



Empirical Research Article

Adoption of Smart Sustainability Performance Measurement System (SPMS) in Hotels and Variations across Ratings, Reviews, and Operational Efficiency Scores

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Abstract

Hotels have recently started to implement enterprise information systems to measure and report sustainability indicators in a smart manner. However, a complex ownership structure in a hotel chain prevents full smart systems adoption at the individual property level. This study explores how a smart sustainability performance measurement system (SPMS) for waste management adoption correlates with customer ratings, customer reviews, operational efficiency scores, and between franchised and corporate-managed properties. We derive insights from the secondary data constructed from multiple sources for a large multinational hotel chain hotel. The findings suggest that hotels that adopt SPMS have better operational efficiency scores and more customer reviews. Within the hotels that adopted SPMS, corporate-managed hotels have a lower level of ratings than franchised hotels, but they have higher operational efficiency scores and more reviews. We discuss research implications for the concept of smart tourism and hotel management literature and managerial implications.

Keywords

SPMS; hotel performance; hotel ownership; sustainability management; smart hotel

1. Introduction

Firms are making an effort to improve their sustainability management performance to address climate change challenges (Dahlmann, Branicki, & Brammer, 2019). Waste management, an essential aspect of sustainability management, is a considerable challenge for hotels. On average, one guest at most hotels creates about 0.9kg of waste per day (Abdulredha et al., 2018). Aggregating it to a total number of hotels and guests worldwide, this is a significant amount. Study shows that for a hotel chain with 170 properties, reducing the food waste can save \$4.7 million and reduce 1,160 tons of carbon emissions (Güçer & Özdemir, 2018). However, managing the waste at the sources may be impossible within the externalities involved with the sourced materials, availability, and human behavior (Rahman, Reynolds, & Svaren, 2012). This study focuses on using a smart sustainability performance measurement system (SPMS), which has gained acceptance as a powerful waste management tool (Fatimah, Govindan, Murniningsih, & Setiawan, 2020).

It is necessary to have a performance measurement system to monitor the sustainability management process to understand the situations and respond accordingly (He, Chen, Liu, & Guo, 2017). As a type of information system, smart SPMS facilitates the planning, implementation, and measurement of waste management processes through process automation, recording tracking, and data analysis (Buhalis & Leung, 2018). It allows hotels to monitor and measure sustainability performance in a smart manner. Like the environment, health, and safety

management system, SPMS measures potential environmental, health, and safety impacts caused by production byproducts such as toxic waste. It also enables the measurement of broader environmental impact from energy uses such as electricity and water, recyclable materials, use of fertilizers, greenhouse gas emission, and so forth (Gössling, 2015). Thus, SPMS is a comprehensive approach that uses data and information to analyze and evaluate direct and indirect environmental impact resulting from various treatment options of waste. SPMS helps to understand the “big picture” of water, energy, and materials used during production and operations. The broad system perspective makes SPMS an effective system for environmental comparison of different options for waste management of a specific product, a material, or a complex waste flow (Cherubini, Bargigli, & Ulgiati, 2009; Ekvall, Assefa, Björklund, Eriksson, & Finnveden, 2007). By tracking each activity and operational process with quantitative data, managers can determine how much excess is produced and then adjust planning for the future ordering of materials to prevent waste generation. Discussion around the role of technologies in hospitality has been a prominent theme in the smart tourism literature (Mehraliyev, Chan, Choi, Koseoglu, & Law, 2020). However, the role of SPMS in hotel sustainability management, especially in waste management, has not been discussed in prior studies. We identify this as one research gap in the smart tourism literature.

Prior research suggests that it is important to understand information systems as solutions for sustainability. For example, studies suggest that firms need management systems and tools

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that integrate environmental, health, and safety metrics with other process-related metrics to improve operational efficiency (Huang & Badurdeen, 2018). Prior research on information systems has made impressive strides in explicating whether and how information systems contribute to hotel performance at multiple levels (Piccoli, Lui, & Grün, 2017). However, sustainability management (e.g., waste management) needs a lifecycle approach focusing on the measure and tacking of the process. We could not find many studies that discuss information systems' role in such a context (i.e., SPMS in this study). Motivated by the gap in prior research and practice insights, the first research purpose of this study is to explore *the impacts of SPMS on ratings, reviews, and operational outcomes?*

Some factors will cause different outcomes even when implementing SPMS. For example, these systems may not function effectively unless other resources, processes, and capabilities are in places, such as ownership management, functional and technical expertise, and reliable measurement of baseline indicators (Aflaki, Kleindorfer, & de Miera Polvorinos, 2013). In such cases, the SPMS and organizational contexts and capabilities may prove inadequate or mismatched to produce positive effects. Given these realizations, examining the differences of SPMS on outcomes in different ownership contexts is a meaningful empirical question (Hodari, Turner, Sturman, & Nath, 2020). Following the prior studies, the first research purpose of this study is to explore *the differences across different ownership types of hotels regarding the impact of SPMS on hotel ratings, reviews, and operational outcomes?*

Overall, we argue hotels' customer ratings and reviews and hotel operational efficiency scores vary with SPMS implementations, influenced by some factors. Besides, the ownership type of a hotel may influence the value of SPMS implementations in the hotel. We analyze hotel data in the year 2016 from a large multinational hotel chain and matched hotel review and rating data from a well-known online tourism site. The findings suggest the value of SPMS on hotel performance. We also find that hotel ownership type can influence the value of SPMS. Research implications for emerging smart tourism literature, as well as managerial implications, are discussed.

2. Background and Theory

2.1 Information Systems and Waste Management in Hotels

Using IT for sustainability challenges, specifically to waste management activities, stems from the fact that various stakeholders such as customers, employees, and investors are demanding businesses to be sustainable (Jacobs, Singhal, & Subramanian, 2010; Khuntia, Saldanha, Mithas, & Sambamurthy, 2018). The increasing attention of academic research deals with sustainability considerations in various aspects of businesses, value chains, operations, and management (Atasu & Wassenhove, 2012; Joshi & Li, 2016). The context of IS in managing waste at the operational and process level in an organization is relevant and emerging as a central piece of discourse in the recent IT/IS enabled business research that should help in the energy consumption reduction (Khuntia et al., 2018) and carbon emissions monitoring (Melville, 2010). Organizations are increasingly looking for ways to manage IT-enabled sustainability practices (Atasu & Subramanian, 2012; Subramanian, Ferguson, & Beril Toktay, 2013). However, we know little about the relationship between IS and hotel performance (Melián-González & Bulchand-Gidumal, 2016). Also, how the effects of IS may differ at various other contingencies remains unexplored. This study fulfills these gaps in the literature exploring SPMS effectiveness on hotels' rating, review, and operational efficiency scores.

Sustainability management is a complex phenomenon with a range of consequences for the involved stakeholders and the society. The majority of the hotel corporations and individual

hotel properties had implemented a program to measure their sustainability performance, including a waste management program (Franzoni, 2015). The practices implemented and the type of materials recycled varied by corporate's emphasis on the importance of recycling and the organization's infrastructure (Pirani & Arafat, 2014). There are many tools for assessing environmental impact, but one of the most commonly used is SPMS. The broad perspective of SPMS makes it possible to take into account the significant environmental benefits that can be obtained through different sustainability management processes (Searcy, 2012). For example, a study has shown how smart systems can be used for solid waste management, from information accumulation, waste generation prediction, decision support to evaluation and assessment, in European countries (Pires, Martinho, & Chang, 2011).

2.2 External and Internal Performance of Hotels

Reputation is a significant factor reflecting a business entity's performance, such as that of a hotel, especially for the online marketplace in recent years (Collier & Hampshire, 2010). The online reviews and ratings manifest a hotel's performance from its customers' perspective. For instance, an online review of a hotel reflects the hotel's reputation in the market space; and leads the hotel to achieve a benchmark in that reputational mechanism (Tadelis, 2016). Undoubtedly, this process is a signaling mechanism and a driver for customers' preferred choice for the hotel. Thus, hotels must have subsequent signal and choices work as a feedback loop to increase hotels' reputation. In the context of this study, they are maintaining a thread in the signal about sustainable behavior through sustainability management (Collier & Hampshire, 2010). Prior literature has shown that hotels tend to have better ratings and positive reviews if they have a good image regarding sustainability management (Brazytė, Weber, & Schaffner, 2017). By adopting SPMS, hotels can also provide a better environment and services to their customers (Peiró-Signes, Segarra-Oña, Verma, Mondéjar-Jiménez, & Vargas-Vargas, 2014). Prior studies have revealed the significant effects of word of mouth on a hotel's reputation and performance (Serra Cantallops & Salvi, 2014; Sparks & Browning, 2011).

Besides external reviews and ratings, hotel performance can also be reflected through its internal operational efficiency regarding sustainability management (Barros, 2005). Traditionally, tourism industry activities' efficiency has received less attention, while it is critical for hotels to understand how to achieve the most effective operations (Sáez-Fernández, Jiménez-Hernández, & Ostos-Rey, 2020). Hotels implement sustainability management strategies to generate higher efficiency, leading to better economic and environmental outcomes. Studies have revealed that global hotel chains initiate their sustainability commitment to improving business efficiency, including resource efficiency (Jones, Hillier, & Comfort, 2014; Zhang, Joglekar, & Verma, 2012). As part of the green business strategies, the implementation of environmental management systems and performance measurement systems were suggested to improve hotels' operational efficiency (Tooman, Sloan, Legrand, & Fendt, 2008). Following the suggested two perspectives of environmental sustainability management in hotels, this study also looks at the customer-centered and operations-centered hotel performance (Zhang et al., 2012).

2.3 Ownership of Hotels

Hotels can be managed by the hotel chain corporate or franchised by independent individuals. There are administrative or hierarchical techniques for the large hotel chain, such as creating standards or policies in the management (Cardinal, Kreutzer, & Miller, 2017). The type of ownership is reflected

through coordination mechanisms and budget appropriation in the organizational context or structure, including managerial techniques, decision-making, or task-directed leaderships (Birkinshaw, Holm, Thilenius, & Arvidsson, 2000). Thus, broadly two ways of management process: a directed and delegated task-activity process to the lower levels, or a process where the discretion is permeated to the lower levels through indirect channels than hierarchical delegation. The corporate-managed hotels would have a direct hierarchical structure and ownership control, while the franchised hotels would have more indirect control through different mechanisms.

We focus on the difference in approach to using SPMS across corporate-managed and franchised hotels. The corporate-managed hotels have a higher dependency on the corporate headquarters, relevant to resource allocations, overseeing activities, and adherence to a specific management approach (Birkinshaw et al., 2000; Songini & Gnan, 2015). In contrast, a franchise hotel may be independent in making decisions regarding the property while adhering to the hotel chain's prevailing norms and guidelines. Corporate managed hotels have to align and follow the practices started and put in place by the headquarters. Denial to follow these approaches may lead the hotel's headquarter to limit budget, resource, or benefit allocations (Songini & Gnan, 2015). Astringent oversight percolated to efficient implementation, follow-up, and management of SPMS and aligned other resources and capabilities to make the system succeed. Besides, frequently, with the implementation of a system, a corporate generally implements a set of performance measures to monitor and report marketable indicators (Pereira-Moliner et al., 2015).

3. Methodology

3.1 Data and Variable

The data for this study comes from a large multinational hotel chain. The hotel chain has several brands under its flagship and has different types of hotel ownership. The dataset comprises data of 3,969 properties for a single year in 2016. As part of the enterprise-wide program to adopt SPMS since 2009, the dataset reports sustainability management progress of corporate-managed and franchised properties. Among the 3,969 properties, 504 hotels have adopted the SPMS, and 3,421 hotels are in the U.S. In addition to the hotel chain data, we collected online ratings and reviews data of the hotels. The datasets are merged to conduct our data analysis. The descriptions of variables used in the data analysis are shown in Table 1. The descriptive statistics are presented in Table 2.

Table 1. Descriptions of variables

Variables	Description
RATINGS	Average ratings of a property on a scale from 1 to 5
SCORES	The standardized score of a property's operational efficiency on a scale from 1 to 5
REVIEWS	The number of reviews for a property. The total number of reviews was divided by 100.
SPMS	Whether a property adopted sustainability performance measurement systems to measure and report sustainability management, a positive value (e.g., 1) indicates a property has adopted SPMS.
MANAGED	Whether a corporate office manages a property, a property may be managed by a corporate or franchised to an independent owner. A property owner may choose to allow the corporate office to manage all of its operations. A positive value (e.g., 1) indicates a corporate office manages a property; otherwise, it is a franchised property.

Table 2. Descriptive statistics

Variables	Obs.	Mean	S.D.	Min	Max
RATINGS	3,969	4.35	0.44	2	5
SCORES	3,969	1.47	0.95	1	5
REVIEWS	3,969	10.89	12.38	0.02	160.05
SPMS	3,969	0.13	0.33	0	1
MANAGED	3,969	0.17	0.37	0	1

3.2 Data Analysis

First, we conducted a t-test to evaluate the hotel performance between hotels that adopted the SPMS and hotels with no SPMS from three perspectives: customer ratings, operational efficiency scores, and customer reviews. Second, for hotels that adopted SPMS, we conduct a t-test to compare the differences between franchised and corporate-managed hotels. Besides, we offer visualizations of the data analyses.

4. Results

For the evaluations on SPMS usage value, Figures 1, 2, and 3 and Table 3 present the results. First, Figure 1 shows the customer ratings of hotels that use SPMS and have no SPMS. Both groups' ratings have a very similar pattern, while the non-SPMS group has a slightly better rating performance. Second, Figure 2 shows the comparison of operational efficiency scores between the SPMS and non-SPMS groups. The scores are higher for hotels in the SPMS group, while for most hotels in the non-SPMS group, their scores are lower.

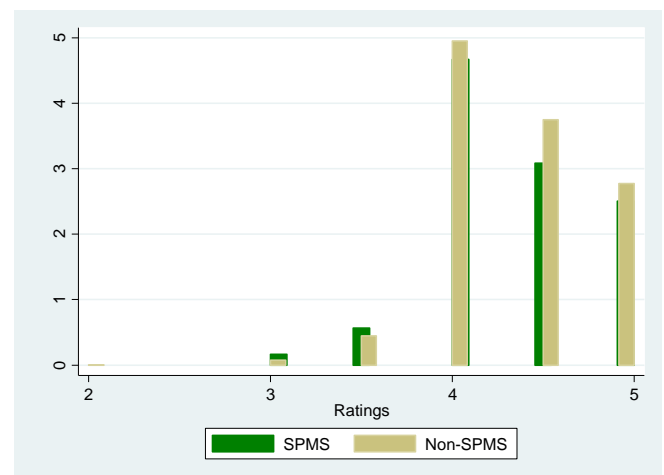


Fig. 1. Ratings by SPMS usage

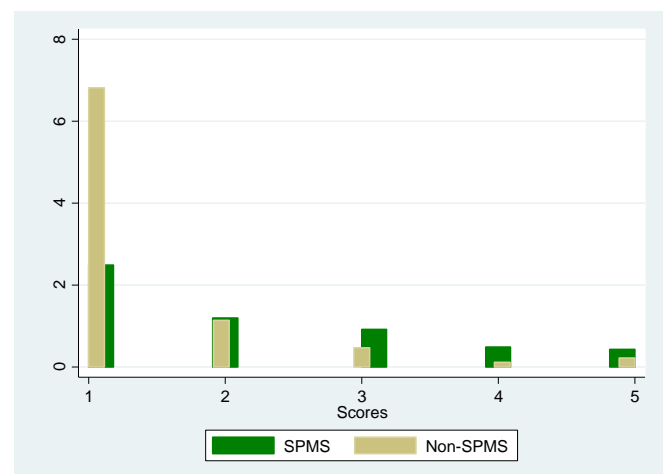


Fig. 2. Scores by SPMS usage

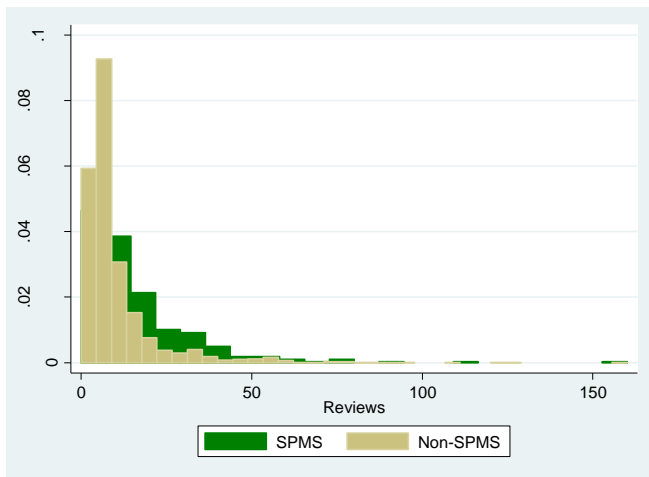


Fig. 3. Reviews by SPMS usage

Table 3. Hotel performance by SPMS usage

	SPMS	Non- SPMS	t-value
Ratings	4.33 ± 0.47	4.36 ± 0.44	1.67*
Scores	2.12 ± 1.29	1.37 ± 0.85	-17.07***
Reviews	15.5 ± 16.0	10.0 ± 11.4	-9.91***

Results: compared to hotels with no SPMS, hotels that adopted SPMS have better operational efficiency scores and more reviews. There are slight differences between hotels with and without SPMS regarding the ratings.

Third, Figure 3 shows the customer reviews in hotels with and without SPMS. It is obvious that hotels with SPMS are more popular with more reviews than hotels with no SPMS. Table 3 summarized the t-test results regarding these three factors: ratings, scores, and reviews in the two groups: SPMS and non-SPMS. First, for the ratings, the t-value is 1.67, indicating slight differences between the two groups. Second, for the scores, the t-value is -17.07, suggesting that hotels with no SPMS, hotels that adopted SPMS have much better operational efficiency scores. Third, for the reviews, the t-value is -9.91. This result implies that hotels that have SPMS have more reviews.

Next, to examine the influence of hotel ownership type for hotels that adopt SPMS, Figures 4, 5, and 6 and Table 4 display the results. First, Figure 4 shows the customer ratings of hotels that use SPMS by hotel ownership types. For the majority of franchised hotels that adopted SPMS, their ratings are at a higher level. Second, Figure 5 shows the comparison of operational efficiency scores by hotel ownership type. The corporate-managed hotels outperform the franchised hotel regarding the scores. Third, Figure 6 shows the customer reviews in corporate-managed and franchised hotels. Corporate-managed hotels have more reviews than franchised hotels. Table 4 summarized the t-test results for ratings, scores, and reviews in the corporate-managed and franchised hotels. First, for the ratings, the t-value is 3.01. This result indicates that franchised hotels have better ratings when they adopt SPMS. Second, for the scores, the t-value is -4.21, implying that compared to franchised hotels, corporate-managed hotels that adopt SPMS have much better operational efficiency scores. Third, for the reviews, the t-value is -6.18, suggesting that corporate-managed hotels have SPMS have more reviews than non-SPMS ones.

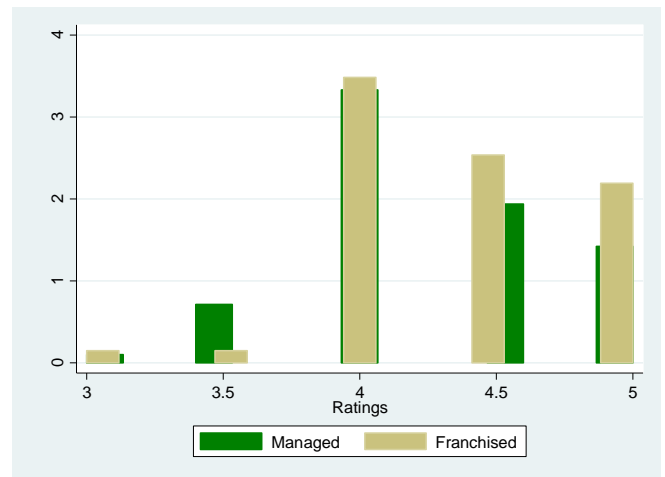


Fig. 4. Ratings by hotel ownership type

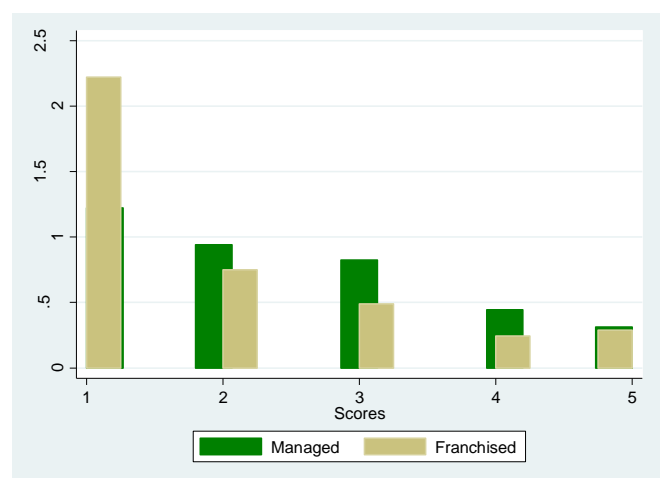


Fig. 5. Scores by hotel ownership type

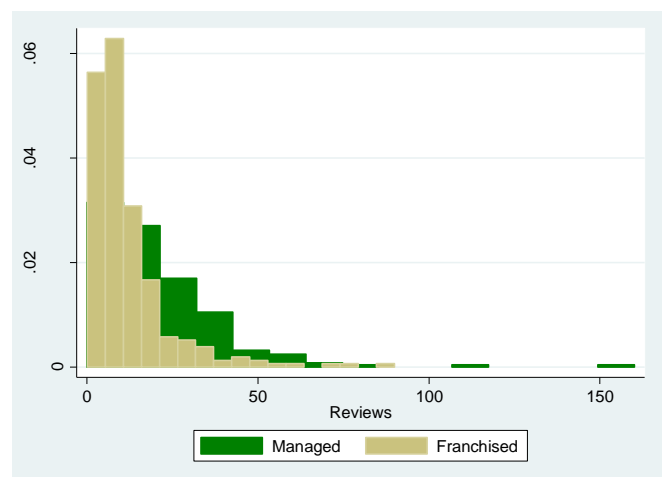


Fig. 6. Reviews by hotel ownership type

Table 4. Hotel performance by hotel ownership type

	For Hotels That Adopt SPMS		t-value
	Managed	Franchised	
Ratings	4.26 ± 0.47	4.38 ± 0.46	3.01***
Scores	2.38 ± 1.28	1.91 ± 1.25	-4.21***
Reviews	20.2 ± 18.9	11.8 ± 12.1	-6.18***

Result: When adopting SPMS, compared to hotels that are franchised, hotels that are managed by the corporate have much better operational efficiency scores and the number of reviews, while the franchised hotels have better ratings.

5. Discussion

Sustainability management is a complex activity for organizations, including hotels. Using information systems, hotels can efficiently improve their sustainability management (e.g., waste management) to reduce cost and carbon emissions. This study explores how SPMS may create value to improve hotel performance from the external customer perspective and internal operational efficiency perspective. The findings of this study provide interesting insights. We find that the usage of SPMS can improve a hotel's operational efficiency scores and increase the hotel's popularity with more customer reviews. These findings highlight the importance of adopting smart systems by hotels to improve their outcomes.

Furthermore, we studied whether there are differences across different types of hotel ownership. This study suggests that when adopting SPMS, franchised hotels have better customer ratings, while corporate-managed hotels have better operational efficiency scores and more reviews. The management structure, the resource allocation, and the connection with the corporate can explain such differences. In other words, as suggested in prior literature, with the direct hierarchical structure, the corporate-managed hotels may not have the motivation to improve the rating of the property. However, they need to follow the headquarters' instructions to fully implement and use the SPMS, increasing their operational efficiency and popularity among customers (Pereira-Moliner et al., 2015; Songini & Gnan, 2015). With corporate support (both financial and technical), the corporate-owned hotels can leverage the SPMS better than franchised hotels.

Previous literature has indicated the value of information systems for sustainability in a general context (e.g., Khuntia et al., 2018). Fewer studies have discussed information systems' role in the hotel industry (Melián-González & Bulchand-Gidumal, 2016). The findings of this study are consistent with previous literature that highlighted the significance of information systems while providing findings in the context of hotel performance. This study also addresses the research gap by showing the differences across different ownership types of hotels. Given this study's findings, it is apparent that ownership is important when it comes to leveraging smart sustainability systems. Future research may explore salient factors associated with these ownership issues and may implicate deeper insights. In that regard, this study informs research to take a holistic perspective to smart systems implementations.

This study also has practical implications. First, hotels can adopt SPMS not only for their sustainability management but also for performance improvement. Armed with IT, hotels can gain both environmental and economic benefits. Second, for the large hotel chains, they can adjust their management strategy to ensure both franchised hotels and corporate-managed hotels achieve good performance, which is beneficial for the hotel brand.

There are some limitations of this study. This study is an initial explorative study that analyzes the variations across several key variables. The theoretical contributions are limited for this explorative study. Future studies can draw hypotheses and test causal models with more robust data and analytical approaches to inform further insights into the context of smart sustainability systems implementations.


Declaration of competing interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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