation	Initiative	Source
Governmental policy/regulation	Hong Kong's Climate Action Plan 2050	Energy saving and green buildings Waste reduction and recycling Technology breakthrough	https://cnsd.gov.hk/en/climate-ready/blueprints-road-maps/
	Environmental Legislation	Waste management Water quality management Air quality management	https://www.epd.gov.hk/epd/english/laws_regulations/environment_legislation/laws_maincontent_el.html
Industrial sustainability reports	SHANGRI-LA Group	Energy efficiency Water conservation Supplier engagement	https://sitecore-cd.shangri-la.com/-/media/Project/Shangri-La-Group/Sustainability/Images/Sustainability-Report/2023_SustainabilityReport.pdf
	Four Seasons	Smart building solutions Waste minimization Water efficiency Renewable energy Life cycle assessment	https://www.fourseasons.com/content/dam/fourseasons/images/web/PDFs/2023-ESG-Report.pdf
	Marriott International	Growing a Responsible Supply Chain Enhancing Resilient Communities and Hotels Reduce waste to landfill Reduce energy intensity	https://serve360.marriott.com/wp-content/uploads/2024/07/2024ESGProgress.pdf
	Hilton	Reduce water intensity Reduce carbon emission Reduce landfill waste Reduce pre and post food waste	https://esg.hilton.com/2023-twp-report/
	Accor Group	Eco-design Responsible sourcing Unlock employee sustainability mindset Develop sustainable solutions for hotel owners	https://ACCOR_IMPACTREPORT_2023.pdf
	IHG Hotels & Resorts	Reduce energy use Sustainable events Water sanitation Introduced new ECMs program for existing and new-build hotels to drive efficiency and reduce carbon. Engagement with local	https://www.ihgplc.com/~media/Files/I/Ihg-Plc/investors/annual-report/2023/ihg-responsible-business-report-2023.pdf

		community for food waste reduction	
	Mandarin Oriental	Carbon intensity reduction Green certification Use renewable energy Electric fleet Water circularity Reduce food waste	https://photos.mandarinoriental.com/is/content/MandarinOriental/_DMO/_Corporate/PDFs/mandarin-oriental-sustainability-report-2023.pdf
	The Hong Kong and Shanghai Hotels	Water efficiency and recovery Manage indoor air quality Sustainable building design Minimize energy use Innovative in-room technology	https://www.hshgroup.com/-/media/files/hsh/sustainability-reports/2022-crs-report_en.pdf

4.1.3 Generated Hotel Environment Management Indicators

Based on the themes and initiatives identified from the literature review, industrial reports, and governmental regulations, the initial HESMI indicator framework was developed. Table 8 concluded the dimensions and the initial indicators.

Table 8. Initial indicators identified from the desk research.

No.	Category	Indicators
1.	Leadership, Policy, Organization and Resources	● Establishing an environmental sustainability committee/task force. ● Establishing environmental/sustainability policy/green management plan for your organization/functional unit. ● Involving senior management in planning and implementation of environment initiatives/campaigns.
2.	Internal HR Practices to Encourage Sustainability	● Providing environmental awareness training among hotel staffs. ● Establishing internal environmental communication channels for sharing environmental policy, initiatives, accomplishments/suggestions. ● Monitoring staff feedback on green behaviors practices and initiatives.
3.	Continual Improvement Management	● Benchmarking the environmental performance with industry/regional/global norms/standards. ● Conducting internal audit to review environmental sustainability performance (e.g., ISO 14001, ISO 50001).
4.	Waste Management: Food, Solid, & Amenity	● Optimizing portion sizes within menu offering to minimize food waste. ● Reducing paper consumption in operation or promotion through electronic platforms/ digitalized documentation platform/digitalized advertisement or other means. ● Avoiding disposable items (e.g., bottled water, single-use cutlery, table mats, non-refillable

		stationeries/decorations /souvenirs).
5.	Energy Conservation	● Using energy efficient lighting and/or appliances. ● Establishing electricity-saving operation in each energy-using department in the hotel. ● Purchasing/switching to hybrid/electric vehicle and/or vehicles with higher emission standards (Euro-VI) for company vehicle fleet.
6.	Water Conservation & Wastewater Control	● Implementing water saving measures according to “Best Practice Guidelines for Water Usage in Hotel Industry” published by Water Supplies Department. ● Installing water sub-meters and conduct water efficiency audit regularly. ● Displaying reminders or by other means to encourage guests to reduce the number of times of changing towels and bed sheets. ● Adopting proper treatment on laundry water from operation.
7.	Internal Environment Sustainability	● Implementing measures to maintain or improve the indoor air quality and to avoid or abate the air emissions emitted from the establishment. ● Taking measures to avoid noise nuisance. ● Cultivating plants in suitable areas and choose suitable species to suit the hotel environment and local weather.
8.	Technology Adoption for Sustainability	● Adopting digital guest engagement tools such as mobile check-in and keyless room. ● Using virtual and augmented reality technology for remote check-in, virtual tours, and even virtual events, reducing the need for guests to travel. ● Adopting smart inventory management systems by analyzing data on food usage and predicting future demand, helping to reduce food waste.
9.	Communication with Local Community	● Participating in environmental program(s) organized by the public/private sector/NGOs. ● Supporting/sponsoring environmental program(s) organized by the public/private sector/NGOs (e.g., by provision of venue, monetary donation).
10.	Communication with Customers	● Providing incentives (e.g., discount/gifts) for customers/clients to encourage them in adopting environmental practices. ● Organizing programs/activities to promote environmental awareness to guests/clients. ● Developing standardized green promotional materials with green hotel logos, which are eye-catching, elegant, and have concise content to promote guests’ awareness.
11.	Communication with Suppliers	● Imposing any environmental requirement to suppliers or contractors (e.g., through written requirement on environmental requirements in tender request).

4.2 Integrated Findings from Interviews and Hotel On-site Visits

To validate and refine the initial framework, we conducted in-depth semi-structured interviews with 50 industry professionals and stakeholders. Among these, 37 were senior hotel managers representing diverse operational departments including general management, engineering, housekeeping, food and beverage, and sustainability offices. These managers were carefully selected from different hotel star-rating (5-star, 4-star) and operating models (international chains, local groups, independent hotels) to ensure comprehensive insights. The remaining 13 interviewees comprised key stakeholders including hotel guests, industry association representatives, and local community representatives (mainly sustainability certification bodies) within the hotel sustainability. Table 9 details the professional profiles of the interviewees.

Table 9. Profile of interviewees.

Interviewee	Gender	Department	Job Title	Hotel Tier
1.	M	Engineering	Director of Engineering	5-star
2.	F	Sustainability Committee	Cluster ESG Manager	5-star
3.	M	Senior Management	Hotel Manager	5-star
4.	M	Engineering	Director of Engineering	5-star
5.	M	Senior Management	Director of Operation	4-star
6.	M	Senior Management	Hygiene Manager	4-star
7.	M	Senior Management	General Manager	5-star
8.	M	Finance	Financial Controller	5-star
9.	M	Engineering	Director of Engineering	5-star
10.	F	Senior Management	Group Assistant Director of Operations	5-star
11.	F	Senior Management	Group Assistant ESG Manager	5-star
12.	M	Engineering	Engineering Director	4-star
13.	M	Senior Management	Regional Executive Vice President	5-star
14.	F	Senior Management	Sustainability Head	4-star
15.	M	Senior Management	ESG Manager	5-star
16.	M	Senior Management	ESG Manager	4-star
17.	M	Senior Management	General Manager 1	5-star
18.	M	Senior Management	General Manager 2	5-star
19.	M	Senior Management	General Manager 3	5-star
20.	M	Senior Management	General Manager 4	5-star
21.	F	Senior Management	General Manager 5	5-star
22.	F	Senior Management	Senior Regional Office Executive	5-star
23.	M	Hotel Employees	Captain of Hotel Green Committee/Director of Rooms	5-star
24.	F	Senior Management	Hygiene Manager	5-star
25.	M	Finance	Assistant Director of Finance	5-star
26.	M	Rooms	Assistant Manager -Materials	5-star
27.	M	Rooms	Assistant Director of Rooms	5-star
28.	F	Rooms	Assistant Housekeeping Manager	5-star
29.	M	Senior Management	Director of Food and Beverage Operations	5-star

30.	M	Senior Management	Executive Chef	5-star
31.	M	Senior Management	Director of Engineering	5-star
32.	M	Engineering	Assistant Director of Engineering	4-star
33.	F	Sales and Marketing	Assistant Director of Sales and Marketing	4-star
34.	F	Senior Management	Director of Marketing Communications	5-star
35.	F	Senior Management	Director of Human Resources	4-star
36.	M	Sustainability Committee	Sustainability Manager	5-star
37.	F	Sustainability Committee		5-star
Other hotel stakeholders				
38.	M	Hotel owner	Hotel owner 1	
39.	M	Hotel owner	Hotel owner 2	
40.	M	Hotel guest	Hotel guest 1	
41.	F	Hotel guest	Hotel guest 2	
42.	F	Hotel guest	Hotel guest 3	
43.	M	Hotel guest	Hotel guest 4	
44.	M	Hotel guest	Hotel guest 5	
45.	F	Hotel guest	Hotel guest 6	
46.	F	Hotel guest	Hotel guest 7	
47.	F	Hotel association	HK Hospitality Association representative	
48.	M	Local community	Residential representative 1	
49.	F	Local community	Residential representative 2	
50.	M	Local community	Residential representative 3	

4.2.1 Environment Initiatives Implemented in the Hong Kong Hotel Industry

These interviews provided valuable perspectives on the practical implementation challenges, strategic considerations, and future directions of environmental sustainability measurement in the hotel industry. Through the valuable insights, we solicited the following environment management dimensions.

4.2.1.1 Environment Governance

The first dimension of EM shows that hotels are emphasizing the development of structured environmental sustainability governance. This involves creating a shared vision and values around EM, as well as establishing goals for EM. Additionally, governance plays a crucial role in setting the tone and fostering a culture of sustainability within the hotel. Our research indicates that hotel leaders who prioritize environmental sustainability and genuinely commit to green practices can inspire and motivate their staff to adopt sustainable behaviors. For example, one manager stated:

“ . . . To be honest, we are far from perfect and there are many great opportunities

for us to pursue. It's a matter of great importance to me, and I feel responsible for addressing these challenges. We need to approach business differently and drive change accordingly." [P11]

We also found that hotels with strong green governance incorporated environmental practices into their strategies, viewing EM as an impact-oriented approach and integrating environmentally friendly practices into their business accountability. They customized EM by integrating specific sustainability practices into the local atmosphere. These hotels adopted impact-oriented thinking, focusing on eliminating negative environmental impacts and promoting real change. For example, a manager stated:

"We need to consider the real impact on our communities and how we can reduce the negative effects of our operations on the environment. We also need to assess its impact on our business, right?" [P4]

These hotels have strong obligations towards sustainability and are dedicated to making a positive impact on the environment rather than exploiting it for social reputation gain: These hotels are deeply committed to sustainability and strive to have a positive impact on the environment instead of using it for social recognition: *"Many people are taking action without considering the true impact. It's all just lip service for publicity"* [P30].

4.2.1.2 Staff training

The second dimension that emerged from the empirical data was staff training related to environmental sustainability. Indeed, hotels have been facing a range of challenges in implementing and maintaining environmental sustainability practices. One significant challenge is the lack of an environmental sustainability mindset among hotel employees. For example, many employees may not fully comprehend the impact of their daily activities on the environment and, therefore, may not prioritize sustainable practices in their work:

"Some of our colleagues, who have been working with us for 10, 15, or even 20 years, don't understand the importance of recycling or how to actually recycle. These long-serving employees didn't grow up in an environment that promoted recycling at home or within their families. It's understandable that they may not know about these practices because it was never a part of their upbringing." [P21]

Meanwhile, employees' lack of up-to-date guidance and actionable skills related to environmental sustainability can also make it difficult for hotels to prioritize and implement EM practices:

"The local market seems to struggle to keep up with the rapid changes. Just three

years ago, understanding the differences between biodegradable, combustible, and recyclable materials was relatively unknown. Back then, there might not even have been a distinct concept of “Cantonese.” Everything was simply categorized as recyclable. However, with sustainability constantly evolving, numerous distinctions now need to be considered. This adds to the challenges we face.” [P24]

In this regard, most hotels are eager to provide comprehensive guidance to train and educate their employees:

“I believe it’s important to look at the bigger picture and consider whether HK is ready to take these steps. If not, what steps need to be taken first before training can begin? Training without readiness can lead to frustration if it doesn’t yield results. Therefore, everyone is seeking tangible outcomes. Successful implementation and its subsequent consequences depend on having the right infrastructure, necessary training, and achieving results.” [P17]

Hotels are no longer relying solely on financial incentives to engage people in sustainability efforts. Instead, they are focusing on educating staff, creating a culture of sustainability, and fostering a sense of collective responsibility towards the environment:

“I believe it will be much easier to implement incentives. We don’t offer financial incentives to encourage people to take action; instead, I think that educating our associates about the impact and benefits on the community is the most powerful incentive we can provide.” [P26]

Some hotels also establish internal sustainability manager positions to monitor and evaluate the progress of sustainability initiatives. This enables hotels to identify areas for improvement and make necessary adjustments to their strategies and practices.

“I carefully examine all the numbers, particularly those that are active and need attention. I compare historical data with current figures, pinpointing any sudden decreases or increases as potential red flags for issues. If these changes persist over several months, it signals that something has occurred.” [P1]

4.2.1.3 Energy, Waste, & Water Management

In addition to embracing green governance and staff training, our findings indicated that hotels have different action plans and tools to ensure the integration of environmental sustainability into their daily operations. These include waste management (Dimension 3), energy saving & carbon emission (Dimension 4), water resource management (Dimension 5), and indoor air quality management (Dimension 6). Through hotel visits, we found that some hotels have

participated in or developed various green programs/initiatives supported by local government or non-government organizations. These initiatives mainly focus on food waste, plastic waste, and recycling to actively engage customers in the hotel's EM programs. Hotels also have their green programs designed to further promote environmental sustainability:

".... Our hotel has been a part of various programs initiated by the local government, including EatSmart which focuses on managing food waste. We have joined forces with multiple local organizations to tackle plastic waste and promote recycling within the hotel premises. Additionally, we have dedicated significant efforts towards enhancing our amenities. Annually, our marketing team and sustainability committee collaborate to create an environmental campaign. Through these initiatives, we aim to showcase our commitment to green values and environmentally friendly practices."

[P14]

Most hotels regularly evaluate their effectiveness in promoting environmental sustainability. This evaluation often takes place through board meetings or the integration of specific internal systems to track and measure key sustainability indicators, such as energy/water efficiency, waste management, and carbon footprint reduction. For instance, a hotel manager mentioned holding monthly sustainability meetings to ensure accountability and progress in this area:

"We have a popular internal system for tracking energy and water utilities, as well as other streams. The system can also calculate greenhouse gas emissions; it's already integrated. This means that the calculations meet industry standards, which is great because we at least meet some minimum requirements of standards. However, since the actual collection and measurement of data has to be done manually, there is always room for error and potential problems." *[P11]*

Most hotels set specific targets and objectives to guide their environmental management efforts. These goals provide a clear direction for the hotels to achieve their sustainability objectives and ensure that their initiatives align with overall business goals. For example, a manager from a local hotel mentioned that they require approval from the property before proceeding with sustainability-related matters. Additionally, these goals include specific and measurable targets (such as tracking electricity and water usage daily) that allow hotels to monitor progress and assess the success of their sustainability initiatives. Another interviewee stated:

"We have regional targets to achieve, with our main goal being a 20% reduction in food waste. Additionally, we aim to eliminate the use of single-use plastic items and ensure that all our associates or colleagues complete 4 hours of sustainability

training within the year” [P2]

A subsequent step after setting up EM goals is to allocate these goals and corresponding practices to specific departments within the hotel:

“Every section of the hotel should have a sustainability plan in place, covering carbon footprint reduction, energy saving, water consumption reduction, and more. For instance, when focusing on guest experience and the room environment with my rooms division manager, we will brainstorm specific actions for each area.” [P10]

During on-site visits to hotels, we gained insights into their energy and water management practices. Some hotels have implemented centralized cooling tower systems to reduce carbon emissions. Additionally, hotels dedicated to environmental sustainability have taken measures such as placing plants in public areas or posting “no smoking” signs to improve indoor air quality. These initiatives demonstrate efforts to minimize their environmental impact and promote sustainable operations.

4.2.1.4 Customer & Local Community Engagement

To effectively implement environmental initiatives, hotels acknowledge the significance of involving key stakeholders such as guests, local communities, and non-governmental agencies (e.g. hotel associations). Involving these stakeholders enables hotels to garner support and collaboration while ensuring alignment between sustainability initiatives and the needs of all parties involved. For instance, hotels in Hong Kong proactively engage with their customers through diverse environmental programs not only to raise awareness about environmental issues but also to inspire them to participate in environmentally friendly practices:

“ Our hotel always puts people first. Through these commitments, we have implemented various actions and tools to globally reach as many hotels as possible with efficient sustainability programs and raise awareness among our guests, associates, and staff members.” [P5]

Hotels are also willing to partner with local authorities, non-profit organizations, and environmental groups to support community-based projects that aim to preserve natural resources and protect the local environment. These projects could involve beach cleanups, tree-planting initiatives, or the establishment of community gardens. Through active participation in such efforts, hotels can show their dedication to environmental stewardship and contribute to the well-being of the local ecosystem.

4.2.1.5 Green technology adoption

During our on-site visits to numerous hotels, we have observed an emerging trend in environmental management practices – the increasing integration of technology. Hotels are now embracing cutting-edge technologies to enhance sustainability efforts across various aspects such as in-room equipment, operations, and performance evaluation. One noteworthy example is the adoption of artificial intelligence and advanced analytics in hotel management systems. These sophisticated technologies enable real-time monitoring and intelligent control of energy consumption, water usage, and other critical resources. By leveraging AI-powered predictive analysis and automated optimization algorithms, hotels can proactively identify inefficiencies, implement targeted interventions, and optimize resource utilization to minimize their environmental footprint. Furthermore, smart building automation systems deployment along with Internet of Things devices has become increasingly prevalent in hotel operations allowing seamless integration for remote control of various systems including contact-less check-in/out processes as well as heating/cooling/lighting/water management controls.

4.3 Barriers for Implementing Hotel Environment Management

In addition to the aforementioned EM aspects and criteria, our study also revealed three conflicting barriers based on the 9 hotel EM dimensions. Although existing research has emphasized that hotels ought to prioritize sustainability practices in their environmental efforts, there are still hindrances preventing effective implementation (Khatter et al., 2021). Therefore, an EM tool is of utmost importance for hotels to evaluate their current environmental performance and pinpoint areas for enhancement. This research delves further into the barriers faced in implementing environmentally friendly measures within hotels. These barriers have both favorable and unfavorable implications for hotel's environmental management, pressuring them to adopt a well-balanced approach toward achieving sustainable outcomes.

Barrier 1: hotel EM governance and implementation

It was observed that there is often friction between the environmental sustainability governance (Dimension 1) in hotels and its execution by staff (Dimension 2). This difficulty stems from the challenge of aligning sustainability objectives with practical measures implemented by hotel employees. While many hotels have established structured environmental management governance systems either at the corporate level or within individual properties, hotel staff may lack awareness or understanding of environmental goals and practices, resulting in inconsistent implementation. Filimonau et al. (2023) highlight

“passive compliance” as a key barrier to effective implementation of hotel environmental management governance. Furthermore, insufficient training and education on environmental practices are also hindering successful implementation (Aboramadan & Karatepe, 2021). Therefore, we recommend that hotel management link environmental management governance to specific actions and responsibilities at the operational level, while prioritizing employee training and education on sustainable practices based on these actions and responsibilities.

Barrier 2: hotel EM guidelines and customization

There is a discrepancy between the EM governance at the property level and the need for customized EM practices (Dimensions 3 to 6) in the local context, which can be described as an “EM gap” among hotels. While previous research has pointed out gaps between the design and implementation of sustainability guidelines (Dos Santos et al., 2017, 2020), this particular barrier is especially prominent in international hotel chains operating across different regions. Global guidelines may not always align with local contexts, leading to varying progress in implementing EM practices across different countries. This lack of alignment could be due to issues such as awareness, cultural differences, and infrastructure challenges. Additionally, unclear guidelines make it difficult for hotels to effectively implement and maintain environmental sustainability practices, resulting in fragmented efforts that hinder long-term sustainability goals. Therefore, hotels must customize their strategies according to specific barriers and drivers within each local context.

Barrier 3: top management vision and key stakeholders’ engagement

The third barrier involves the alignment of the senior management’s vision for environmental management and the level of involvement from stakeholders (Dimensions 7 to 8). It has been observed that even though senior management is committed to environmental management and holds an idealized view of a hotel’s green culture, this often does not translate into active engagement from key stakeholders such as customers and local communities. Research in the hotel industry recognizes the importance of stakeholder involvement in effectively implementing sustainable practices (Farmaki, 2019; Fauzi et al., 2023), but senior management frequently struggles to assess feasibility regarding customer engagement and supplier involvement due to a gap between their aspirations and reality. Therefore, we recommend that hotels actively engage with local community-led environmental sustainability initiatives to benefit from their expertise and resources. Furthermore, communicating efforts related to environmental management with customers can help increase their active participation.

4.4 Insights Generated from Hotel On-site Visits

Our evidence-based on-site visits to participating hotels allow us to observe diverse environmental initiatives implemented across various operational areas. These observations provided valuable insights into the development of HESMI. During the visits, photos were taken to record the participating hotels' environment management initiatives (see Appendix 4).

Back-of-House Operations:

In the back-of-house areas, hotels demonstrated significant environmental efforts in resource management and waste reduction. The kitchen facilities showcased advanced energy-efficient cooking equipment, food waste management systems, and water-saving installations. The participating hotels had implemented food waste digesters and detailed waste segregation protocols. The laundry facilities exhibited notable technological upgrades, including water recycling systems, energy-efficient washing machines, and heat recovery systems that capture and reuse thermal energy from wastewater. Many hotels have established comprehensive waste management areas with sophisticated sorting and recycling facilities, implementing clear protocols for handling different types of waste streams.

Guest-Facing Areas:

In guest rooms, environmental initiatives ranged from smart energy management systems to water-efficient fixtures. Notable implementations included occupancy sensors controlling lighting and air conditioning, low-flow shower heads and dual-flush toilets, and digital guest service systems reducing paper usage. The room automation systems in several hotels demonstrated advanced integration of environmental controls with guest comfort features. Swimming pool facilities showed the adoption of energy-efficient filtration systems and chemical-reduction technologies, while restaurants had implemented smart kitchen equipment and food waste monitoring systems.

Technological Integration:

A significant observation across all areas was the increasing integration of smart technologies for environmental management. Building Management Systems (BMS) were widely used to optimize energy consumption, while IoT sensors monitored and controlled resource usage throughout the facilities. Several hotels have implemented real-time monitoring dashboards that track environmental performance metrics across different operational areas.

Operational Challenges and Solutions:

The site visits also revealed various challenges in implementing environmental initiatives. These included space constraints for waste management facilities, the need to balance guest comfort with energy conservation, and the complexity of retrofitting older building systems with new environmental technologies. Hotels demonstrated creative solutions to these challenges, such as innovative space utilization for recycling stations and careful integration of new technologies with existing infrastructure.

Staff Engagement and Training:

A notable aspect observed during the visits was the emphasis on staff training and engagement in environmental initiatives. Hotels had established comprehensive training programs and clear standard operating procedures for environmental management, with visible signage and reminder systems throughout staff areas to reinforce environmental practices.

4.5 HESMI Framework

Building upon the previous stage of desk research, and empirical data collection through interviews and hotel on-site visits, we developed the HESMI framework. This framework encompasses 9 dimensions of hotel environment management and were compiled into 60 indicators by researchers. This framework can be defined as a hierarchical structure to model the hotel's environmental sustainability management problem. Table 10 lists all the dimensions and indicators that hotels can use for self-monitoring and benchmarking.

Table 10. HESMI Framework.

<i>Dimension 1: Environmental Sustainability Governance</i>
1.1 The hotel has an official management structure for hotel environmental sustainability strategies and action planning (Yes/No).
1.2 Senior management members are involved in hotel sustainability committee, including (General manager, Front Office Director, Food & Beverage Director, Engineering Director, Housekeeping Director, Financial Director, External Consultant) (Multiple choice).
1.3 The frequency of holding hotel sustainability committee meeting (Weekly, Monthly, Quarterly, Semi-annually, Semi-annually) (Single choice).
1.4 The hotel has key performance indicators for improving EM, including the aspects of (Energy consumption, Water consumption, Waste management, Green procurement, Participate in sustainability-related partners/programs, Greenhouse Gas Emission, Staff

training on hotel EM issues) (Multiple choice). 1.5 The hotel publicly publishes an annual sustainability report (either by the hotel management company or the hotel owner) related to EM practices (Yes/No). 1.6 The hotel's sustainability report undergo third-party auditing (Yes/No). 1.7 The hotel has been awarded/is in the process of applying for any sustainability certifications, such as (BEAM+, LEED, Green Building Evaluation Label - China Three Star, EarthCheck Certification, Global Sustainable Tourism Council (GSTC), Multi Hazard and Climate Change Certification, Green Key, ISO 14001) (Multiple choice).
<i>Dimension 2: Staff Training on Environmental Sustainability</i>
2.1 The hotel organizes staff training programs on environmental sustainability practices (e.g., HVAC systems, lighting controls, water conservation, and waste management, etc.) (Yes/No). 2.2 The frequency of conducting staff training related to environmental sustainability practices (Weekly, Monthly, Quarterly, Semi-annually, Annually) (Single choice). 2.3 The topics have been covered in staff training (Waste categorization/recycling, Water consumption control, Energy saving, Subject knowledge (e.g., why saving energy is vital) Communication skills on environmental sustainability) (Multiple choice). 2.4 The hotel uses encouragements to motivate staff to participate in online courses related to environmental sustainability (Financial incentives, Non-financial incentives, None) (Single choice). 2.5 The hotel has a feedback channel for frontline and management staff to provide suggestions and comments on the current environmental sustainability practices (Yes/No).
<i>Dimension 3: Waste Management</i>
3.1 Food Waste Management 3.1.1 The hotel uses different garbage bins to categorize different types of food waste, such as (meat, fish, fresh fruit, vegetables, grains, residues, and other expired or cooked leftovers) (Yes/No). 3.1.2 The hotel conducts food inventory evaluation exercise to avoid the possibilities of over-ordering and loss of perishable food materials (Yes/No). 3.1.3 The hotel adjusts portion size at restaurant outlets to reduce food waste (Yes/No). 3.1.4 The hotel donates food surplus to any local charitable organizations (e.g., Feeding HK, Food Angel, etc.) (Yes/No).

- 3.1.5 The hotel recycles waste cooking oil either by themselves or through a third-party service (Yes/No).
- 3.1.6 The hotel encourages customers to minimize food waste at restaurant outlets through posters or signage (Yes/No).
- 3.1.7 The hotel conducts food waste management auditing by a third party (Yes/No).
- 3.2 Solid Waste Management**
- 3.2.1 The hotel banned single-use plastics products in their premise, including (Plastic bottled water, Plastic bags, Plastic amenities, Plastic cutlery - plastic cups, plates, straws, food containers, etc., Plastic laundry bags, Plastic slippers) (Multiple choice).
- 3.2.2 The hotel recycles products, including (Paper products - paper, tissues, cardboards, Metal products - aluminium cans, tins, Glass products - glass bottles, Others - table cloth, napkins, ropes) (Multiple choice).
- 3.2.3 The hotel uses staff uniforms made from more environmentally friendly materials (Yes/No).
- 3.2.4 The hotel donates used items to non-government organizations or charitable organizations for reusing/recycling/up-cycling (e.g. furniture, bed linens, uniforms, etc.) (Yes/No).
- 3.3 Amenity Management**
- 3.3.1 The hotel uses bathroom amenities that made from sustainable materials (e.g., bamboo made amenities) (Yes/No).
- 3.3.2 The hotel installed in-shower dispensers for shampoo, conditioner, body and hand wash, to replace individual bathroom amenities in guestrooms (Yes/No).
- 3.3.3 The hotel collaborates with a third party to recycle bathroom amenities (e.g., soap) (Yes/No).

Dimension 4: Energy Saving & Carbon Emission

- 1.1 The hotel sets up measurable annual energy-saving goal and integrate it as an KPI (Yes/No).
- 1.2 The hotel installed and optimized HVAC system to optimize energy usage (Yes/No).
- 1.3 The hotel installed thermostats and sensors in guest rooms for precise temperature control to optimize energy usage (Yes/No).
- 1.4 The hotel installed LED lighting in various areas, including (Hotel lobby, Guest rooms, Restaurant outlets, Kitchens, Back-offices) (Multiple choice).
- 1.5 The hotel controls the duration of external lighting (e.g., signboards, exterior spotlights,

outdoor electric display panels) during nighttime (Yes/No). 4.6 The hotel offers electric vehicles to guests (Yes/No). 4.7 The hotel uses renewable energy for reducing energy consumption and lower carbon emission, such as (Solar energy, Combined heating and power (CHP), Geothermal energy, Biofuels, Wind energy) (Multiple choice). 4.8 The frequency of measuring energy consumption (Daily, Weekly, Monthly, Quarterly, Semi-annually, Annually) (Single choice). 4.9 The hotel can differentiate and measure the energy consumption from different sections of the hotels (e.g., kitchen, laundry, guest rooms, etc.) (Yes/No).
<i>Dimension 5: Water Resource Management</i>
5.1 The hotel has adopted sustainability practices for improving water resources management, including (Bathroom (e.g. water-saving tap, dual flush toilet), Laundry (e.g. run washing machine under full capacity), Towels and linens reuse (e.g. only change upon request), Water auditing (e.g., check the water meter to avoid leakage), Water recycling (e.g., reuse rainwater, greywater), Use of seawater (e.g., desalinate for swimming pool), Pool management (e.g., cover up the pools when they are not in service) (Multiple choice). 5.2 The frequency of measuring water consumption (Daily, Weekly, Monthly, Quarterly, Semi-annually, Annually) (Single choice). 5.3 The hotel can differentiate and measure the water consumption from different sections of the hotels (bathrooms, laundry, swimming pools, etc.) (Yes/No).
<i>Dimension 6: Indoor Air Quality Management</i>
6.1 The hotel installed sensors to monitor key indicators – such as volatile organic compounds (VOCs) to ensure indoor air quality (Yes/No). 6.2 The hotel places high-efficiency particulate air (HEPA) purifiers in high-traffic areas (e.g., hotel lobby) to maintain indoor air quality (Yes/No). 6.3 The hotel locates photocopiers and laser printers in ventilated areas (Yes/No). 6.4 The hotel cultivates plants in suitable areas and choose suitable species to suit the hotel environment and local weather (Yes/No). 6.5 The frequency of conducting indoor air quality assessment (Daily, Weekly, Monthly, Quarterly, Semi-annually, Annually) (Single choice).
<i>Dimension 7: Customer Engagement</i>
7.1 The hotel organizes programs/activities to actively engage customers, such as (Food

waster, Energy saving, Water saving, Plastic waste, Bathroom amenities) (Multiple choice). 7.2 The hotel promotes environmental sustainability practices in the official social media accounts. 7.3 The hotel collects guest's feedback on the current environmental sustainability practices, such as (Social media platforms, Customer survey by email, Customer survey by SMS) (Multiple choice). 7.4 The hotel encourages customers to participate in environmental practices through (Financial incentives (e.g. discounts/points/vouchers, etc.), Non-financial incentives (e.g., loyalty program reward points, None) (Multiple choice). 7.5 The hotel offers low carbon diet to customers (Yes/No). 7.6 The hotel encourages guests to reduce the number of times they change towels and bed sheets (Yes/No). 7.7 The hotel places recycling bins in guest rooms to encourage guests to sort waste (Yes/No). 7.8 The hotel places no smoking signs in public areas to remind guests that the premises are statutory (Yes/No).
<i>Dimension 8: Local Community Involvement</i>
8.1 The hotel participates in environmental programs organized by the local community (Yes/No). 8.2 The hotel participates in environmental programs developed by the local government (Yes/No). 8.3 The hotel collaborates with local non-government organizations/green groups listed below to promote hotel's environmental sustainability initiatives (Yes/No).
<i>Dimension 9: Technology Adoption</i>
9.1 The hotel implements paperless check-in/out (Yes/No). 9.2 The hotel installed contactless payment software that enable guests to obtain digital authorization to process payment (Yes/No). 9.3 The hotel installed smart Energy Management System (EMS) (e.g., Evergreen, Facilio, etc.) to monitor energy consumption (Yes/No). 9.4 The hotel installed sensors to monitor the temperature of the guest room and automatically adjust it accordingly (Yes/No). 9.5 The hotel adopts a smart inventory management system by optimizing food storage and

usage to help reduce food waste (Yes/No).

9.6 The hotel implements ORCA alike technology that can turn food waste into water (Yes/No).

4.6 Evaluation of the HESMI Framework

4.6.1 Experts' Evaluation of HESMI Indicators

The expert evaluation reveals notable variations in perceived importance across nine key environmental management initiatives. Customer Engagement emerged as a particularly significant dimension, with Expert 1 and Expert 2 assigning it the highest weights (35.5% and 30.8% respectively), though interestingly, Expert 3 and Expert 4 rated it considerably lower (5.5% and 5.9%). This divergence suggests different perspectives on the role of customer participation in environmental initiatives. Managerial Governance shows striking variation, with Expert 4 attributing it the highest weight (34.2%) while other experts assigned it relatively low importance (between 2.2% and 8.1%). Similarly, Technology Adoption received notably different weightings, with Expert 4 rating it at 25.2% while others assigned it between 4.4% and 14.3%. Staff Training demonstrates more consistency across expert evaluations, receiving relatively high weights from all experts (ranging from 12.5% to 20.7%), suggesting general agreement on the importance of human resource development in environmental management. Waste Management also shows interesting variation, with Expert 3 rating it particularly high (32%) compared to others. The standardized weights suggest Staff Training (20.51%), Customer Engagement (17.36%), and Waste Management (13%) as the top three priorities for hotel environmental management initiatives. Although indoor Air Quality Management consistently received lower weightings across all experts, this dimension increasingly become a critical component of overall environmental management strategies.

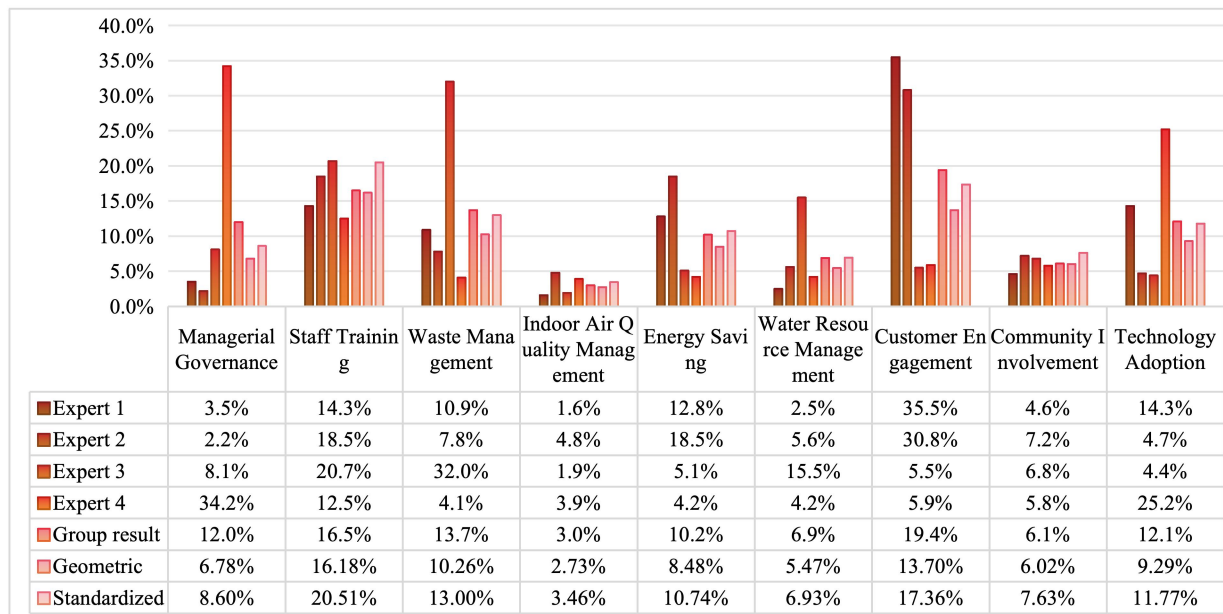


Figure 7. Distribution of Experts' Evaluation of HESMI Indicators.

4.6.2 Consistency check

Based on the AHP consistency evaluation results, the analysis of four experts' judgments demonstrates strong reliability and consistency in their assessments. The data shows remarkably consistent patterns across all evaluators, with Consistency Index (CI) values ranging from 0.1402 to 0.1444, and Consistency Ratio (CR) values falling between 0.0967 and 0.0996. The maximum eigenvalues ($\lambda_{\max}$) are also closely aligned, ranging from 10.1219 to 10.1553.

All experts' CR values are below the standard threshold of 0.1 (or 10%), with Expert 2 showing the lowest CR at 0.0967 and Expert 1 the highest at 0.0996. This indicates that all expert judgments meet the AHP consistency requirements, validating the reliability of their evaluations. The proximity of these values across all four experts further suggests a high degree of inter-rater reliability and consistency in their assessment approaches. The stability in $\lambda_{\max}$ values around 10.1 also reinforces the robustness of the evaluation process and the experts' coherent understanding of the assessment criteria.

Table 11. Consistency check.

Expert	CI	CR	$\lambda_{\max}$
1	0.1444	0.0996	10.1553
2	0.1402	0.0967	10.1219
3	0.1430	0.0986	10.1443
4	0.1422	0.09805	10.1373

4.7 General Information of Participating Hotels

4.7.1 Star-rating distribution of the participating hotels

Determining and differentiating the star rating of the participating hotels is important in the HESMI survey. As illustrated in Figure 8, the star rating distribution of participating hotels in the HESMI survey reveals a comprehensive representation across different hotel categories, with a notable concentration in the upscale and luxury segments. 4-star hotels constitute most participants, accounting for 62% of the sample, which provides a robust foundation for understanding environmental management practices in the mainstream upscale hotel sector. The luxury segment is well-represented through a combined 34% share, comprising 24% 5-star hotels, 6% 5-star Golden Diamond, and 4% 5-star Platinum Diamond properties. The sample also includes a smaller proportion (4%) of 3-star hotels, ensuring perspectives from the mid-scale market segment are captured.

This distribution pattern is particularly significant for the HESMI survey as it encompasses hotels across different service levels and operational complexities. The predominance of four-star and above properties (96% of the sample) suggests that the findings will be especially relevant for understanding environmental management practices in establishments with more comprehensive facilities and services, where environmental impacts and management opportunities are typically more extensive. The inclusion of different star ratings enables comparative analysis of environmental management capabilities and implementations across various hotel categories, contributing to the development of a more nuanced and applicable measurement framework.

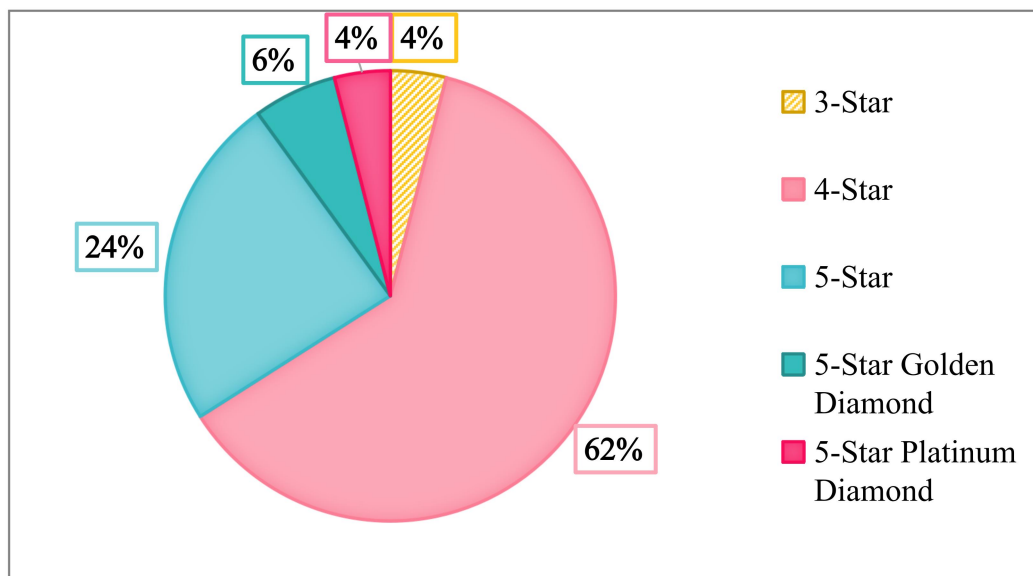


Figure 8. Star rating of HESMI participating hotels.

4.7.2 Geographical distribution of the participating hotels

The geographical distribution of participating hotels reflects a comprehensive coverage across Hong Kong's key districts, with Tsim Sha Tsui emerging as the dominant location, representing 34% of the sample. This substantial representation in Tsim Sha Tsui, one of Hong Kong's premier tourist and business districts, is consistent with the area's status as a major hospitality hub. The New Territories account for the second-largest share at 14%, indicating significant hotel presence in this expanding region. Central/Western and Island districts each represent 10% and 6%, respectively, reflecting the established business and tourism infrastructure in these traditional commercial areas. The distribution also captures other key areas, with Eastern/Southern Hong Kong accounting for 8% and Other Kowloon areas representing 6% of the surveyed hotels. This diverse geographical spread ensures the study captures variations in environmental management practices across different urban contexts, from dense commercial areas to more peripheral locations.

The balanced representation across different districts is particularly valuable for the HESMI survey as it accounts for varying operational contexts, local infrastructure capabilities, and district-specific environmental challenges. This geographical diversity strengthens the study's ability to develop comprehensive environmental management indicators applicable across Hong Kong's varied urban landscape.

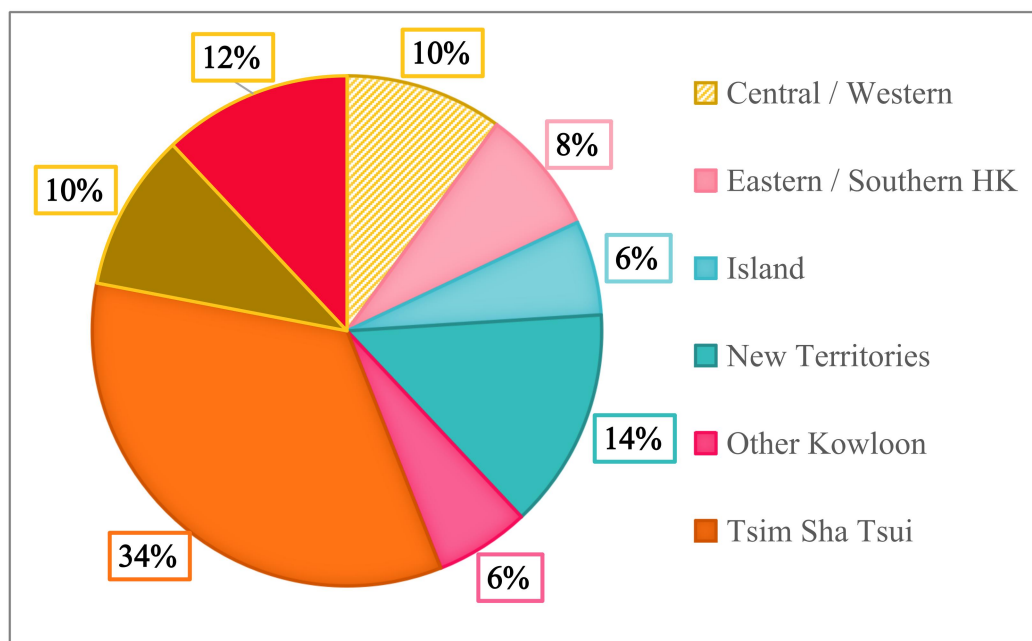


Figure 9. Geographical distribution of the participating hotels.

4.7.3 Distribution of Hotel Groups / Properties

The sample demonstrates a relatively balanced distribution between international and local hotel operations, with international hotel groups slightly predominating at 54.5% of the surveyed properties, while local hotel groups and properties constitute 45.5% of the sample. This near-even split provides a comprehensive perspective on environmental management practices across different ownership structures and operational frameworks in Hong Kong.

The substantial representation of international hotel groups (54.5%) reflects the significant presence of global hospitality brands in Hong Kong's hotel market. These international properties typically operate under standardized corporate environmental policies and benefit from group-wide sustainability initiatives and resources. Their environmental management practices often align with global standards and corporate sustainability goals established by their parent companies. The strong showing of local hotel groups and properties (45.5%) ensures the study captures the unique characteristics and approaches of Hong Kong-based operations. These local establishments demonstrate more localized environmental management strategies that are specifically adapted to Hong Kong's context, regulations, and market conditions.

This balanced distribution strengthens the study's validity by allowing meaningful comparisons between international and local approaches to environmental management, while also enabling the identification of best practices from both operational models. The mix provides valuable insights into how different ownership structures influence environmental management implementation and effectiveness.

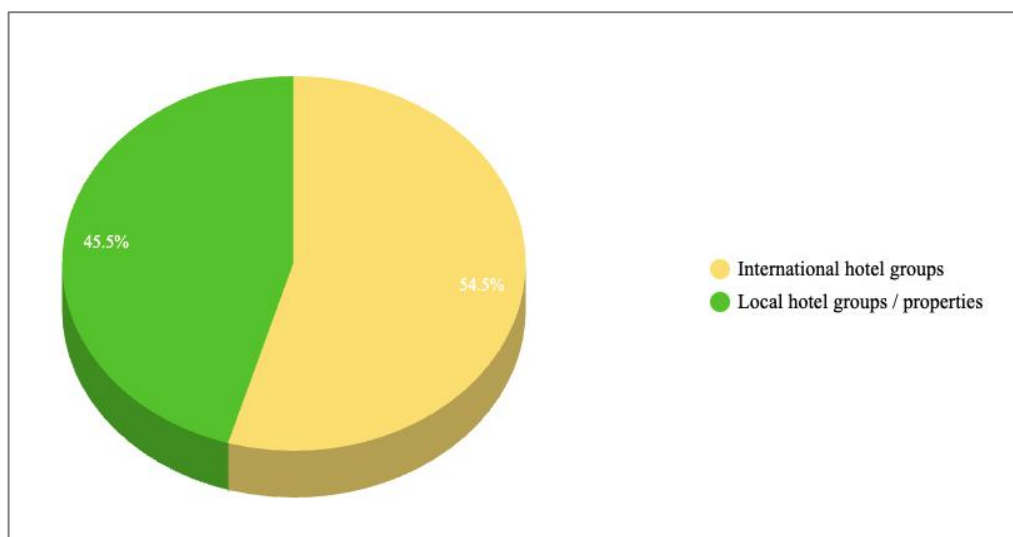


Figure 10. Distribution of hotel groups.

4.7.4 Green Marketing

The data reveals a clear preference for mainstream Western social media platforms in hotels' green marketing efforts, with Instagram emerging as the dominant channel. Instagram leads significantly, being utilized by 25 hotels (50% of the sample), likely due to its visual-centric nature which is particularly effective for showcasing environmental initiatives and sustainable practices. LinkedIn ranks as the second most popular platform, employed by 15 hotels (30% of the sample), suggesting a strong focus on business-to-business communication and professional networking in environmental sustainability messaging. This aligns with LinkedIn's role in corporate communication and stakeholder engagement. Facebook maintains a notable presence with 9 hotels (14% of the sample) utilizing the platform, indicating its continued relevance in reaching general audiences with sustainability messages. The lower usage compared to Instagram might reflect shifting social media demographics and engagement patterns.

Chinese social media platforms show a limited but strategic presence, with Douyin, RED (Xiaohongshu), and Weibo each being used by 1 hotel (2% respectively). This modest representation might indicate targeted efforts to reach specific market segments or reflect the geographical focus of the surveyed hotels. This distribution pattern suggests that hotels are prioritizing platforms with high visual impact and broad reach for their green marketing initiatives while maintaining a presence on specialized platforms for specific market segments. The strong preference for Instagram and LinkedIn indicates a dual strategy targeting both consumer and professional audiences in environmental communication.

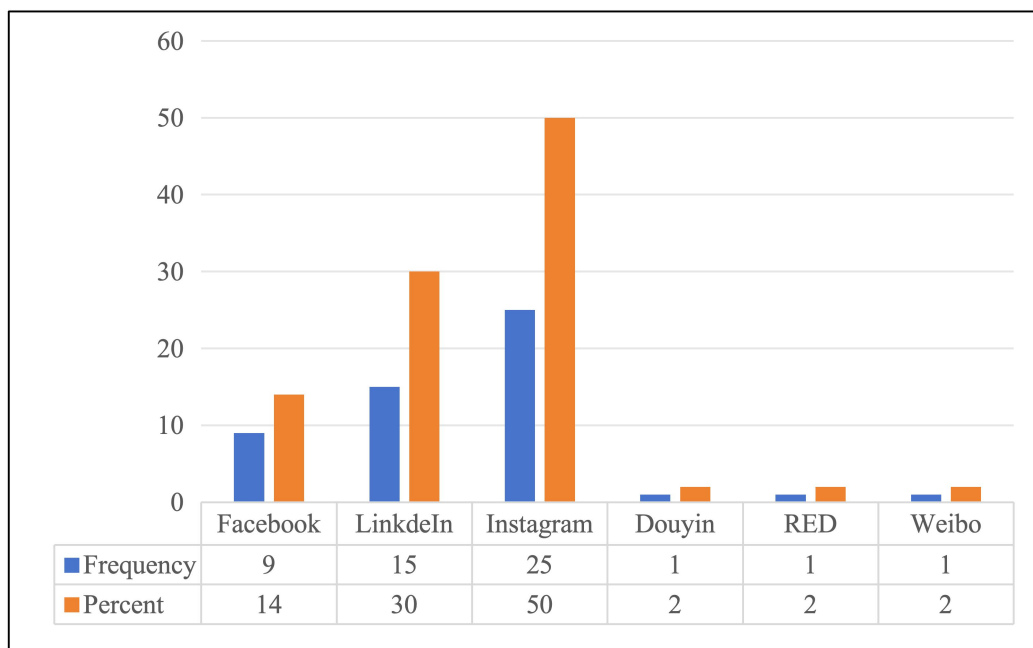


Figure 11. Marketing channels.

4.7.5 Green certifications

The green certifications among surveyed hotels reveal a diverse range of environmental credentials, with EarthCheck Certification emerging as the most prevalent at 38% of the sample. This high adoption rate of EarthCheck suggests its strong recognition and acceptance in the hospitality industry, particularly for its comprehensive approach to environmental management and sustainability benchmarking. BEAM+ certification ranks as the second most common, held by 28% of hotels, reflecting its significance as a locally relevant building environmental assessment method in Hong Kong. The substantial representation of BEAM+ indicates the industry's commitment to sustainable building practices and energy efficiency standards specific to the local context. ISO 14001, an internationally recognized environmental management system standard, is maintained by 18% of the surveyed hotels, demonstrating a commitment to systematic environmental management practices and continuous improvement processes. LEED certification is present in 7% of the properties, indicating the adoption of this internationally recognized green building certification system. A small portion (2%) holds the Green Building Evaluation Label (China Three Star), while 1% possesses Green Key certification, showing some diversification in certification choices.

Notably, 6% of hotels report having no green certifications, suggesting potential opportunities for increasing environmental certification coverage in the sector. This distribution pattern indicates that 94% of surveyed hotels maintain at least one form of environmental certification, reflecting the industry's strong commitment to validated environmental management practices.

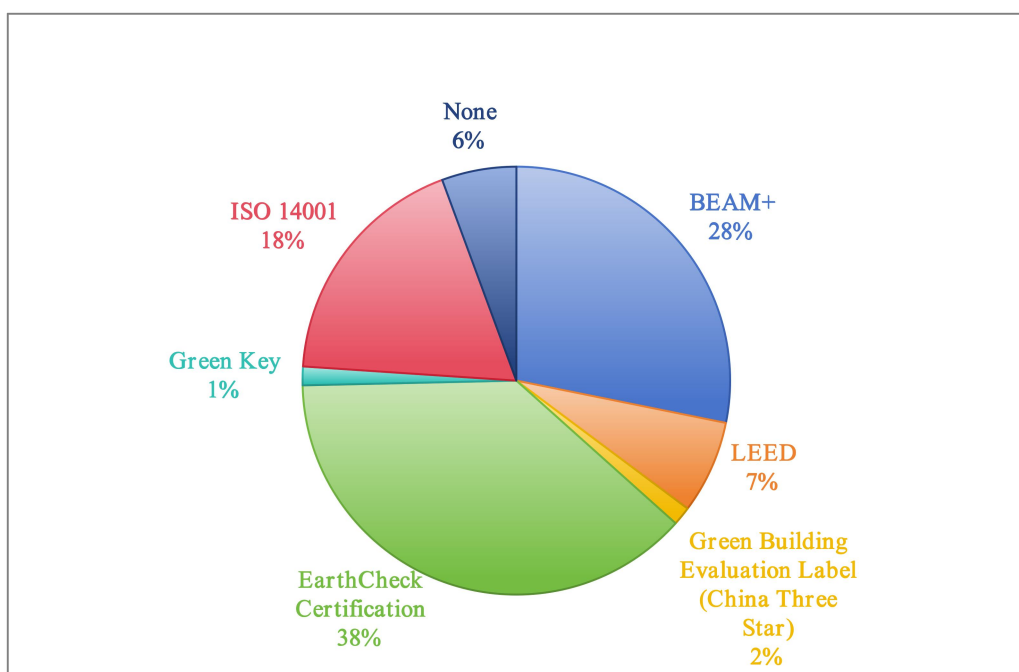


Figure 12. Green certifications.

4.7.6 Water Resources Management

Figure 13 reveals a comprehensive overview of water management practices among the participating hotels. Specifically, bathroom facilities represented the highest proportion at 25% (51 responses), followed by water auditing at 21.4% (42 responses) and towels and linens reuse at 19.9% (39 responses). These three practices collectively account for more than two-thirds of all water management initiatives implemented. The remaining practices show lower adoption rates, with laundry management at 13.3% (26 responses), use of seawater at 9.2% (18 responses), swimming pool management at 6.6% (13 responses), and water recycling showing the lowest implementation rate at 4.6% (9 responses). This distribution suggests that while basic water conservation measures are widely adopted, more advanced or resource-intensive practices like water recycling and seawater utilization are less commonly implemented.

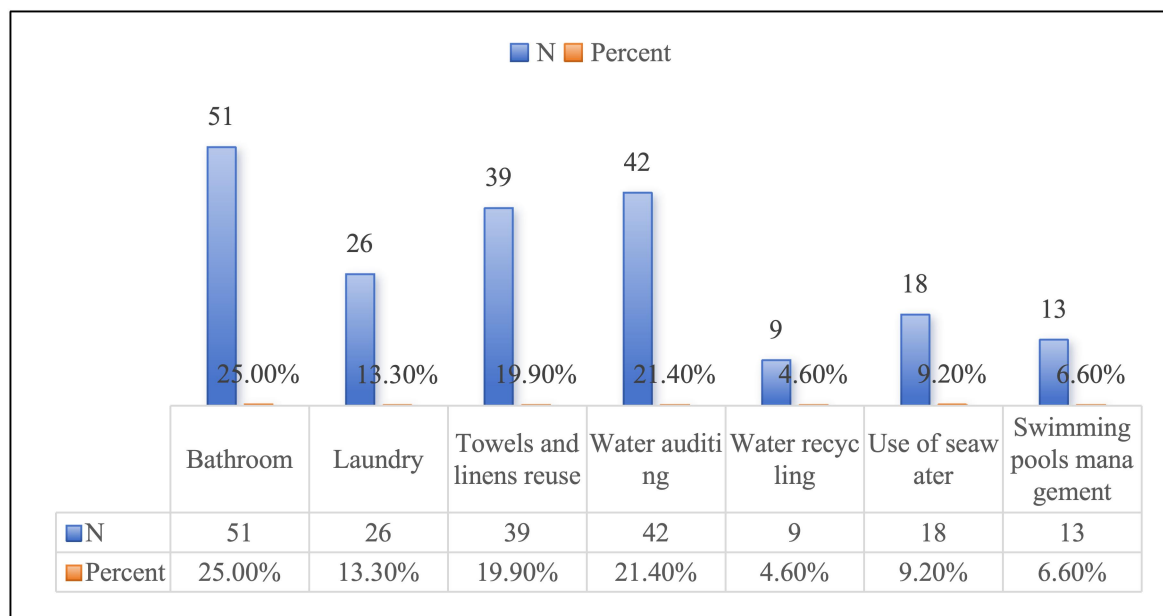


Figure 13. Water resources management.

4.7.7 Local Governmental Programs

Figure 14 provides a detailed overview of hotel participation in government-sponsored environmental management programs in Hong Kong, revealing varying levels of engagement across different initiatives. The Hong Kong Awards for Environmental Excellence emerged as the most popular program, with 27.6% (24 hotels) participation, likely due to its prestigious status and comprehensive approach to environmental management. This is complemented by

the Hong Kong Green Organization Certification scheme, which attracted 24.1% (21 hotels), suggesting a strong interest in formal environmental credentials among hospitality establishments. However, a significant portion of hotels, specifically 20.7% (18 hotels), reported no participation in any environmental programs, highlighting a potential gap in environmental engagement that could be addressed through more targeted outreach or incentives. The remaining participation was distributed across various specialized initiatives: 8% (7 hotels) engaged in other unspecified programs, while 6.9% (6 hotels) participated in promotion programs focused on waste source separation. The remaining participation was distributed across various specialized initiatives: 8% (7 hotels) engaged in other unspecified programs, while 6.9% (6 hotels) participated in promotion programs focused on waste source separation.

Both the waste separation and recycling schemes in schools and the carbon neutrality publicity campaign showed modest participation at 5.7% (5 hotels each), indicating room for growth in these areas. The Green Link environmental education support program, with just 1.1% participation (1 hotel), suggests an opportunity for expanding educational initiatives within the sector. This distribution pattern reveals that while there is significant engagement in major environmental certification programs, there remains substantial potential for increasing participation in specialized environmental initiatives, particularly those focusing on waste management, carbon reduction, and environmental education. The data also suggests that hotels prefer programs that offer tangible recognition or certification over those requiring more specific operational commitments.

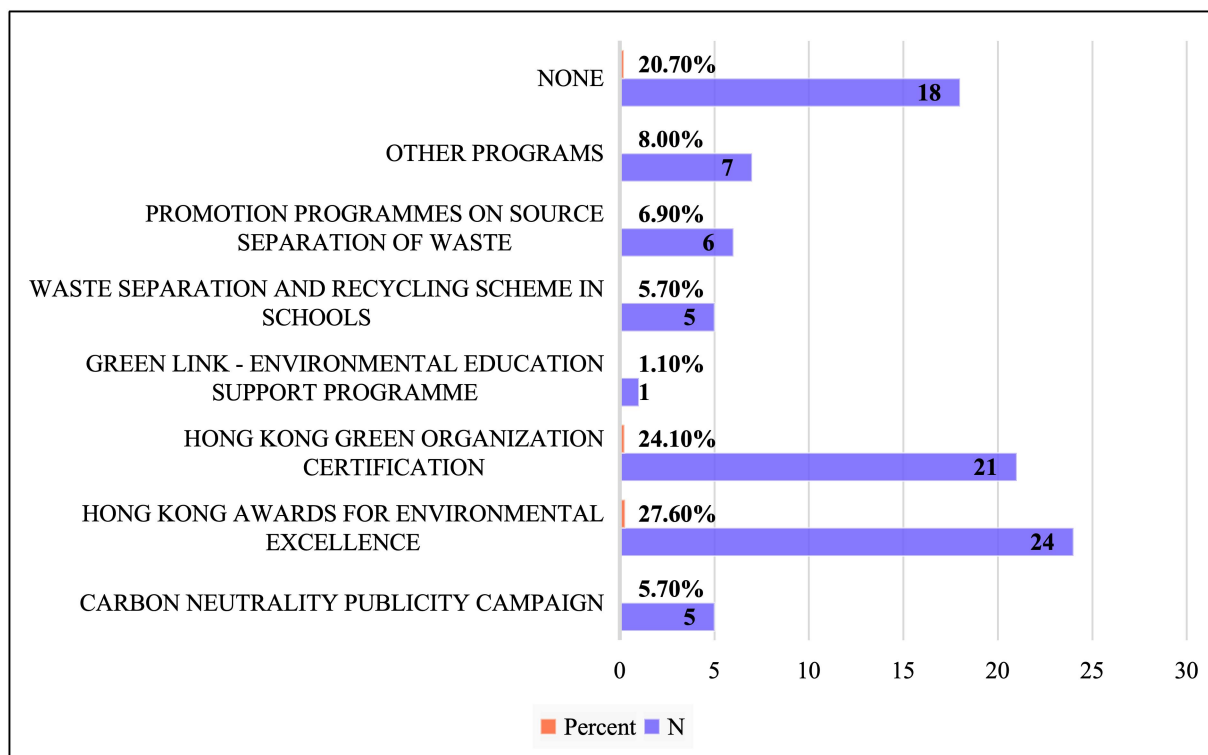


Figure 14. Participation of governmental programs.

4.8 Descriptive Statistics

The overall Cronbach's alpha value of the indicators is 0.793, which is above the suggested benchmark of 0.6 (Nunnally & Bernstein, 1994). The data reveals that Energy Saving & Carbon Emission has the highest mean score ($M=0.776$, $SD=0.248$), followed closely by Staff Training Environmental Sustainability ($M=0.767$, $SD=0.254$) and Waste Management ($M=0.729$, $SD=0.218$). These three areas demonstrate the strongest implementation levels among all environmental practices. Indoor Air Quality Management also shows relatively high adoption ($M=0.700$, $SD=0.168$). In contrast, Local Community Involvement ($M=0.193$, $SD=0.112$) and Environmental Sustainability Governance ($M=0.262$, $SD=0.120$) show the lowest mean scores, suggesting these areas receive less attention in current environmental management practices. Water Resource Management ($M=0.480$, $SD=0.131$), Customer Engagement ($M=0.415$, $SD=0.245$), and Technology Adoption ($M=0.365$, $SD=0.347$) fall in the middle range.

The correlation analysis indicates significant relationships ($p<0.001$) between many of these factors, particularly among the core environmental practices (Energy Saving, Waste Management, and Staff Training). The data also reveals that Local Community Involvement and Technology Adoption show weaker correlations with other factors, suggesting these areas might be managed more independently from other environmental initiatives. This comprehensive analysis suggests that while hotels are strongly focused on operational environmental practices, there remains room for improvement in community engagement and governance aspects of environmental sustainability.

Table 12. Means, standard deviations, and correlations of HESMI dimensions.

		<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7	8	9
1	Environmental Sustainability Governance	0.262	0.120	-	<.001	<.001	<.001	<.001	0.018	<.001	0.200	0.322
2	Staff Training Environmental Sustainability	0.767	0.254	0.000	-	0.003	0.000	0.008	0.064	0.000	0.218	0.174
3	Waste Management	0.729	0.218	0.000	0.003	-	0.000	0.000	0.003	0.000	0.116	0.238
4	Energy Saving & Carbon Emission	0.776	0.248	0.000	0.000	0.000	-	0.000	0.000	0.000	0.408	0.306
5	Water Resource Management	0.480	0.131	0.000	0.008	0.000	0.000	-	0.005	0.000	0.000	0.001
6	Indoor Air Quality Management	0.700	0.168	0.018	0.064	0.003	0.000	0.00	-	0.206	0.330	0.383
7	Customer Engagement	0.415	0.245	0.000	0.000	0.000	0.000	0.00	0.206	-	0.022	0.016

8	Local Community Involvement	0.193	0.112	0.200	0.218	0.116	0.408	0.00	0.330	0.022	-	0.000
9	Technology Adoption	0.365	0.347	0.322	0.174	0.238	0.306	0.001	0.383	0.016	0.00	-

Note: Sig. <.001.

Table 13 presents the cross-tabulation analysis of environmental management practices across different hotel star ratings, revealing several notable patterns in the implementation of various environmental dimensions. In terms of star rating distribution, 4-star hotels show the highest participation rates across multiple dimensions, particularly in Environmental Sustainability Governance (66.7%), Energy Saving & Carbon Emission (62.5%), and Customer Engagement (57.1%). Water Resource Management shows a unique pattern with 5-star hotels (50%) and combined Platinum and Golden Diamond hotels (50%) sharing implementation equally, while notably absent in 4-star properties. Indoor Air Quality Management is more prevalent in higher-rated establishments, with 5-star hotels leading at 40%, followed by an equal distribution (20% each) among 5-star Platinum Diamond, Golden Diamond, and 4-star properties.

The chi-square test results indicate statistically significant differences in three dimensions: Waste Management ($X^2=44.528$, $p=.025$), Customer Engagement ($X^2=16.464$, $p=.0171$), and Technology Adoption ($X^2=35.009$, $p=.004$). This suggests that hotel star ratings significantly influence these environmental practices. Interestingly, 3-star hotels show no participation across all dimensions, indicating a potential gap in environmental management implementation at lower star ratings. The analysis also reveals that higher-rated hotels (5-star categories) generally show more balanced distribution across different environmental dimensions, while 4-star hotels tend to dominate in terms of participation rates in most categories except for Water Resource Management.

Table 13. Cross-tabulation results.

Dimensions	Star rating				
	5-Star Platinum Diamond	5-Star Golden Diamond	5-Star	4-Star	3-Star
Environmental Sustainability Governance X^2 : 26.065(24) =.350	11.1%	2.0%	16.7%	66.7%	0.0%
Staff Training Environmental Sustainability X^2 : 8.920(12) =.710	16.7%	16.7%	16.7%	50.0%	0.0%
Waste Management X^2 : 44.528(28) =.025	16.7%	33.3%	16.7%	33.3%	0.0%
Energy Saving & Carbon Emission X^2 : 17.427(12) =.134	8.3%	8.3%	20.8%	62.5%	0.0%
Water Resource Management X^2 : 31.847(24) =.131	25%	25%	50%	0.0%	0.0%
Indoor Air Quality Management	20%	20%	40%	20%	0.0%

χ^2 : 16.736(16) = .403					
Customer Engagement	4.8%	4.8%	23.8%	57.1%	0.0%
χ^2 : 16.464(12) = .0171					
Local Community Involvement	14.3%	14.3%	28.6%	42.9%	0.0%
χ^2 : 20.002(16) = .220					
Technology Adoption	25%	25%	12.5%	37.5%	0.0%
χ^2 : 35.009(16) = .004					

4.9 The Performance of Participating Hotels

By applying the AHP method, we benchmark the environmental performance of all the participating hotels. The HESMI scores analysis reveals distinct patterns across different hotel star-rating in Hong Kong (see Table 14). Among the 52 participating hotels, 5-star establishments demonstrated the highest environmental performance with a mean score of 60.35, significantly above the overall industry average of 54.60. The 19 participating 5-star hotels showed considerable variation in their environmental management practices, with scores ranging from 39.66 to 89.93, representing the widest performance spread of 50.27 points among all categories. This suggests that while some luxury hotels are leading in environmental initiatives, others have substantial room for improvement.

The 4-star hotel segment, comprising the largest sample with 31 properties, recorded a mean HESMI score of 51.45, slightly below the industry average. These hotels displayed a relatively narrower performance range of 46.42 points, with scores spanning from 19.58 to 66.00. The median score of 59.11 for this category indicates that many 4-star hotels are performing above their category's mean, suggesting a positively skewed distribution. The 3-star hotel category, with only two participating properties, showed the lowest mean score of 40.60. Both hotels in this category recorded identical scores, resulting in a zero range. While this limited sample may not be fully representative of all 3-star hotels in Hong Kong, it suggests that lower-tier hotels may face more challenges in implementing comprehensive environmental management practices. Overall, the industry-wide HESMI scores ranged from 19.58 to 89.93, with a substantial gap of 70.35 points between the best and worst-performing hotels. The overall median score of 59.11 indicates that half of the participating hotels achieved relatively strong environmental performance, though significant variations exist across different star ratings and individual properties.

Table 14. HESMI scores analysis.

	<i>N</i>	<i>Mean</i>	<i>Medium</i>	<i>Range</i>	<i>Max</i>	<i>Min</i>
5-star	19	60.35	59.11	50.27	89.93	39.66
4-star	31	51.45	59.11	46.42	66.00	19.58
3-star	2	40.60	\	0	40.60	40.60

Overall 52 54.60 59.11 70.35 89.93 19.58

Table 15. Overall HESMI ranking of participating hotels.

HESMI ranking	HESMI score	Star rating	Region
1	89.93	5-star	Tsim Sha Tsui
2	82.25	4-star	Other Kowloon
3	82.25	4-star	Central / Western
4	82.25	4-star	Central / Western
5	82.25	5-star	New Territories
6	66.45	5-star	Island
7	66.00	4-star	Other Kowloon
8	65.35	5-star platinum diamond	Tsim Sha Tsui
9	65.27	5-star golden diamond	Tsim Sha Tsui
10	64.95	5-star golden diamond	Central / Western
11	64.43	5-star golden diamond	Tsim Sha Tsui
12	60.55	5-star	Tsim Sha Tsui
13	60.22	5-star	Tsim Sha Tsui
14	59.11	4-star	Eastern / Southern HK
15	59.11	4-star	New Territories
16	59.11	4-star	Tsim Sha Tsui
17	59.11	5-star	Other Kowloon
18	59.11	5-star	Island
19	59.11	4-star	Island
20	59.11	4-star	Other Kowloon
21	59.11	4-star	Other Kowloon
22	59.11	4-star	Other Kowloon
23	59.11	5-star	Island
24	59.11	4-star	New Territories
25	59.11	4-star	New Territories
26	59.11	4-star	Island
27	59.11	4-star	Tsim Sha Tsui
28	54.68	5-star	Other Kowloon
29	53.12	5-star	Central / Western
30	53.06	4-star	Tsim Sha Tsui
31	45.36	5-star platinum diamond	Tsim Sha Tsui
32	45.33	4-star	Island
33	43.17	5-star	Tsim Sha Tsui
34	42.62	5-star	Tsim Sha Tsui
35	42.39	4-star	Tsim Sha Tsui
36	41.88	4-star	New Territories
37	40.60	4-star	Eastern / Southern HK
38	40.60	4-star	New Territories
39	40.60	4-star	Island
40	40.60	4-star	Tsim Sha Tsui
41	40.60	4-star	Tsim Sha Tsui
42	40.60	4-star	Island
43	40.60	4-star	Other Kowloon
44	39.66	5-star	Tsim Sha Tsui
45	38.84	4-star	Island

46	37.32	5-star	Other Kowloon
47	36.55	4-star	Central / Western
48	34.13	4-star	Central / Western
49	31.96	4-star	Tsim Sha Tsui
50	29.33	4-star	Tsim Sha Tsui
51	25.67	3-star	Eastern / Southern HK
52	19.58	3-star	Eastern / Southern HK

5. Policy Implications and Recommendations

This section provides policy implications extracted from the findings. This challenge-led and problem-focused project has generated significant impacts on hotel environmental management from both academic and policy perspectives, particularly addressing the challenges faced by Hong Kong's hospitality sector in pursuing environmental sustainability.

5.1 Policy Implications

5.1.1 Implication of Hong Kong's Climate Action Plan 2050

The development of the HESMI offers several crucial implications for policy development and implementation. First, the HESMI index provides a granular, operation-focused framework for evaluating hotel environmental management practices. Unlike existing sustainability indices such as CHSB, WTTC's toolkit, and SHA's "Pathway to Net Positive Hospitality" which address broader sustainability metrics, HESMI specifically focuses on ground-level operational practices. This enables precise measurement and monitoring of environmental initiatives, moving beyond general sustainability assessments.

Second, the research directly addresses Hong Kong's pressing environmental challenges by helping align hotel industry practices with regional environmental priorities. It provides concrete metrics for tracking progress toward environmental sustainability goals and supports evidence-based policymaking for the hospitality sector. This alignment is crucial for ensuring that industry efforts contribute meaningfully to regional environmental objectives.

Third, in terms of industry implementation, the index addresses the critical gap between environmental initiative adoption and effective implementation. It helps prevent "greenwashing" by establishing clear, measurable criteria and provides practical guidance for hotels to translate environmental policies into operational practices. This practical approach supports hotels in meeting both regulatory requirements and social expectations while maintaining operational efficiency.

Fourth, from a strategic perspective, the index offers policymakers a robust framework for assessing industry-wide environmental performance and identifying areas requiring additional policy support or intervention. It provides a solid foundation for developing appropriate incentives and recognition programs while supporting the development of sector-specific environmental guidelines. This comprehensive approach ensures that policy initiatives are both practical and effective in driving environmental sustainability in the hotel sector.

Therefore, this research thus serves as a crucial bridge between policy objectives and practical implementation in the hotel sector, making a significant contribution to Hong Kong's environmental sustainability goals and the Climate Action Plan 2050. It provides both the tools and insights necessary for effective policy development and implementation in the hospitality sector's environmental management practices. The research makes a substantial contribution to the Hong Kong Climate Action Plan 2050 by providing specific, actionable metrics for the hotel industry's role in achieving carbon neutrality goals. It enables targeted policy interventions based on identified implementation challenges and supports comprehensive monitoring and reporting of the hotel sector's environmental performance. This framework facilitates better alignment between industry practices and policy objectives, ensuring more effective outcomes.

5.1.2 Hong Kong's Tourism Industry Blueprint 2.0

The findings of this research have significant implications for Hong Kong's Tourism Industry Blueprint 2.0, particularly in advancing the territory's eco-tourism initiatives as highlighted in the 2024 Policy Address. The development of the HESMI offers valuable insights and practical frameworks that can strengthen Hong Kong's position as a sustainable tourism destination, aligning with the government's vision for eco-tourism development.

The research findings demonstrate that hotels, as key stakeholders in the tourism industry, play a crucial role in promoting environmental sustainability and eco-tourism. The comprehensive environmental management practices identified through the HESMI can serve as operational guidelines for hotels to enhance their eco-credentials, thereby supporting Hong Kong's broader eco-tourism objectives. This is particularly relevant as tourists increasingly prioritize environmental considerations in their travel decisions, making sustainable hotel practices a crucial component of destination attractiveness.

Furthermore, the index provides a structured approach for hotels to demonstrate their environmental commitment, which can be integrated into Hong Kong's eco-tourism marketing strategy. By implementing the environmental management practices outlined in the HESMI, hotels can contribute to Hong Kong's reputation as an environmentally responsible destination. This will contribute to the development of Tourism Blueprint 2.0, emphasizing developing sustainable tourism products and experiences that appeal to environmentally conscious travelers.

The research also highlights opportunities for creating synergies between hotel environmental practices and eco-tourism initiatives. For instance, hotels' environmental

programs can be linked to local conservation efforts, nature-based tourism activities, and community environmental projects. This integration can enhance the overall eco-tourism experience while promoting environmental awareness among both visitors and local stakeholders. Additionally, the findings suggest that hotels implementing comprehensive environmental management practices can serve as showcases for sustainable tourism, potentially becoming attractions for environmentally conscious tourists.

Moreover, the HESMI framework can support policymakers in developing targeted initiatives to promote eco-tourism through the hotel sector. This includes potential incentive schemes for hotels demonstrating exceptional environmental performance, guidelines for eco-certification programs, and frameworks for industry-wide environmental standards that align with Hong Kong's eco-tourism objectives. These policy tools can help ensure that the hotel sector's environmental practices effectively contribute to Hong Kong's positioning as a leading sustainable tourism destination.

5.2 Recommendations

Based on the research findings, the following key recommendations have emerged for the Hong Kong hotel industry and relevant governmental departments to enhance its environmental management practices and regulations. The sub-sections below present the discussions of recommendations.

5.2.1 Recommendations for the Hong Kong Hotel Industry

Change staff mindset and provide solid staff training - The research reveals a critical need to transform staff mindsets and strengthen environmental training programs within the hotel industry. Through extensive hotel investigations, this project identifies significant challenges in engaging staff in environmental initiatives during their daily work routines. The findings highlight two major barriers to effective environmental management implementation at the staff level: limited environmental awareness and resistance to change. The first challenge stems from insufficient environmental consciousness among hotel employees. Many staff members demonstrate a limited understanding of environmental sustainability, perceiving environmental issues as abstract concepts disconnected from their daily operations. This perception gap significantly hampers the effective implementation of environmental initiatives, as staff fail to recognize the immediate relevance and impact of their actions on environmental outcomes. The second barrier relates to operational resistance, where staff members view

environmental initiatives as burdensome additions to their existing workload rather than integral components of their responsibilities. This perception often leads to reluctance to adopt new environmental practices and can result in inconsistent implementation of environmental policies. The resistance is particularly evident in departments with high operational pressures and tight scheduling constraints.

To address these challenges, hotels need to develop and implement comprehensive training programs that go beyond basic environmental education. These programs should Integrate environmental awareness into core job competencies, Demonstrate the direct connection between individual actions and environmental impacts, provide practical tools and techniques for incorporating environmental practices into daily routines, and Highlight the personal and professional benefits of environmental stewardship. Developing comprehensive training initiatives that not only educate staff about environmental practices but also foster a deeper understanding of sustainability principles. This cultural transformation should extend from front-line employees to senior management, ensuring a consistent commitment to environmental sustainability throughout the organization. This comprehensive approach to environmental training can help bridge the gap between environmental policy and practice, ensuring consistent commitment to sustainability throughout the organization. By addressing both awareness and operational barriers, hotels can create a more engaged and environmentally conscious workforce that views sustainability as an integral part of their professional identity and responsibility.

Improve hotel green governance - Hotel green governance emerges as a fundamental cornerstone for successful environmental management implementation. The research findings emphasize that effective environmental initiatives require robust organizational structures and leadership commitment. Green governance should be embedded in the hotel's strategic framework, with clear environmental objectives, policies, and accountability measures integrated into the corporate strategy. This requires establishing dedicated environmental committees or task forces with representation from various departments and management levels. Senior management must demonstrate visible leadership in environmental initiatives through 1) Allocating adequate resources for environmental programs; 2) Incorporating environmental metrics into performance evaluations; 3) Regular review and updates of environmental policies and targets; 4) Active participation in environmental initiatives and decision-making; 5) Clear communication of environmental priorities and achievements.

Seek collaboration with stakeholders - collaboration with various stakeholders emerges as

another crucial recommendation. The research highlights the critical importance of stakeholder engagement in achieving environmental objectives. Effective environmental management requires a multi-stakeholder approach that leverages diverse expertise, resources, and perspectives. Hotels should actively engage with local communities, the Hong Kong Hotel Association (HKHA), and other industry partners to create synergistic environmental initiatives. This collaborative approach can lead to knowledge sharing, resource optimization, and the development of industry-wide best practices. Furthermore, partnerships with local communities can enhance the effectiveness of environmental programs while contributing to broader social sustainability goals.

Adoption and implementation of green technology - The integration of green technology emerges as a crucial enabler for effective environmental management. The research strongly indicates the need for increased technology adoption in environmental management. Hotels should develop comprehensive technology adoption strategies that align with their environmental objectives and operational needs. Hotels should invest in smart technologies, automated systems, and data analytics tools to monitor and optimize their environmental performance. This includes implementing energy management systems, waste-tracking solutions, and water conservation technologies. Such technological integration can improve operational efficiency while providing valuable data for environmental decision-making. Key areas for technology implementation can be considered: 1) Building Management Systems (BMS) for optimal energy efficiency; 2) Smart room management systems integrating occupancy sensors; 3) Advanced waste management and recycling technologies; 4) Water conservation and monitoring systems; 5) Real-time energy consumption monitoring and analytics; 6) Digital platforms for environmental data collection and analysis; 7) Automated environmental reporting systems; 8) IoT solutions for equipment maintenance and optimization.

Standardize environmental management initiatives - The standardization of environmental management practices through HESMI integration into SOPs is essential for ensuring consistent and measurable environmental performance. This integration would provide a structured framework for implementing and maintaining environmental management practices, ensuring consistency and measurability of environmental initiatives across operations.

5.2.2 Recommendations for Relevant Governmental Departments

Environmental Protection Department: Developing a blueprint for hotel environment sustainability based on the HESMI indicators.

The Environmental Protection Department (EPD) should take a leading role in developing a comprehensive blueprint for hotel environmental sustainability based on the HESMI indicators. This blueprint should establish clear guidelines, targets, and timelines for the hotel industry's environmental performance. The EPD should also consider implementing a certification or recognition system based on these indicators to encourage continuous improvement in environmental management practices.

HKTB Marketing: Promoting and branding the pro-environmental culture of the Hong Kong hotel industry among cross-border tourists.

The Hong Kong Tourism Board (HKTB) should leverage the growing environmental consciousness of international travelers by promoting Hong Kong's pro-environmental hotel culture. Marketing strategies should highlight the industry's commitment to sustainability and showcase innovative environmental practices implemented by local hotels. This approach can enhance Hong Kong's reputation as a sustainable tourism destination while attracting environmentally conscious visitors.

Hong Kong Government: Provide financial support for small-medium hotels to implement environment management.

Financial support mechanisms should be established to assist small and medium-sized hotels in implementing environmental management practices. This could include grants, subsidies, or low-interest loans for environmental upgrades and technology adoption. The government should consider developing a dedicated fund for hotel environmental initiatives, particularly focusing on properties that may face resource constraints in implementing comprehensive environmental management systems.

Cross-departmental coordination.

Additionally, cross-departmental coordination should be strengthened to ensure policy coherence and effective implementation of environmental initiatives. This could involve creating a task force comprising representatives from relevant government departments, industry associations, and environmental experts to oversee and coordinate hotel environmental management efforts.

These recommendations, when implemented cohesively, can significantly advance the

environmental sustainability of Hong Kong's hotel industry while contributing to the territory's broader environmental objectives and maintaining its competitive position in the global tourism market.

6. Details of the Public Dissemination

The research outcomes and methodological framework for developing HESMI have been systematically disseminated through multiple scholarly and public engagement channels. The academic dissemination encompasses a range of research outputs, including peer-reviewed publications, conference proceedings, and academic presentations, as documented in Table 16. Additionally, to facilitate knowledge transfer to industry practitioners and the broader community, the findings have been communicated through various public channels, detailed in Table 17. This dual-track dissemination approach ensures both scholarly rigor and practical applicability, contributing to the broader discourse on hotel environmental sustainability measurement and implementation.

6.1 Research Outputs

Table 16. Research outputs.

No.	Output type	Title	Publish Date
1	Journal Article	Wang, D., Yang, M., & Deng, Z. (2024). Pathway to Environment Management in Hotel Industry: A Stakeholder Engagement Framework. <i>Journal of China Tourism Research</i> , 1-21.	04/07/2024
2	Journal Article	Wang, D., Deng, Z., & Lo, W. H. (2024). A toolkit for hotel environment management capability development. <i>Journal of Travel & Tourism Marketing</i> , 41(7), 1005-1019.	01/07/2024
3	Peer Reviewed Conference Paper	Wang, D., Deng, Z., Chon, K., & Lo, W. H. (2024, February). Developing a Hotel Environmental Sustainability Management Index (HESMI) for hotels in Hong Kong: An action research. In <i>CAUTHE 2024 Conference Proceedings: Diverse Voices: Creating Change in Tourism, Hospitality and Events</i> (pp. 327-327). Hobart: Council for Australian University Tourism and Hospitality Education.	11/02/2024
4	Peer Reviewed Conference Paper	Developing A Hotel Environmental Sustainability Management Index (HESMI) For Hotels in Hong Kong: An Action Research	07/12/2023

6.2 Publish Dissemination

Table 17. Public dissemination.

No.	Name	Type	Date	Host & Location	Presentation Type
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1.	IMPACT2023	Academic and Industry conference	07/12/2023	School of Hotel and Tourism Management, The Hong Kong Polytechnic University, Hong Kong SAR.	Oral presentation
2.	The 34th Annual Council for Australasian Tourism and Hospitality Education (CAUTHE) Conference	Academic conference	11/02/2024	The University of Tasmania, Hobart, Australia.	Oral presentation
3.	Business Sustainability Conference 2024	Academic and Industry conference	08/11/2024	Business School, Chinese University Hong Kong, Hong Kong SAR.	Oral presentation
4.	China Hotel Association	Industry conference	28/11/2024	China Hospitality Industry Brand Development Conference, Hainan, China.	Oral presentation

Note: the CUHK conference served as a strategic venue to engage a diverse and influential audience of nearly 100 attendees across business industries, including policymakers, sustainability experts, and hotel industry professionals. We also invited our participating hotels to join the conference and share our findings with them. The event's structure included oral presentations, a recognition ceremony, and interactive demonstrations of the HESMI platform, enabling direct hands-on engagement with stakeholders. During these sessions, we facilitated live walkthroughs of the platform's functionalities and gathered actionable feedback from hotel industry representatives. The conference served as a critical step in generating interest and establishing connections.

6.3 Established a HESMI Website

We also developed a website for data collection and dataset accumulation. The platform also functions as a crucial dissemination channel for the HESMI framework, extending its impact across the hotel industry. Furthermore, the website facilitates broader stakeholder engagement by providing transparent access to aggregated environmental performance data, research findings, and industry insights. This transparency helps build credibility for the hotel industry's environmental efforts while encouraging continuous improvement and innovation in environmental management practices. Looking ahead, the website's role will expand to include interactive features such as real-time performance dashboards, automated reporting tools, and community forums, further enhancing its value as a central resource for advancing hotel environmental sustainability in Hong Kong and potentially serving as a model for other regions.

6.4 Developing Collaboration with The China Hospitality Association

To facilitate broader industry adoption of the HESMI, we established a strategic collaboration with the China Hospitality Association (CHA). This partnership enables direct engagement with over 5,000 member hotels across China, providing a robust platform for disseminating the HESMI framework. Through CHA's established network, we aim to conduct regular workshops and training sessions to guide hotel practitioners in implementing the index. The collaboration also facilitates data collection for continuous refinement of the HESMI metrics, ensuring their practical relevance and applicability. This industry-academic partnership represents a crucial bridge between theoretical development and practical implementation, accelerating the adoption of standardized ESG practices across China's hotel sector.

7. Conclusion

This research project has made significant contributions to advancing environmental sustainability in Hong Kong's hotel industry through the development and implementation of the HESMI. The comprehensive study, conducted across multiple phases, has generated valuable insights into the current state of hotel environmental management practices while providing a structured framework for future development.

The HESMI framework represents a pioneering effort to create a standardized, industry-specific tool for measuring and promoting environmental management practices in hotels. By incorporating input from industry experts, academic researchers, and practitioners, the index provides a robust and practical framework that bridges the gap between theoretical understanding and operational implementation of environmental management practices. The research has identified critical success factors, barriers, and opportunities in hotel environmental management, contributing both to academic knowledge and practical applications in the field.

A key strength of this research lies in its methodological rigor, combining qualitative and quantitative approaches to ensure comprehensive coverage of environmental management dimensions. The application of the AHP in determining relative weights of different environmental management aspects has provided a scientific basis for index calculation, enhancing the reliability and validity of the HESMI framework. The establishment of the HESMI digital platform further extends the impact of this research by creating a sustainable mechanism for ongoing data collection, analysis, and knowledge sharing within the industry.

The research findings have significant implications for various stakeholders in Hong Kong's hospitality sector. For hotel operators, HESMI provides a practical tool for assessing and improving their environmental management practices. For policymakers, the research offers evidence-based insights for developing environmental regulations and support mechanisms. For industry associations, the framework facilitates standardization and promotion of best practices in environmental management.

Looking forward, this research lays a strong foundation for future developments in hotel environmental management. The HESMI framework's flexibility allows for adaptation to evolving environmental challenges and emerging sustainability priorities. The established digital platform provides opportunities for longitudinal studies and continuous improvement in industry practices. Furthermore, the framework's potential applicability extends beyond Hong Kong, offering possibilities for regional and international adoption with appropriate

modifications.

However, the success of HESMI in driving environmental sustainability depends on continued commitment from all stakeholders. Regular updates to the index, ongoing data collection and analysis, and active stakeholder engagement will be crucial for maintaining its relevance and effectiveness. The recommendations provided in this research offer a roadmap for stakeholders to advance their environmental management practices and contribute to Hong Kong's broader sustainability objectives.

In conclusion, this research project has delivered not only a practical tool for measuring and improving hotel environmental management but also a comprehensive framework for advancing sustainability in Hong Kong's hospitality sector. The HESMI framework, supported by its digital platform and stakeholder network, represents a significant step forward in promoting environmental sustainability in the hotel industry, contributing to Hong Kong's vision of becoming a leading sustainable tourism destination.

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Supporting Documents

This section presents a comprehensive compilation of supporting documents that substantiate the findings and methodological rigor of this research project.

Appendix 1: semi-structured Interview Protocols

Interview Protocol (For hotel senior managers)

Aspect	Interview Questions
Hotel operations	● Please share with us your current practices related to environmental sustainability. <i>Note: Probing questions are related to sustainability program participation, building design, technology adoption, service design, supplier management, energy management, and waste management.</i>
Governance	● How do you manage the sustainability practices in your hotel? <i>Note: Probing questions on the governance structure, incentive mechanisms, review, and evaluation processes.</i>
	● How do you communicate with staff, customers, and the public about your sustainability goals, efforts, and expectations?
Vision	● In your view, how can the hotels in Hong Kong collectively contribute to the 2030 carbon neutrality goal?

Interview Protocol (For hotel guests)

Aspect	Interview Questions
Hotel choice	● When selecting this hotel for your stay, did environmental sustainability play a role in your decision-making process? ● How important is a hotel's commitment to environmental sustainability when you make future booking decisions?
Guest experience	● During your stay, have you noticed or experienced any environmental sustainability initiatives implemented by the hotel? ● If you've observed any environmental initiatives, how do you perceive them? ● In what ways, if any, have these environmental initiatives positively or negatively influenced your overall hotel experience? ● How effectively do you think the hotel staff incorporates environmental guidance into their service? ● Are there any additional environmental initiatives you'd like to see implemented in this hotel?
Service	● How do you think the staff service in this hotel? Any environmental guidance?

Interview Protocol (For other hotel stakeholders)

Aspect	Interview Questions
Connection with the hotel	● Have you ever stayed at or visited this hotel? ● Are you aware of any environmental initiatives implemented

	by this hotel? If so, could you describe them? ● How well do you think the hotel's environmental initiatives align with local regulations, particularly regarding issues like plastic waste management?
Environmental impacts to the local community	● In your opinion, what positive or negative environmental impacts does this hotel have on the local community? ● What role do you believe this hotel should play in promoting environmental sustainability within the local community? ● How effectively do you think the hotel communicates its environmental initiatives to local residents? ● Are there any specific environmental concerns in our community that you think the hotel should address?
Social responsibility	● How do you think the hotel's environmental practices compare to other businesses in the area? ● In what ways could the hotel better engage with local residents on environmental issues?

Appendix 2: Information Sheet (English and Traditional Chinese Version)



INFORMATION SHEET

Developing a Hotel Environmental Sustainability Management Index (HESMI) for Hotels in Hong Kong

You are invited to participate on a study conducted by Dr. Dan Wang, who is an Associate Professor of the School of Hotel and Tourism Management in The Hong Kong Polytechnic University. The project has been approved by the Human Subjects Ethics Sub-committee (HSESC) (or its Delegate) of The Hong Kong Polytechnic University (HSESC Reference Number: HSEARS20221115002).

The proposed research aims to develop a Hotel Environmental Sustainability Management Index (HESMI) for benchmarking hotels in Hong Kong. To achieve this aim, this study seeks to: 1) identify indicators of environmental sustainability management in hotels through literature review and interviews with experts; 2) evaluate the environmental sustainability management practices in different hotels groups in Hong Kong by conducting on-site evaluations; 3) benchmark the environmental sustainability management of hotels in Hong Kong by developing a hotel environmental sustainability management index (HESMI), and publish HESMI annually with the Hong Kong Hotel Association (HKHA); 4) provide a self-evaluation tool that hotels can use to monitor and plan their pathway to carbon neutrality; 5) provide a historical data asset of hotel environmental sustainability management in the long run and provide policy implications in short-term and long-term.

The study will need your contribution to share with us how you routinely implement hotel's environmental sustainability management, and your perceptions/feelings toward the current practices in the interview. The interview will take about 1 hour. Also, we will ask you to fill a survey to self-evaluate the hotel's environmental performance. The whole exercise will take about 20 to 30 minutes. The organization name and interviewee's identity will be hidden in the report and the quotations in the report will be anonymous.

The participation should not result in any undue discomfort. All information related to you will remain confidential, and will be identifiable by codes only known to the researcher. You have every right to withdrawn from the study before or during the process without penalty of any kind. If you would like to get more information about this study, please contact Dr. Dan Wang on tel. no. (852)34002282; mailing address (17 Science Museum Road, Hong Kong) and email address: d.wang@polyu.edu.hk. If you have any complaints about the conduct of this research study, please do not hesitate to contact Miss Cherrie Mok, Secretary of the Human Subjects Ethics Sub-Committee of The Hong Kong Polytechnic University in writing (c/o Research Office of the University) stating clearly the responsible person and department of this study. Thank you for your interest in participating in this study.

Dr. Dan Wang
Principal Investigator/Chief Investigator

研究課題說明

構建香港酒店業環境可持續發展管理指標

您被诚挚的邀请参与由香港理工大学酒店及旅游管理学院的王丹博士开展的一项研究课题。该课题已得到香港理工大学人类课题伦理小组委员会（HSESC）批准（参考编号：HSEARS20221115002）。

擬議的研究旨在制定酒店環境可持續發展管理指數（HESMI）作為香港酒店的基準。為實現這一研究目標，本研究將：1) 通過文獻回顧和專家訪談確定酒店環境可持續發展管理指標；2) 以實地評估的方法來評測香港不同酒店集團的可持續發展管理實踐；3) 通過制定酒店環境可持續發展管理指數來評估香港酒店的環境可持續發展表現，並通過與香港酒店業協會合作，與每年發佈HESMI指標；4) 為香港酒店業提供環境可持續發展自我評估工具，以用來監測和規劃實現碳中和的目標；5) 為酒店環境可持續發展管理提供歷史數據，以提供短期和長期的政策啟示。

該研究需要您在訪談中與我們分享您日常工作中如何實施酒店環境可持續發展管理，以及您對當前實踐的環境措施的看法和感受。訪談的時間大約需要 1 小時。此外，我們需要您填寫一份調差問卷來自我評估酒店目前的環境可持續發展管理表現。問卷的時間大約需要 20 至 30 分鐘。數據將被保密。報告中的引用將是匿名的。參與該研究將不會導致任何不適。所有與您相關的信息將被嚴格保密，且僅能被研究人員識別。您擁有在研究之前與研究過程隨時退出的一切權利。整個研究過程持續大概 1-1.5 小時。

如果您想獲得關於這項研究的更多信息，請聯系王丹博士，電話：(852)34002282；地址：香港科學館道 17 號；電子郵箱：d.wang@polyu.edu.hk。

如果您有關於這項研究的進行投訴，請聯系香港理工大學人類課題倫理小組委員會的秘書 Cherrie Mok 女士，以書面形式明確說明這項研究的負責人及部門。感謝您對參與這項研究的興趣。

王丹博士
首席研究員

Appendix 3: Consent Form



CONSENT TO PARTICIPATE IN RESEARCH

Developing a Hotel Environmental Sustainability Management Index (HESMI) for Hotels in Hong Kong

I _____ hereby consent to participate in the captioned research conducted by __Dr. Dan Wang_____.

I understand that information obtained from this research may be used in future research and published. However, my right to privacy will be retained, i.e. my personal details will not be revealed.

The procedure as set out in the attached information sheet has been fully explained. I understand the benefit and risks involved. My participation in the project is voluntary.

I acknowledge that I have the right to question any part of the procedure and can withdraw at any time without penalty of any kind.

Name of participant:

Signature of participant:

Name of researcher:

Signature of
researcher:

Appendix 4: Hotel On-site Visits

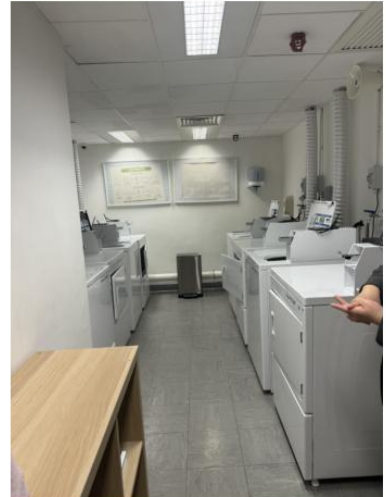




Waste oil management



Food waste management-kitchen



Waster resource management - laundry



Energy management-1



Guest room energy management



Food waste management-
Buffet



Non-plastic bottle water-guest
room

Appendix 5: Expert's Evaluation Questionnaire

Criterion	Explanation with an example
1. Managerial Governance	The policies and procedures that guide the decision-making and oversight of a hotel's ESG management, i.e., having an official management structure for ESG strategies.
2. Staff Training	Providing employees with the knowledge and skills necessary to perform environmental sustainability practices, i.e., organizing staff training programs on lighting controls.
3. Waste Management	Control of the generation, collection, separation, recycling, treatment, and disposal of waste materials, i.e., donating food to charitable organizations.
4. Indoor air quality management	Monitor, maintain, and enhance the quality of indoor air within the workplace, i.e., installing sensors to monitor air quality.
5. Energy saving	Reduce energy consumption, enhance energy efficiency, and encourage the use of renewable energy sources, i.e., offer new energy vehicle services to guests.
6. Water resource management	Efficiently and sustainably manage the water usage, conserve, and protect water resources, i.e., measure water consumption from different sections of the hotels.
7. Customer engagement	Foster meaningful interactions, communication, and relationships with guests on sustainability practices, i.e., offer low-carbon diet choices to customers.
8. Community involvement	Efforts to engage with and contribute to local communities, i.e., sponsor environmental programs organized by the local community.
9. Technology adoption	Integrate innovative technologies and digital solutions to enhance hotels' sustainability and competitiveness, i.e., implement paperless check-in/out.

Please follow the instructions below to complete the pairwise comparisons:

1. Comparison scale:

You will use a scale from 1 to 9 to make your comparisons.

Scale point	Definition
1	Equally important
3	Moderately important
5	Strongly important
7	Very strongly important
9	Extremely important
2,4,6,8	Intermediate values

2. Making comparisons:

You will be presented with a series of pairwise comparison questions. For each pair, decide which of the two criteria is more important in hotels and, then by how much.

For instance, if “managerial governance” is moderately more important than “water resource management”, select “managerial governance” first, then select scale 2. The response should

look like:

	Which criterion is more important?		Equal	How much more?							
			1	2	3	4	5	6	7	8	9
1.	Managerial governance ☒	Water resource management ☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

3. Consistency

Try to be consistent in your evaluations. If you rate one criterion as moderately more important than another in one comparison, ensure that this judgment is reflected in all relevant comparisons.

This research has been approved by the Human Subjects Ethics Sub-committee (HSESC) of The Hong Kong Polytechnic University (HSESC Reference Number: HSEARS20221115002).

If you would like to get more information about this study, please contact Dr. Dan Wang at 852-34002282 or by email (d.wang@polyu.edu.hk). Thank you for your interest in participating in this study.

Dr. Dan Wang

Associate Professor

Associate Director of Research Center of Digital Transformation of Tourism

School of Hotel & Tourism Management

The Hong Kong Polytechnic University

Comparing the environmental management practices in hotels, which criterion is more important, and by how much more on a scale from 1 to 9?

	Which criterion is more important?		Equal	How much more?							
			1	2	3	4	5	6	7	8	9
1.	Managerial Governance ☐	Staff Training ☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
2.	Managerial Governance ☐	Waste Management ☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
3.	Managerial Governance ☐	Indoor Air Quality Management ☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
4.	Managerial Governance ☐	Energy Saving ☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
5.	Managerial Governance ☐	Water Resource Management ☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
6.	Managerial Governance ☐	Customer Engagement ☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
7.	Managerial Governance ☐	Community Involvement ☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
8.	Managerial Governance ☐	Technology Adoption ☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
9.	Staff Training ☐	Waste Management ☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
10.	Staff Training ☐	Indoor Air Quality Management ☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
11.	Staff Training ☐	Energy Saving ☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
12.	Staff Training ☐	Water Resource Management ☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
13.	Staff Training ☐	Customer Engagement ☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
14.	Staff Training ☐	Community Involvement ☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
15.	Staff Training ☐	Technology Adoption ☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

	Which criterion is more important?		Equal	How much more?								
			1	2	3	4	5	6	7	8	9	
		☐										
16.	Waste Management ☐	Indoor Air Quality Management	☐	☐	☐	☐	☐	☐	☐	☐	☐	
17.	Waste Management ☐	Energy Saving ☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
18.	Waste Management ☐	Water Resource Management	☐	☐	☐	☐	☐	☐	☐	☐	☐	
19.	Waste Management ☐	Customer Engagement ☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
20.	Waste Management ☐	Community Involvement ☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
21.	Waste Management ☐	Technology Adoption ☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
22.	Indoor Air Quality Management ☐	Energy Saving ☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
23.	Indoor Air Quality Management ☐	Water Resource Management ☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
24.	Indoor Air Quality Management ☐	Customer Engagement ☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
25.	Indoor Air Quality Management ☐	Community Involvement ☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
26.	Indoor Air Quality Management ☐	Technology Adoption ☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
27.	Energy Saving ☐	Water Resource Management	☐	☐	☐	☐	☐	☐	☐	☐	☐	
28.	Energy Saving ☐	Customer Engagement ☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
29.	Energy Saving ☐	Community Involvement ☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	

	Which criterion is more important?		Equal	How much more?							
			1	2	3	4	5	6	7	8	9
30.	Energy Saving ☐	Technology Adoption ☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
31.	Water Resource Management ☐	Customer Engagement ☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
32.	Water Resource Management ☐	Community Involvement ☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
33.	Water Resource Management ☐	Technology Adoption ☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
34.	Customer Engagement ☐	Community Involvement ☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
35.	Customer Engagement ☐	Technology Adoption ☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
36.	Community Involvement ☐	Technology Adoption ☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Appendix 6: HEMSI Questionnaire

HESMI Questionnaire - English Version

Section 1: Hotel Information

- ☐ Hotel name in English _____
- ☐ Hotel name in Chinese _____
- ☐ Hotel address _____
- ☐ Inception year of the hotel _____
- ☐ Number of guestrooms _____

Section 2: Hotel ESG Practices

2.1 ESG Governance

2.1.1. Does your hotel have an official management structure for ESG strategies and action planning?

- ☐ Yes (please go to the next question)
- ☐ No (please go to question 2.1.4)

Skip To: QID4 If 2.1.1. Does your hotel have an official management structure for ESG strategies and action planning? = No (please go to question 2.1.4)

2.1.2. Please specify which of the following management personnel are included in the hotel sustainability committee? (please select all that apply)

- ☐ General Manager
- ☐ Front Office Manager
- ☐ Food & Beverage Manager
- ☐ Manager of Engineering
- ☐ Manager of Housekeeping
- ☐ Manager of Finance
- ☐ Manager of Sales
- ☐ Manager of Marketing
- ☐ Sustainability Manager
- ☐ Manager of Procurement
- ☐ Manager of People and Culture
- ☐ Executive Chief
- ☐ Others (please specify) _____

2.1.3. How often does the hotel sustainability committee hold meetings? (please select only one)

- ☐ Weekly
- ☐ Monthly
- ☐ Quarterly
- ☐ Semi-annually
- ☐ Annually
- ☐ Other time frequency (please specify)

2.1.4. Does your hotel have key performance indicators for improving the following aspects? (please select all that apply)

- ☐ Energy consumption
- ☐ Water consumption
- ☐ Waste management
- ☐ Green procurement
- ☐ Participate in sustainability-related partners/programs
- ☐ Greenhouse Gas Emission
- ☐ Staff training on hotel environmental sustainability issues
- ☐ Others (please specify) _____
- ☐ ☒ No specific key performance indicators have been established

2.1.5. Does your hotel publish an annual report for ESG practices?

- ☐ Yes, published by the hotel management company
- ☐ Yes, published by the hotel owner
- ☐ No (please go to question 2.1.7)

Skip To: QID7 If 2.1.5. Does your hotel publish an annual report for ESG practices? = No (please go to question 2.1.7)

2.1.6. Does your hotel's ESG report undergo third-party auditing?

- ☐ Yes
- ☐ No

2.1.7. Has your hotel been awarded or is in the process of applying for any sustainability certifications? (please select all that apply)

- ☐ BEAM+
- ☐ LEED
- ☐ Green Building Evaluation Label (China Three Star)
- ☐ EarthCheck Certification
- ☐ Global Sustainable Tourism Council (GSTC)
- ☐ Multi Hazard and Climate Change Certification
- ☐ Green Key
- ☐ ISO 14001
- ☐ Others (please specify) _____
- ☐ ☒ None

2.2 ESG Related Staff Training

2.2.1. Does your hotel organize staff training programs on environmental sustainability practices (e.g., HVAC systems, lighting controls, water conservation, and waste management, etc.)?

- ☐ Yes (please go to the next question)
- ☐ No (please go to question 2.2.4)

Skip To: If 2.2.1. Does your hotel organize staff training programs on environmental sustainability practices... = No (please go to question 2.2.4)

2.2.2. How often is environmental sustainability-related staff training organized? (please select only one)

- ☐ Weekly
- ☐ Monthly
- ☐ Quarterly
- ☐ Semi-annually
- ☐ Annually
- ☐ Other time frequency (please specify) _____

2.2.3. What topics have been covered in staff training? (please select all that apply)

- ☐ Waste categorization/recycling
- ☐ Water consumption control
- ☐ Energy saving
- ☐ Workshop on improving environmental awareness
- ☐ Communication skills on environmental sustainability
- ☐ Others (please specify) _____

2.2.4. Does your hotel use the following encouragements to motivate staff to participate in online courses related to environmental sustainability? (please select all that apply)

- ☐ Financial incentives
- ☐ Non-financial incentives
- ☐ Others (please specify) _____
- ☐ ☒ None

2.2.5. Does your hotel have a feedback channel for frontline and management staff to provide suggestions and comments on the current environmental sustainability practices?

☐ Yes

☐ No

2.3 Waste ManagementFood Waste Management

2.3.1. Does your hotel implement the following food waste management measures?

	Yes	No
Categorize different types of food waste, such as meat, fish, fruits, vegetables, grains, residues, and other expired or cooked leftovers.	☐	☐
Conduct food inventory evaluation exercise to avoid the possibilities of over-ordering and loss of perishable food materials.	☐	☐
Adjust portion size in served restaurants based on customer consumption behaviors to reduce food waste.	☐	☐
Donate food surplus to local charitable organizations (e.g., Feeding HK, Food Angel, etc.).	☐	☐
Recycle waste cooking oil.	☐	☐
Encourage customers to minimize food waste in served restaurants by posters or signage.	☐	☐

2.3.2. Does your hotel engage a third party to conduct food waste management auditing?

☐ Yes (please specify the third party)

☐ No

Solid Waste Management

2.3.3. Has your hotel banned the following single-use plastics products in your premise? (please select all that apply)

☐ Plastic bottled water

☐ Plastic bags

☐ Plastic amenities

☐ Plastic cutlery (e.g., plastic cups, plates, straws, food containers, etc.)

☐ Plastic laundry bags

☐ Plastic slippers

☐ Others (please specify) _____

☐ ☒ None

2.3.4. Which of the following products does your hotel recycle? (please select all that apply)

- ☐ Paper products (paper, tissues, cardboards)
- ☐ Metal products (aluminium cans, tins)
- ☐ Glass products (glass bottles)
- ☐ Coffee capsule
- ☐ Linen products
- ☐ Others (please specify) _____
- ☐ ☒ None

2.3.5. Does your hotel use staff uniforms made from more environmentally friendly materials?

- ☐ Yes
- ☐ No

2.3.6. Does your hotel donate used items to non-government organizations or charitable organizations for reusing/recycling/up-cycling (e.g. furniture, bed linens, uniforms, etc.)?

- ☐ Yes (please specify the organizations)

- ☐ No

Amenity Waste & Recycling

2.3.7. Does your hotel take the following amenity waste & recycling measures?

	Yes	No
Use bathroom amenities that made from sustainable materials (e.g., bamboo made amenities).	☐	☐
Install in-shower dispensers for shampoo, conditioner, body and hand wash, to replace individual bathroom amenities in guestrooms.	☐	☐
Recycle bathroom amenities (e.g., soap).	☐	☐

2.4 Carbon Emission and Energy Management

2.4.1. Does your hotel implement the following energy saving measures?

	Yes	No
Set measurable annual energy-saving goal and integrate it as an KPI.	☐	☐
Install and optimize HVAC system to optimize energy usage.	☐	☐
Install thermostats and sensors in guest rooms for precise temperature control to optimize energy usage.	☐	☐
Control the duration of external lighting (e.g., exterior spot lights, outdoor electric display panels) during nighttime.	☐	☐
Offer new energy vehicle services to guests.	☐	☐
Differentiate and measure the energy consumption from different sections of the hotels (e.g., kitchens, laundry rooms, guestrooms, etc.).	☐	☐

2.4.2. Has your hotel installed LED lighting in the following areas? (please select all that apply)

- ☐ Hotel lobby
- ☐ Guestrooms
- ☐ Restaurants
- ☐ Kitchens
- ☐ Back-offices
- ☐ Other areas (please specify) _____
- ☐ ☒ No LED lighting has been installed in any area

2.4.3. Which renewable energy does your hotel use to reduce energy consumption and lower carbon emission? (please select all that apply)

- ☐ Solar energy
- ☐ Combined heating and power (CHP)
- ☐ Geothermal energy
- ☐ Bio fuels
- ☐ Wind energy
- ☐ Other renewable energy (please specify) _____
- ☐ ☒ None

2.4.4. Does your hotel inspect energy consumption? How often? (please select only one)

- ☐ Daily
 - ☐ Weekly
 - ☐ Monthly
 - ☐ Quarterly
 - ☐ Semi-annually
 - ☐ Annually
 - ☐ Other time frequency (please specify)
-
- ☐ No, we do not measure energy consumption at the moment

2.4.5. Does your hotel inspect electricity consumption? How often? (please select only one)

- ☐ Daily
 - ☐ Weekly
 - ☐ Monthly
 - ☐ Quarterly
 - ☐ Semi-annually
 - ☐ Annually
 - ☐ Other time frequency (please specify)
-
- ☐ No, we do not measure electricity consumption at the moment

2.5 Water Resource Management

2.5.1. Has your hotel adopted any sustainability practices for improving water resources management? (please select all that apply)

- ☐ Yes - Bathroom (e.g. water-saving tap, dual flush toilet)
- ☐ Yes - Laundry (e.g. run washing machine under full capacity)
- ☐ Yes - Towels and linens reuse (e.g. only change upon request)
- ☐ Yes - Water auditing (e.g., check the water meter to avoid leakage)
- ☐ Yes - Water recycling (e.g., reuse rainwater)
- ☐ Yes - Use of seawater (e.g., desalinate for swimming pool)
- ☐ Yes – Swimming pools management (e.g., cover up the swimming pool when they are not in service)
- ☐ Others (please specify) _____
- ☐ ☒ None

2.5.2. Does your hotel measure water consumption? How often? (please select only one)

- ☐ Daily
- ☐ Weekly
- ☐ Monthly
- ☐ Quarterly
- ☐ Semi-annually
- ☐ Annually
- ☐ Other time frequency (please specify) _____
- ☐ No, we do not measure water consumption at the moment

2.5.3. Is your hotel able to differentiate and measure the water consumption from different sections of the hotels (e.g., kitchens, laundry rooms, swimming pool, etc.)?

☐ Yes

☐ No

2.6 Indoor Air Quality Management

2.6.1. Does your hotel implement the following indoor air quality management measures?

	Yes	No
Install sensors to monitor key indicators – such as volatile organic compounds (VOCs) to ensure indoor air quality.	☐	☐
Place high-efficiency particulate air (HEPA) purifiers in high-traffic areas (e.g., hotel lobby) to maintain indoor air quality.	☐	☐
Locate photocopiers and laser printers in ventilated areas.	☐	☐
Cultivate plants in suitable areas and choose suitable species to suit the hotel environment and local weather.	☐	☐

2.6.2. Does your hotel conduct indoor air quality assessment?

☐ Yes, conducted by the hotel

☐ Yes, conducted by a third party (please specify)

☐ No

2.7 Customer Engagement

2.7.1. What types of environmental programs/activities has your hotel organized to actively engage customers in 2023? (please select all that apply)

- ☐ Reducing food waste
 - ☐ Energy saving
 - ☐ Water saving
 - ☐ Reducing plastic waste
 - ☐ Reducing bathroom amenities
 - ☐ Other programs/activities (please specify)
-

☐ ☒ None

2.7.2. Does your hotel promote environmental sustainability practices on its official social media accounts? (please select all that apply)

- ☐ Yes - Facebook
 - ☐ Yes - LinkedIn
 - ☐ Yes - Instagram
 - ☐ Yes - Douyin/TikTok
 - ☐ Yes - RED
 - ☐ Yes - Weibo
 - ☐ Other platforms (please specify)
-

☐ ☒ No

2.7.3. How does your hotel collect customers' feedback on its current environmental sustainability

practices? (please select all that apply)

- ☐ Social media platform
- ☐ Customer survey by email
- ☐ Customer survey by smart phone SMS
- ☐ Others (please specify) _____
- ☐ ☒ No, we do not collect customers' feedback at the moment

2.7.4. Does your hotel implement the following measures to engage customers in environmental practices?

	Yes	No
Offer low carbon diet choices to customers.	☐	☐
Encourage customers to reduce the number of times they change towels and bed sheets.	☐	☐
Place recycling bins in guestrooms to encourage customers to sort waste.	☐	☐
Place no smoking signs in public areas to remind guests that the premises are statutory.	☐	☐
Offer financial incentives (e.g. discounts/points/vouchers, etc.).	☐	☐
Offer non-financial incentives (e.g., loyalty program reward points).	☐	☐

2.8 Local Community Involvement

2.8.1. Does your hotel participate in and sponsor environmental programs organized by the local community? (please select all that apply)

- ☐ The Hong Kong Flower Show
- ☐ Greening Hong Kong Activities Subsidy Scheme
- ☐ Green Volunteer Scheme
- ☐ Community Planting Day
- ☐ Community Garden Programme
- ☐ Best Landscape Award for Private Property Development
- ☐ Blossoms Around Town
- ☐ Green Council
- ☐ Other programs (please specify)

- ☐ ☒ No

2.8.2. Does your hotel participate in environmental programs developed by the HK government?
(please select all that apply)

- ☐ Carbon Neutrality Publicity Campaign
 - ☐ Hong Kong Awards for Environmental Excellence
 - ☐ Hong Kong Green Organization Certification
 - ☐ Green Link - Environmental Education Support Programme
 - ☐ Green Perfect Programme
 - ☐ Waste Separation and Recycling Scheme in Schools
 - ☐ Promotion Programmes on Source Separation of Waste
 - ☐ Other programs (please specify)
-

☐ ☒ No

2.8.3. Does your hotel collaborate with local non-government organizations/green groups listed below to promote hotel's environmental sustainability initiatives? (please select all that apply)

- ☐ Environmental Association
 - ☐ Friends of the Earth (HK)
 - ☐ Green Council
 - ☐ Green Peace
 - ☐ The Green Earth
 - ☐ Other organizations/groups (please specify)
-

☐ ☒ No

2.9 Green Technology Adoption

2.9.1. Has your hotel implemented paperless check-in/out?

- ☐ Yes
- ☐ No

2.9.2. Has your hotel installed contactless payment software that enable customers to obtain digital authorization to process payment?

- ☐ Yes
- ☐ No

2.9.3. Has your hotel installed smart Energy Management System (EMS) (e.g., evergreen, Facilio, etc.) to monitor energy consumption?

- ☐ Yes (please specify the system)
-

☐ No

2.9.4. Does your hotel implement ORCA alike technology that can turn food waste into water?

- ☐ Yes
- ☐ No

HESMI Questionnaire - Traditional Chinese Version

第1部分：酒店資訊

- ☐ 酒店英文名稱： _____
- ☐ 酒店中文名稱： _____
- ☐ 酒店地址： _____
- ☐ 酒店開業年份： _____
- ☐ 客房數量： _____

第 2 部分：酒店ESG實踐

2.1 ESG監管

2.1.1. 貴酒店是否有正式的管理架构負責ESG戰略以及行動規劃？

- ☐ 是（請回答下一個問題）
- ☐ 否（請轉到問題 2.1.4）

*Skip To: If 2.1.1. Does your hotel have an official management structure for ESG strategies and action planning?
= No (please go to question 2.1.4)*

2.1.2. 貴酒店的ESG管理委員會包括下列哪些管理人員?(多選)

☐ 總經理

☐ 前臺部經理

☐ 餐飲部經理

☐ 工程部經理

☐ 客房部經理

☐ 財務部經理

☐ 銷售部經理

☐ 市場運營部經理

☐ 可持續發展經理

☐ 採購部經理

☐ 人力資源及文化部經理

☐ 行政總廚

☐ 其他管理人員（請註明）_____

2.1.3. 貴酒店召開可持續發展委員會會議的頻率是? (單選)

- ☐ 每週
- ☐ 每月
- ☐ 每季度
- ☐ 每半年
- ☐ 每年
- ☐ 其他時間頻率 (請註明) _____

2.1.4. 貴酒店目前設立了哪些關鍵績效指標? (多選)

- ☐ 能源消耗量
- ☐ 耗水量
- ☐ 廢物管理
- ☐ 綠色採購
- ☐ 參與可持續發展相關的合作項目或合作夥伴數量
- ☐ 溫室氣體排放量
- ☐ 就酒店環境可持續發展問題對員工進行培訓
- ☐ 其他 (請註明) _____
- ☐ ☒ 沒有設立具體關鍵績效指標

2.1.5. 貴酒店是否發佈有關ESG的年度報告?

- ☐ 是, 由酒店管理公司發佈
- ☐ 是, 由酒店業主發佈
- ☐ 否 (請轉到問題2.1.7)

Skip To: If 2.1.5. Does your hotel publish an annual report for ESG practices? = No (please go to question 2.1.7)

2.1.6. 貴酒店的ESG報告是否經由第三方審核?

- ☐ 是
- ☐ 否

2.1.7. 貴酒店是否已獲得或者正在申請任何關於可持續性發展的認證? (多選)

- ☐ 綠建環評+ (BEAM+)
- ☐ 能源與環境設計先鋒 (LEED)
- ☐ 綠色建築評價標準 (中國三星級)
- ☐ EarthCheck認證
- ☐ 全球永續旅遊認證 (GSTC)
- ☐ 多種災害和氣候變遷認證
- ☐ 綠色鑰匙 (Green Key)
- ☐ ISO 14001
- ☐ 其他 (請註明) _____
- ☐ ☒ 無

2.2 ESG相關的員工培訓

2.2.1. 貴酒店是否為員工提供有關環境可持續發展實踐 (如空氣調節系統、照明控制、節水和廢物管理等) 的培訓?

- ☐ 是 (請回答下一個問題)
- ☐ 否 (請轉到問題2.2.4)

Skip To: If 2.2.1. Does your hotel organize staff training programs on environmental sustainability practices... = No (please go to question 2.2.4)

2.2.2. 貴酒店組織與可持續發展實踐相關的員工培訓的頻率是? (單選)

- ☐ 每週
- ☐ 每月
- ☐ 每季度
- ☐ 每半年
- ☐ 每年
- ☐ 其他時間頻率（請註明） _____

2.2.3. 貴酒店員工培訓涉及哪些主題? (多選)

- ☐ 廢物分類/回收
- ☐ 用水量控制
- ☐ 節能
- ☐ 提高環保意識的工作坊
- ☐ 關於環境可持續性的對客交流技巧
- ☐ 其他（請註明） _____

2.2.4. 貴酒店是否採用以下措施來激勵員工參加與環境可持續性相關的線上或者線下課程？

- ☐ 提供經濟獎勵
- ☐ 提供非經濟獎勵
- ☐ 其他（請註明） _____
- ☐ ☒ 無

2.2.5. 貴酒店是否設有反饋渠道供一線員工和管理人員就當前酒店的環境可持續性實踐提出建議和意見？

- ☐ 是
- ☐ 否

2.3 廢物管理 泔水管理

2.3.1. 貴酒店是否採取以下措施來進行泔水管理？

	是	否
對不同類型的廚餘進行分類，例如肉類、魚類、新鮮水果、蔬菜、穀物、殘渣以及其他過期或煮熟的剩菜剩飯	☐	☐
進行食品庫存評估，以避免過量訂購和損失易腐食品	☐	☐
根據顧客消費習慣調整餐廳食品的分量以減少食物浪費	☐	☐
將剩餘食物捐贈給當地慈善機構（如：Foodlink, Feeding HK, Food Angel等）	☐	☐
回收廢棄食用油	☐	☐
通過海報或標牌鼓勵顧客儘量減少餐廳的食物浪費	☐	☐

2.3.2. 貴酒店是否聘請第三方進行廚餘管理審核?

- ☐ 是 (請註明第三方) _____
- ☐ 否

固體廢物管理

2.3.3. 貴酒店是否已禁止使用下列一次性塑料製品? (多選)

- ☐ 塑膠瓶裝水
- ☐ 塑料膠袋
- ☐ 塑料洗滌用品
- ☐ 塑膠餐具 (如塑膠杯、盤子、吸管、食品容器等)
- ☐ 塑膠洗衣袋
- ☐ 塑膠拖鞋
- ☐ 其他 (請註明) _____
- ☐ ☒ 否

2.3.4. 貴酒店回收下列哪些物品? (多選)

- ☐ 紙製品 (紙、紙巾、紙板)
- ☐ 金屬製品 (鋁罐、錫罐)
- ☐ 玻璃製品 (玻璃瓶)
- ☐ 咖啡膠囊
- ☐ 亞麻物品
- ☐ 其他 (請註明) _____
- ☐ ☒ 無

2.3.5. 貴酒店是否使用更環保的材料製作員工制服?

- ☐ 是
- ☐ 否

2.3.7. 貴酒店是否將使用過的物品 (如傢俱、床單、制服等) 捐贈給非政府組織或慈善機構, 以供重新使用/回收/升級再造?

- ☐ 是 (請註明合作方) _____
- ☐ 否

備品廢物與回收

2.3.8. 貴酒店是否採取以下措施進行備品回收?

	是	否
使用由可持續材料製成的浴室用品（如竹制用品）	☐	☐
在淋浴間安裝洗發水、護髮素、沐浴露和洗手液分配器，以取代客房內的獨立包裝浴室用品	☐	☐
回收洗滌用品（如肥皂）	☐	☐

2.4 碳排放與能源管理

2.4.1. 貴酒店是否採取以下節能措施以優化能源使用?

	是	否
設定可衡量的年度節能目標並將其作為關鍵績效指標	☐	☐
安裝空氣調節系統	☐	☐
在客房內安裝溫度感測器以精確控制溫度	☐	☐
控制夜間外部照明（例如招牌、外部聚光燈、戶外電子顯示器）的持續時間	☐	☐
為住客提供新能源汽車服務	☐	☐
能夠區分並監測酒店不同區域（廚房、洗衣房、客房、照明等）的能源消耗	☐	☐

2.4.2. 貴酒店在下列哪些區域安裝了LED燈? (多選)

- ☐ 大堂
- ☐ 客房
- ☐ 餐廳
- ☐ 後廚
- ☐ 後臺辦公室
- ☐ 其他區域 (請註明) _____
- ☐ ☒ 目前沒有在任何區域安裝LED燈

2.4.3. 貴酒店使用何種可再生能源以減少能源消耗和碳排放? (多選)

- ☐ 太陽能
- ☐ 熱電共生 (CHP)
- ☐ 地熱能源
- ☐ 生物燃料
- ☐ 風能
- ☐ 其他 (請註明) _____
- ☐ ☒ 無

2.4.4. 貴酒店是否監測能源消耗的情況？頻率是？（單選）

- ☐ 每日
- ☐ 每週
- ☐ 每月
- ☐ 每季度
- ☐ 每半年
- ☐ 每年
- ☐ 其他時間頻率（請註明） _____
- ☐ 不，我們目前不監測能源消耗情況

2.4.5. 貴酒店是否監測用電情況？頻率是？（單選）

- ☐ 每日
- ☐ 每週
- ☐ 每月
- ☐ 每季度
- ☐ 每半年
- ☐ 每年
- ☐ 其他時間頻率（請註明） _____
- ☐ 不，我們目前不監測用電情況

2.5 水資源管理

2.5.1. 貴酒店是否採取了可持續發展措施來改善水資源管理? (多選)

- ☐ 是 - 浴室 (如節水龍頭、雙沖水馬桶)
- ☐ 是 - 洗衣 (如在未滿載量的情況下運行洗衣機)
- ☐ 是 - 毛巾和床單重複使用 (例如, 只應要求更換)
- ☐ 是 - 水審計 (例如, 檢查水錶以避免漏水)
- ☐ 是 - 水回收利用 (如雨水)
- ☐ 是 - 海水使用 (如用於游泳池的海水淡化)
- ☐ 是 - 泳池管理 (例如, 在關閉時遮蓋泳池)
- ☐ 其他 (請註明) _____
- ☐ ☒ 否

2.5.2. 貴酒店是否監測用水量? 多長時間測量一次? (單選)

- ☐ 每日
- ☐ 每週
- ☐ 每月
- ☐ 每季度
- ☐ 每半年
- ☐ 每年
- ☐ 其他時間頻率 (請註明) _____
- ☐ 不, 我們目前不監測用水量消耗

2.5.3. 貴酒店是否能夠區分並測量酒店不同區域（浴室、洗衣房、游泳池等）的用水量？

☐ 是

☐ 否

2.6 室內空氣品質治理

2.6.1. 貴酒店是否採取下列措施進行室內空氣品質管理？

	是	否
安裝感測器來監測揮發性有機化合物 (VOC) 等關鍵指標，以確保室內空氣品質	☐	☐
在人流量大的區域（如酒店大堂）安裝高效空氣微粒（HEPA）淨化器，以保持室內空氣品質	☐	☐
將影印機和鐳射印表機放置在通風處	☐	☐
選擇適合酒店環境和當地氣候的綠植放置在合適的區域	☐	☐

2.6.2. 貴酒店是否進行室內空氣品質評估？

☐ 是，由酒店進行

☐ 是，由第三方進行（請註明） _____

☐ 否

2.7 顧客參與

2.7.1. 貴酒店在2023年組織了哪些類型的環保計畫/活動來積極鼓勵顧客參與? (多選)

- ☐ 減少食物浪費
- ☐ 節能
- ☐ 節水
- ☐ 減少塑膠垃圾
- ☐ 減少浴室用品的浪費
- ☐ 其他計劃/活動 (請註明) _____
- ☐ ☒ 無

2.7.2. 貴酒店是否在官方社交媒體賬戶上推廣酒店的环境可持續發展實踐? (多選)

- ☐ 是 - 臉書Facebook
- ☐ 是 - 領英LinkedIn
- ☐ 是 - Instagram
- ☐ 是 - 抖音/TikTok
- ☐ 是 - 小紅書
- ☐ 是- 微博
- ☐ 其他 (請注明社交媒體平臺) _____
- ☐ ☒ 否

2.7.3. 貴酒店是否收集顧客對酒店當前環保實踐的反饋? (多選)

- ☐ 是，通過社交媒體平臺
- ☐ 是，通過電子郵件進行客戶調查
- ☐ 是，通過手機短信進行客戶調查
- ☐ 其他方式（請註明） _____
- ☐ ☒ 否

2.7.4. 貴酒店是否採取下列措施來鼓勵顧客參與到酒店的環保措施中?

	是	否
為客人提供低碳飲食選擇	☐	☐
鼓勵客人減少更換毛巾和床單的次數	☐	☐
在客房內放置分類垃圾箱，以鼓勵客人進行垃圾分類	☐	☐
在公共區域設置禁言標識，以提醒客人酒店是法定禁煙場所	☐	☐
提供經濟獎勵（如折扣/積分/禮券等）	☐	☐
提供非經濟獎勵（如忠誠度計畫獎勵積分）	☐	☐

2.8 當地社區參與

2.8.1. 貴酒店是否參與並贊助當地社區組織的環保活動? (多選)

☐ 香港花卉展

☐ 綠化香港活動資助計畫

☐ 綠色志願者計畫

☐ 社區種植日

☐ 社區園圃計劃

☐ 私人物業最佳園林大獎

☐ 賞花好去處

☐ 香港綠色日

☐ 其他 (請註明) _____

☐ ☒ 否

2.8.2. 貴酒店是否參與香港政府推出的環保計畫/活動? (多選)

☐ 碳中和宣傳活動

☐ 香港環境卓越大獎

☐ 香港綠色機構認證

☐ 綠線通-環境教育支援服務計劃

☐ 環保風紀計劃

☐ 廢物分類及回收計劃

☐ 廢物源頭分類推廣計畫

☐ 其他 (請註明) _____

☐ ☒ 否

2.8.3. 貴酒店是否與下列非政府組織/綠色團體合作，以促進酒店的環境可持續發展計劃？

☐ 環保協進會

☐ 香港地球之友

☐ 環保促進會

☐ 綠色和平

☐ 綠惜地球

☐ 其他（請註明） _____

☐ ☒ 否

2.9 有關環保科技的採用

2.9.1. 貴酒店是否已實現無紙化入住/退房？

☐ 是 (1)

☐ 否 (2)

2.9.2. 貴酒店是否已安裝非接觸式支付軟件，以便客人獲得數字授權來處理付款？

☐ 是 (5)

☐ 否 (6)

2.9.3. 貴酒店是否安裝了智能能源管理系統 (EMS) (如evergreen、Facilio等) 來監控能源消耗？

☐ 是（請註明系統） _____

☐ 否

2.9.4. 貴酒店是否採用可將食物垃圾轉化為水的ORCA相似技術？

☐ 是

☐ 否

Appendix 7: Research Outputs

Journal Article 1:

JOURNAL OF CHINA TOURISM RESEARCH
<https://doi.org/10.1080/19388160.2024.2374726>

 **Routledge**
Taylor & Francis Group



Pathway to Environment Management in Hotel Industry: A Stakeholder Engagement Framework

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ABSTRACT

The hotel industry plays a crucial role in the global tourism sector, and with increasing awareness of environmental issues, it is essential for hotels to actively engage in sustainability management. The existing literature offers limited insights into how the stakeholders of hotels can contribute more to improve the EM in the hotel industry. Embracing stakeholder engagement can empower hotels to strategically tackle environmental sustainability challenges through collaborative efforts with diverse stakeholders. This engagement involves identifying and actively engaging key stakeholders such as hotel owners, employees, customers, local communities, suppliers, and government agencies. This study aims to explore stakeholder engagement in driving effective environmental sustainability initiatives within the hotel industry. By conducting in-depth interviews, observations, and on-site observations in three cities in China, the study uncovers the distinct roles and engagement pathways of different stakeholders groups concerning hotel environment management. The proposed stakeholder engagement framework elaborates the intricate relationships and interdependencies between various stakeholders, and their engagement in hotel environment management.

ARTICLE HISTORY

Received 30 March 2024
Accepted 24 May 2024

KEYWORDS

Environment management; stakeholder engagement; hotel environment sustainability; stakeholder salience; hotel sustainability pathway

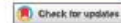
关键词

环境管理; 利益相关者参与; 酒店环境可持续性; 利益相关者持著性; 酒店可持续发展之路

酒店业环境管理之路：利益相关者参与框架

摘要

酒店业在全球旅游业中扮演着关键角色。随着人们对环境问题的日益关注，酒店积极参与可持续性发展管理至关重要。现有文献对于酒店业的利益相关者如何为改善酒店环境管理做出更多的贡献见解有限。通过利益相关者参与可以让酒店与不同利益相关者达成通力合作，继而战略性应对环境可持续发展的挑战。这种参与涉及识别和积极让酒店业主，员工，顾客，当地社区，供应商，以及政府机构等利益相关者参与其中。本研究旨在探讨如何通过利益相关者的参与使得酒店业环境可持续性管理举措更加有效。通过在中国三个城市进行深入访谈，观察，和实地考察，本研究揭示了不同利益相关者在酒店环境管理中的独特角色和参与途径，根据研究结果所提出的利益相关者参与框架阐述了不同利益相关者之间错综复杂的关系，相互依赖性，以及他们在酒店环境管理中的参与度。



A toolkit for hotel environment management capability development

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ABSTRACT

The environment management (EM) in hotels is increasingly expected by both consumers and regulatory bodies. The complexities of hotel EM practices require hotels to develop EM capabilities. However, the existing sustainability measurement tools focus on the measures of outcomes and benchmarking. The hotels need a practical guideline and tools to develop EM practices, and to monitor and identify weaknesses and problems. This study aims to provide actionable guidelines for EM capability development. A multi-case study is designed to achieve this goal. This research offers detailed insights into specific actions and strategies that hotels can employ to enhance their sustainability efforts.

ARTICLE HISTORY

Received 23 March 2024
Revised 17 May 2024
Accepted 19 June 2024

KEYWORDS

Hotel environment management; sustainability; environment management capability; environment management practices; benchmarking; hotels; multi-case study; ESG; Hong Kong; toolkit

Introduction

The tourism industry consumes and produces a significant amount of resources, such as water, energy, and waste (UNEP, 2023). Therefore, it is crucial for hotels to adopt green approaches and implement sustainable practices in order to minimize their environmental impact (Chua & Han, 2022; Sancak, 2023). The environment management (EM) in hotels is increasingly expected by both consumers and regulatory bodies (Wang, 2022). Hotels that prioritize green marketing and environment management can benefit from improved reputation, increased customer loyalty, and cost savings through resource efficiency (Chung, 2020). Thus, monitoring and measuring indicators related to green marketing and hotel environment management (EM) is essential for evaluating the effectiveness of these practices.

At the broad managerial level, various principles and agreements, such as ISO14001 (ISO 14001, 2015) or Global Reporting Initiative (GRI) (Global Reporting Initiative, 2016), function as frameworks for guiding business organizations' EM. These frameworks are mainly created at a broad level and not necessarily provide practical guidelines for hotel EM. Hotel EM is complicated and requires innovations in technology, operations, and stakeholder engagement (Duric & Potočnik Topler, 2021). Except a few international hotel chains

such as Marriott and Hilton, most of medium and small scale hotels are lack of EM capability. To facilitate hotels to develop EM capability, different frameworks and tools have been developed by non-profit organizations and academic institutions. For example, the Cornell Hotel Sustainability Benchmarking (CHSB) enables hotels to measure their carbon footprints related to energy usage, water consumption, and carbon emissions to evaluate their EM performance. Other benchmarking tools, such as the World Travel & Tourism Council (WTTC) and the Sustainability Hospitality Alliance (SHA) have developed hotel sustainability basics as a guideline for hotels globally to develop basic sustainability indicators. These tools have been widely recognized for hotel EM benchmarking. However, these tools provide little insights for hotel EM capability development because the measures only focus on EM outcomes rather than the processes leading to such outcomes.

For providing practical EM guidelines for hotels to develop actionable practices, self-monitoring, and benchmarking, this study aims to develop a comprehensive framework with actionable indicators for hotels to effectively implement and monitor its EM practices. Through in-depth interviews with hotel senior managers and on-site visits to hotel EM best practices, this study spotlights EM processes and evaluation components, providing detailed insights into the specific

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 Supplemental data for this article can be accessed online at <https://doi.org/10.1080/10548408.2024.2371905>

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Funding

This work was supported by the [Public Policy Research (PPR) Fund of Chief Executive's Policy Unit, Hong Kong SAR #1] under Grant [number: 2023.A6.220.23A]; [Research Seed Fund by ZJU-PolyU Joint Center #2] under Grant number [number: ZUPUC-2023-01HT].

Appendix 8: Public Dissemination Materials

Public dissemination 3:

Business Sustainability Conference 2024 Designing Resilient Supply Chains: Innovation, Visibility, and Sustainability 8 Nov 2024 09:30 to 12:30 LT1, Cheng Yu Tung Building, CUHK		
Time	Activities	Speakers
09:00-09:20	VIP Booth tour & photos	GoH, Hosts, VIPs
Event Open		
09:30-09:35	Welcome speech	To Be Confirmed
09:35-09:50	Opening remarks	Mr. Lam Sai Hung, GBS, JP, Secretary for Transport and Logistics (To be confirmed)
09:50-09:55	Group Photo	
09:55-10:10	Innovative Business Models in Ocean-Bound Plastic Recycling	Prof. Sean Zhou, Department of Decisions, Operations and Technology, The Chinese University of Hong Kong
10:10-10:25	Garment Waste Recycling in Hong Kong: Navigating Challenges and Unlocking Opportunities	Prof. Magnum Lam, Assistant Professor (Fashion Business), School of Fashion and Textiles, The Hong Kong Polytechnic University
10:25-10:40	Political Ideology and Carbon Emissions along Supply Chain	Prof. Haibin Yang, Director, MSc in Sustainable Global Business Programme, The Chinese University of Hong Kong
10:45 -11:10	Coffee Break	
11:10-11:25	Redesign Procurement: Leveraging Circular Economy Principles	Mr. Felix Lam, Head of Communications, Institute of Supply Management-HK
11:25-11:40	Integrating Sustainability in Supply Chain Finance: Strategies for Mitigating ESG Risks	Mr. Calvin Wong, Head of Sustainability Assurance Services, SGS Hong Kong Limited
11:40-11:55	Environment Management Indicators Development for Hotels: An Effective Benchmarking Tool	Prof. Dan Wang, School of Hotel and Tourism Management, The Hong Kong Polytechnic University
11:55-12:30	Panel discussion	Moderator: TBC Panelists: Representative of the 3 companies in the Hong Kong Business Sustainability Index
12:30-12:35	Closing remarks	Prof. Lin Zhou, Dean, The Chinese University of Hong Kong (CUHK) Business School
Organiser   Co-Organiser     		

Public Dissemination 4:



中国酒店与餐饮业品牌发展大会
China Hospitality Industry
Brand Development Conference

2024中国酒店与餐饮业品牌发展大会
China Hospitality Industry Brand Development Conference

会议手册

2024年11月·海口

2024 全国酒店餐饮业绿色发展论坛			
11 月 28 日 星期四	09:00-09:30	演讲主题：生成式大模型在酒店业的应用与合规建设 演讲嘉宾：浙江大学管理学院旅游与酒店管理学系教授 博士生导师 周玲强	大宴会厅
	09:30-09:50	全国首发：中国饭店业绿色发展指数 发布人：香港理工大学酒店及旅游管理学院副教授 王丹	
	09:50-10:10	主题发布：《2024 中国住宿业品质服务报告》 发布人：华客科技创始人兼 CEO、原携程集团 COO 兼大住宿 CEO 孙茂华	
	10:10-10:30	全国首发：酒店年度运营品质评价赋能工作 发布人：德勤中国审计与鉴证总监 倪力	