Research Article

Environmental Management Accounting and Financial Performance: Empirical Evidence from Thailand's Green Hotels

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Dr.Komkrit Singjai
Assistant Professor of Department of Accounting,
Faculty of Business Administration, Kasetsart University

Dr.Chatmongkon Wongrathanandha
Lecturer of Department of Accounting,
Faculty of Business Administration, Kasetsart University
(Corresponding Author)

Dr.Lanita Winata
Senior Lecturer of Department of Accounting, Finance and Economics,
Griffith Business School

ABSTRACT

This study examines the level of adoption and the impact of Environmental Management Accounting (EMA) in the Thai hotel industry, specifically among environmentally proactive businesses, through the lens of the Resource-Based View (RBV). The empirical analysis is based on survey data collected in 2016 from environmentally proactive hotels affiliated with the Green Leaf Foundation in Thailand. A cluster analysis and the Mann–Whitney U test were used to test the proposed hypothesis. The results showed that hotels with proactive green strategies implement EMA tools at the moderate level. While green strategies are pursued, the results suggest that extensive EMA implementation is not always a top priority. Furthermore, the results reveal that varying levels of EMA adoption lead to different financial outcomes, especially operating profit, operating cash flow, and ROI. However, EMA adoption had no impact on sales volume between hotels with Extensive and Limited EMA adoption. The results suggest that the financial benefits of EMA are more pronounced in cost-related aspects than in revenue generation.

Keywords: Financial Performance, Environmental Management Accounting, Hotel, Proactive Environmental Strategies, Thailand

บทความวิจัย

การบัญชีการจัดการด้านสิ่งแวดล้อม กับผลการดำเนินงานทางการเงิน : หลักฐานเชิงประจักษ์ จากโรงแรมที่เป็นมิตรต่อสิ่งแวดล้อมในประเทศไทย

วันที่ได้รับต้นฉบับบทความ : *25 ธันวาคม 2568*
วันที่แก้ไขปรับปรุงบทความ : *9 กุมภาพันธ์ 2569*
วันที่ตอบรับตีพิมพ์บทความ : *18 กุมภาพันธ์ 2569*

ดร.คมกฤษณ์ สิงห์ใจ
ผู้ช่วยศาสตราจารย์ประจำภาควิชาบัญชี
คณะบริหารธุรกิจ มหาวิทยาลัยเกษตรศาสตร์

ดร.ฉัตรมงคล วงศ์รัฐนันท์
อาจารย์ประจำภาควิชาบัญชี
คณะบริหารธุรกิจ มหาวิทยาลัยเกษตรศาสตร์
(ผู้ประสานงานหลัก)

Dr.Lanita Winata
Senior Lecturer of Department of Accounting, Finance and Economics,
Griffith Business School, Australia

บทคัดย่อ

งานวิจัยนี้มีวัตถุประสงค์ เพื่อศึกษาระดับการนำการบัญชีการจัดการด้านสิ่งแวดล้อม (Environmental Management Accounting: EMA) มาใช้ และผลกระทบของ EMA ต่อผลการดำเนินงานของธุรกิจโรงแรมในประเทศไทย โดยมุ่งเน้นกลุ่มโรงแรมที่ใช้กลยุทธ์เชิงรุกด้านสิ่งแวดล้อม ภายใต้กรอบแนวคิดฐานทรัพยากรขององค์กร (Resource-Based View: RBV) การวิเคราะห์เชิงประจักษ์อาศัยข้อมูลจากแบบสอบถามที่เก็บรวบรวมในปี พ.ศ. 2559 จากโรงแรมในประเทศไทยที่มีการดำเนินกลยุทธ์เชิงรุกด้านสิ่งแวดล้อม และเป็นสมาชิกของมูลนิธิใบไม้เขียว จากการทดสอบสมมติฐานด้วยการวิเคราะห์จำแนกกลุ่ม Cluster Analysis และ Mann–Whitney U Test พบว่า โรงแรมที่มีกลยุทธ์การเป็นมิตรต่อสิ่งแวดล้อมเชิงรุกมีการนำเครื่องมือ EMA มาใช้ในระดับปานกลาง แม้ว่าโรงแรมเหล่านี้จะให้ความสำคัญกับการดำเนินกลยุทธ์ด้านสิ่งแวดล้อม แต่ผลการวิจัยชี้ให้เห็นว่าการนำ EMA มาใช้ยังไม่ถือเป็นลำดับความสำคัญสูงสุด นอกจากนี้ผลการวิเคราะห์ยังพบว่าระดับการนำ EMA มาใช้ที่แตกต่างกันส่งผลให้เกิดผลลัพธ์ทางการเงินที่แตกต่างกัน โดยเฉพาะในด้านกำไรจากการดำเนินงาน กระแสเงินสดจากการดำเนินงาน และอัตราผลตอบแทนจากการลงทุน อย่างไรก็ตาม ระดับการนำ EMA มาใช้ไม่ส่งผลต่อปริมาณยอดขายระหว่างโรงแรมที่มีการนำ EMA มาใช้ในระดับสูงและโรงแรมที่มีการนำมาใช้อย่างจำกัด ผลการศึกษาชี้ให้เห็นว่าประโยชน์ทางการเงินของ EMA ปรากฏชัดเจนมากกว่าในด้านการควบคุมและจัดการต้นทุน เมื่อเปรียบเทียบกับด้านการสร้างรายได้

คำสำคัญ : ผลการดำเนินงานทางการเงิน การบัญชีการจัดการด้านสิ่งแวดล้อม โรงแรม กลยุทธ์เชิงรุกด้านสิ่งแวดล้อม ประเทศไทย

INTRODUCTION

Over recent decades, many businesses have placed greater emphasis on environmental sustainability by adopting strategies motivated by regulatory requirements, cost reductions, risk management, and stakeholder expectations (Dornfeld et al., 2021; Kaur & Lodhia, 2018; Kumar & Dua, 2022; Singjai & Wongrathanandha, 2022). Environmental Management Accounting (EMA) has become a useful tool for supporting sustainability management because it integrates environmental data into business decisions to help improve both environmental and financial outcomes (Burritt et al., 2019; Passetti et al., 2014; Qian et al., 2018). EMA offers both physical data and monetary data, which support regulatory compliance, enhance resource efficiency, and contribute to strategic positioning. Key EMA tools include environmental budgeting, environmental cost accounting, life-cycle assessment, and environmental performance evaluation. These tools help firms measure environmental costs, benchmark against industry standards, and align their operations with sustainability objectives (Passetti et al., 2014; Qian et al., 2018). EMA can be considered a strategic resource that helps firms gain competitive advantage by improving their operational efficiency and strengthening financial performance.

This study employs the resource-based view of the firm (RBV) to investigate the strategic role of EMA. According to RBV, firms can obtain a competitive advantage by using resources and capabilities that are valuable, rare, and difficult to imitate (Barney, 1991). EMA aligns with this framework as it offers operational and financial benefits that are difficult to replicate. Previous studies have examined the relationship between EMA and financial performance and reported mixed findings, largely due to differences across industries and regional contexts (Albertini, 2013; Deb et al., 2023; Gunarathne et al., 2021). Kruesi and Bazelmans (2023) conducted a meta-analysis and observed that many studies applying the RBV are grounded in Western contexts and recommended further research in non-Western settings. Existing research tends to concentrate on broad financial measures, with limited attention given to specific indicators such as sales volume, operating profit, and cash flow. This highlights a need for further investigation into the specific financial implications of EMA adoption.

The hotel industry provides a relevant context for investigating the adoption of EMA due to its high resource consumption, seasonal demand fluctuations, and increasing sustainability pressures (Fraj et al., 2015; Ouyang et al., 2019; Singjai et al., 2018). Many hotels have responded to these challenges and implemented green practices such as water and energy conservation, air quality improvement, and waste management. These efforts aim not only to reduce environmental impacts but also to influence customer perceptions and employee attitudes (Akgunduz et al., 2025). These operational efforts require more formal environmental management tools, such as EMA, which can support the measurement of environmental costs and the identification of efficiency improvements. Although some studies have examined EMA in Asian countries (Al-Mawali et al., 2018; Deb et al., 2023), limited research has addressed its financial implications in Thailand's hotel sector, which plays a crucial role in the national economy.

Previous research on EMA in Thailand has primarily focused on its general adoption and implementation (Klaprabchone et al., 2020; Setthasakko, 2010), often within industrial or manufacturing contexts. However, little is known about the impact of EMA on financial performance in service-based sectors. This study aims to address this gap by examining how the use of EMA tools influences financial outcomes in proactive green hotels in Thailand. In particular, it investigates whether different levels of EMA adoption lead to different levels of financial performance. By focusing on hotels that have actively embraced sustainability practices, this research seeks to offer practical insights into the value of EMA in enhancing financial performance within a resource-intensive service industry.

This study is intentionally framed as an exploratory, baseline investigation of EMA adoption among environmentally proactive hotels. EMA adoption is voluntary in Thailand and is not mandated by regulation; therefore, examining hotels that have proactively adopted green strategies provides a theoretically aligned setting for studying variation in EMA utilisation and its associated outcomes. While the hotel industry has evolved substantially since the 2016 data collection (e.g., post-pandemic disruptions, accelerated digital transformation, and the emergence of new sustainability reporting standards), establishing baseline empirical evidence remains important for theory development and for enabling meaningful comparisons in future research.

The remainder of the paper is organised as follows. Section 2 provides the theoretical background that supports this study and introduces the research hypothesis. Section 3 explains the research methodology, including the procedures for data collection and the methods used for analysis. Section 4 presents the empirical results. Finally, Section 5 discusses the findings, concludes the paper, and offers implications for both researchers and practitioners.

LITERATURE REVIEW

This section examines the resource-based view (RBV) as a theoretical lens for understanding the adoption of EMA within the Thai hotel industry. It discusses how EMA tools may enhance a firm's competitive advantage and financial performance by improving operational efficiency, managing environmental costs, and supporting sustainability initiatives. This section also examines the potential link between the extent of EMA adoption and financial outcomes.

The Resource-Based View of the Firm

The RBV asserts that firms can gain a competitive advantage by utilising resources that are valuable, rare, imperfectly imitable, and not easily substituted (Barney, 1991). These resources include both tangible and intangible assets, while capabilities refer to a firm's ability to utilise them effectively (Barney, 2001). Building on this framework, Hart (1995) proposed the natural-resource-based view of the firm and suggested that a firm's ability to implement environmental strategies is key to gaining a

competitive advantage and improving financial performance. Proactive environmental strategies can enhance operational efficiency, strengthen reputation, and shape industry standards, while also imposing additional costs on competitors (Fraj et al., 2015; Singjai et al., 2018).

To effectively measure and monitor environmental initiatives, firms require robust accounting tools. Management can rely on environmental accounting data to ensure compliance and optimise operations (Passetti et al., 2014). Therefore, EMA can be seen as a critical resource that supports firms in gaining a competitive advantage. A well-structured management accounting system can improve resource allocation and strategic planning (Ghasemi et al., 2019). By systematically identifying environmental costs and opportunities, EMA also enables firms to align their sustainability objectives with financial performance. However, limited expertise in EMA adoption remains a challenge among financial leaders (Gibassier & Palmeiro, 2020), highlighting the need for stronger engagement and capability development among financial controllers.

Although EMA has attracted growing attention in sustainability accounting research, empirical evidence suggests that its implementation remains uneven, especially in service industries such as hospitality (Setthasakko, 2010; Klaprabchone et al., 2020). In the Thai hotel context, even environmentally proactive firms often prioritise visible environmental practices or certification-related initiatives over the systematic integration of environmental information into management accounting systems (Singjai et al., 2018). From an RBV perspective, this limited diffusion may enhance the relative rarity and firm-specific nature of EMA capabilities. Unlike manufacturing firms, where environmental accounting is more directly embedded in production processes, hotels must integrate EMA across dispersed operational activities, including energy use, water consumption, waste management, and labour-intensive services. As a result, EMA adoption in hotels tends to be more path-dependent and reliant on managerial expertise and cross-functional coordination, making such capabilities more difficult to replicate (Fraj et al., 2015; Gunarathne et al., 2021).

In the resource-intensive hospitality industry, EMA can serve as a key differentiator by demonstrating a firm's commitment to sustainability, a factor increasingly valued by customers, investors, and regulators (Fraj et al., 2015; Singjai et al., 2018). Given the strategic significance of EMA, this study applies the RBV framework to examine how EMA adoption contributes to financial success.

Environmental Management Accounting (EMA) Tools

EMA refers to the integration of environmental and financial performance by developing and applying appropriate accounting methods and systems (IFAC, 2005). While traditional management accounting primarily focuses on financial data, EMA incorporates environmental considerations into decision-making, allowing firms to align sustainability initiatives with financial objectives (Burritt et al., 2019). EMA provides two primary types of information: physical data, which includes resource

consumption, waste, and emissions, and monetary data, which encompasses environmental costs, savings, and revenues (IFAC, 2005). These components facilitate a systematic assessment of environmental impacts and their financial implications, supporting firms in developing cost-effective sustainability strategies.

Various EMA tools have been identified in the literature. Each tool serves a distinct function in enhancing environmental and financial performance. Firstly, environmental cost accounting enables tracking of direct and indirect environmental costs, along with more accurate cost allocation and improved resource efficiency (Henri et al., 2014). Secondly, environmental budgeting supports cost-effective allocation of financial resources to sustainability initiatives, promoting long-term financial and environmental benefits (Blomquist et al., 2003). Thirdly, environmental life-cycle assessment (LCA) evaluates the environmental impact of a product or process across its entire life cycle and supports sustainability-focused investment decisions (Rebitzer et al., 2004). Finally, environmental performance evaluation uses financial and non-financial indicators for assessing and improving performance, reinforcing firms' sustainability commitment (Deb et al., 2023).

Beyond these specific tools, EMA encompasses broader measurement, auditing, and control functions that facilitate sustainable decision-making. Measurement tools, such as material flow cost accounting and ecological cost accounting, quantify environmental costs and identify opportunities for cost reduction (Christ & Burritt, 2015; Passarini et al., 2014). Auditing and benchmarking tools support performance assessment against industry standards, enabling continuous improvement and stronger competitive positioning (Qian et al., 2018). Control tools integrate environmental considerations into business operations, ensuring that sustainability principles are embedded within corporate decision-making processes (Qian et al., 2018). Adoption of EMA tools can enhance regulatory compliance, environmental performance, and competitive advantage through cost efficiency and innovation. From the perspective of the RBV, EMA provides firms with specialised capabilities that are difficult to imitate, positioning environmental accounting as a strategic resource that contributes to long-term financial success.

EMA Tools and Financial Performance

The adoption of EMA tools provides several financial benefits through systematic identification, measurement, and management of environmental costs. Environmental cost accounting improves cost allocation by separating environmentally related costs from conventional costs, resulting in better resource conservation, pollution reduction, and operational efficiency (Henri et al., 2014). Eco-investment accounting supports capital investment decisions by incorporating environmental costs and long-term savings, enabling sustainability-driven financial optimisation (Bouten & Hoozée, 2013). Chen and Low (2021) found that green investments may initially reduce financial performance but generate positive returns once sustainability efforts reach a critical threshold, particularly in high-polluting industries. This

suggests that firms integrating EMA into investment decisions can achieve both environmental and financial sustainability.

Across hospitality and service-sector studies, the financial effects of EMA adoption appear more consistently in cost-related performance measures than in revenue outcomes. Research examining EMA and environmental practices in hotels and related service industries reports associations with improved cost control, operational efficiency, and profitability, whereas evidence of direct sales growth tends to be weaker or more context-dependent (Bagur-Femenias et al., 2013; Leonidou et al., 2013; Gunarathne et al., 2021). Similarly, studies in emerging economy contexts suggest that EMA adoption often contributes initially to internal efficiency and risk management, with market-based or revenue-related benefits developing more gradually, if at all (Al-Mawali et al., 2018; Deb et al., 2023). A recent meta-analysis by Barani et al. (2025) confirms that EMA adoption is generally associated with enhanced organisational performance, while also highlighting how contextual factors such as national EMA maturity and performance type influence the strength of this relationship.

Environmental budgeting further enhances financial performance by embedding environmental considerations into financial planning, allowing firms to track sustainability-related expenses, revenues, and savings (Bouten & Hoozée, 2013). This approach improves financial projections and enables firms to respond proactively to budgetary challenges, ultimately increasing operational efficiency (Schaltegger & Zvezdov, 2015).

Environmental LCA extends EMA's financial relevance by revealing cost-saving opportunities throughout the supply chain. Environmental impact evaluation at each production stage supports investment in eco-friendly products, energy-efficient equipment, and sustainable infrastructure (Hellweg & Milà i Canals, 2014; Manzardo et al., 2016). In addition to cost reduction, LCA enhances brand value by signalling a strong sustainability commitment and attracting environmentally conscious consumers (Qian et al., 2018).

Auditing and benchmarking tools contribute to financial performance through environmental comparison against industry standards and best practices (Qian et al., 2018). Benchmarking facilitates targeted improvements, enhances innovation, and fosters operational efficiency. Firms that communicate these efforts effectively benefit from increased transparency, stronger stakeholder trust, and enhanced market reputation (Bagur-Femenias et al., 2013). Moreover, firms with superior environmental risk management practices often experience lower capital costs, as investors perceive them as lower-risk entities (Sharfman & Fernando, 2008). Sustainability-driven firms also gain better access to financing due to reduced information asymmetry and stronger investor confidence (Cheng et al., 2014).

EMA tools further contribute to corporate sustainability reporting, which has a direct impact on financial performance. By integrating EMA into sustainability disclosures, firms can enhance transparency, strengthen stakeholder relationships, and attract long-term investment (Gunarathne et al., 2023). Empirical

evidence links robust Environmental, Social, and Governance (ESG) initiatives with improved financial performance and increased investor confidence (Ademi & Klungseth, 2022). Sandberg et al. (2023) show that higher sustainability-related performance is associated with improved profitability measures, although the magnitude of effects varies across industries, highlighting the role of internal management systems in translating sustainability efforts into financial outcomes.

Drawing on the RBV, this study conceptualises EMA tool utilisation as a firm-specific managerial capability that supports environmental cost visibility and operational control. The empirical focus is on whether financial performance differs across hotels exhibiting different degrees of EMA tool utilisation. Accordingly, the study proposes the following hypothesis:

Financial performance varies with the extent of environmental management accounting tool utilisation.

Figure 1 summarises the conceptual framework underpinning the study.

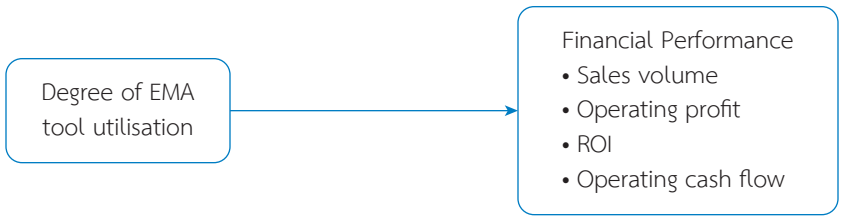

Figure 1: Conceptual framework

METHODOLOGY

This study examines businesses that actively engage in proactive environmental strategies, focusing on the Thai hotel industry for several reasons. First, tourism and hospitality are highly dependent on natural resources, yet hotels exert substantial environmental pressures through excessive energy and water consumption, fixed asset investments, ecosystem disruption, and reliance on non-durable goods (Fraj et al., 2015; Singjai et al., 2018; Su et al., 2013). Second, the hotel and tourism industries are pivotal to Thailand's economy. According to the Travel and Tourism Economic Impact 2021: Thailand report, the sector's direct contribution reached USD 106.5 billion in 2019 but plummeted to USD 41.7 billion in 2020 due to the COVID-19 pandemic (Jus & Misrahi, 2021), underscoring its economic significance. Third, while Thailand ranks 36th globally in the Travel and Tourism Development Index (Uppink & Soshkin, 2022), its environmental sustainability performance is notably weak (97th), despite strong natural resource rankings (14th). These factors collectively highlight the urgency of promoting proactive environmental strategies in Thai hotels, making this industry an ideal research context.

The study specifically targets hotels affiliated with the Green Leaf Foundation, an organisation dedicated to advancing sustainability in hospitality. Because the adoption of EMA is voluntary and not mandated by regulation in Thailand, restricting the sample to green hotels is therefore consistent with the research objectives and the RBV emphasis on heterogeneity in organisational resources and capabilities. This focus allows for an in-depth examination of differences in EMA utilisation among early adopters, rather than a comparison between adopters and non-adopters.

A population-based sampling approach was employed, with questionnaires distributed to all member hotels of the Green Leaf Foundation to ensure alignment with the study's objectives. As part of a larger research project, data were collected during a national conference held in 2016 and attended by Green Leaf–certified hotels. The conference was jointly organised by leading organisations in Thailand's tourism, hospitality, and environmental sustainability sectors. Paper-based questionnaires were administered to hotel representatives at the event. Each participating hotel appointed a representative responsible for environmental management or green strategy implementation to attend the conference. Consequently, the survey responses were provided by knowledgeable informants directly involved in the hotel's sustainability initiatives (e.g., directors, general managers, sustainability or environmental managers, or departmental managers overseeing environmental programs).

From an initial pool of 78 responses, 15 were excluded due to incomplete entries or inconsistent response patterns, yielding 63 valid questionnaires for analysis. This represents a 29 percent response rate relative to the 219 hotels registered with the Green Leaf Foundation at the time. Table 1 summarises the demographic and operational characteristics of the participating hotels.

Table 1: Characteristics of Participants

Number of Staff	n	Percentage	Number of Rooms	n	Percentage
Less than 75	10	16%	Less than 60	8	13%
75–149	6	10%	60–149	14	22%
150–249	15	24%	150–299	10	16%
250–349	4	6%	300–449	9	14%
350 and more	28	44%	450 and more	22	35%
Hotel Rating	**n**	**Percentage**	**Chain**	**n**	**Percentage**
3 stars or lower	9	14%	International chain	7	11%
4-star hotels	20	32%	Domestic chain	26	41%
5-star hotels	34	54%	Stand-alone	30	48%

Although the data were collected in 2016, they remain relevant to the present study for several reasons. First, the environmental challenges addressed by environmental management accounting—such as climate change, pollution, and resource constraints—are enduring rather than transient, and the core principles underpinning environmental management and sustainable development have not fundamentally changed. Second, EMA practices are typically embedded within organisational routines and developed over extended periods, meaning that insights drawn from earlier data remain informative for understanding patterns of adoption and implementation. Importantly, methodological guidance emphasises that the appropriateness of older data should be assessed based on the stability of the underlying phenomenon rather than the age of the dataset alone (Ketchen et al., 2023). Third, the dataset provides a meaningful baseline for assessing subsequent developments in sustainability practices, which is particularly valuable for theory development and comparative analysis over time. Finally, many regulatory and institutional frameworks governing environmental and sustainability practices that were in place at the time of data collection continue to shape organisational behaviour, supporting the continued applicability of the findings.

All constructs were measured using multi-item scales adapted from established studies and assessed via a 7-point Likert scale. The adoption of EMA tools was evaluated using a four-item instrument derived from Passetti et al. (2014), with detailed explanations provided to respondents (Table 2). Financial performance was operationalised using a four-item scale adapted from Leonidou et al. (2013), which captures respondents' assessments of their hotel's performance relative to its main competitors. This relative measurement approach is consistent with the Resource-Based View's emphasis on competitive advantage, which is inherently comparative rather than absolute. Because objective, hotel-level financial statement data were not accessible within the anonymous survey design, competitor-referenced indicators were employed to capture perceived competitive positioning instead of absolute financial outcomes. To enhance the questionnaire's validity, the instrument was reviewed by two academic experts and a hospitality industry practitioner, leading to minor refinements in wording and structure.

Table 2: Variables and Descriptions

Variable	Description
1. EMA, adapted from Passetti et al. (2014)	Please indicate how frequently your hotel makes use of the following tools? (1 = Never, 7 = Very frequently)
1.1 Environmental budgeting	An anticipation of future needs and an allocation of resources for environmental issues in the upcoming period, with the primary purpose of facilitating the establishment of environmental targets.

Table 2: Variables and Descriptions (Cont.)

Variable	Description
1.2 Environmental cost accounting	A process of recording and evaluating both direct and indirect environmental costs to enable the calculation of service provision and production costs.
1.3 Environmental life-cycle assessment	An assessment of the environmental problems associated with a product or service, considering its impact throughout its entire life cycle. It encompasses all stages of service provision, from customer check-in to check-out, including those in restaurants and other non-accommodation services within the hotel. The primary purpose is to predict environmental consequences and identify precautionary measures within and outside the organisation in a timely manner.
1.4 Environmental performance evaluation	Measurement and evaluation of environmental performance, including factors such as water usage, greenhouse gas emissions, and waste management, which connect the hotel's business operations with the environment. It utilises both financial and non-financial information to offer important insights into the environmental implications of the organisation's activities.
2. Financial performance, adapted from Leonidou et al. (2013)	Since your hotel is a green hotel, please assess its financial performance in comparison to your main competitors. (1 = Significantly worse than competitors, 7 = Significantly better than competitors)
2.1 Sales volume	The quantity of goods or services sold by a hotel during a specific period.
2.2 Operating profit (EBIT)	The profit a hotel earns from its core business operations, excluding interest and tax expenses.
2.3 Return on investment (ROI)	A financial ratio used to evaluate the efficiency or profitability of an investment. It is calculated by dividing the net profit from the initial cost of the investment.
2.4 Operating cash flow	The cash provided or used by a hotel’s core business operations during a specific period.

Given the reliance on self-reported data, steps were taken to mitigate common method bias. Procedural remedies included temporal separation of questions and assurances of respondent anonymity (Podsakoff et al., 2003). Statistically, Harman's single-factor test was conducted via principal component analysis, revealing that a single factor accounted for only 39 percent of the variance, below the 50 percent threshold indicative of significant bias. Additionally, the Lindell and Whitney (2001) test was applied, using a theoretically unrelated marker variable to control for potential common method bias in the relationships among key constructs. The correlations between this unrelated construct and the main constructs were found to be weaker than those among the main constructs themselves, suggesting minimal evidence of common method bias. Therefore, the results of these tests indicate that common method bias is unlikely to pose a significant threat to the validity of this study.

Cronbach's alpha was computed to evaluate construct validity. The results showed a Cronbach's alpha value of 0.932 which affirmed the construct validity. To test the proposed hypothesis, a two-step analysis was then employed. Firstly, a cluster analysis was conducted to identify groups of green hotels that had adopted EMA tools. Secondly, these groups were compared to determine whether varying levels of EMA tool adoption led to different financial outcomes.

RESULTS

As presented in Table 3, the descriptive statistics showed that EMA tools were adopted at a moderate level, with an average score of 3.914. Environmental performance evaluation was a tool frequently used among the green hotels, with an average score of 4.094. This was closely followed by environmental budgeting. On the other hand, environmental cost accounting had the lowest level of usage, with an average score of 3.609.

Table 3: Descriptive Statistics

Variable	Min	Max	Mean	Std Dev
EMA tools	1	7	3.914	1.673
Environmental budgeting	1	7	4.077	1.882
Environmental cost accounting	1	7	3.609	1.696
Environmental life-cycle assessment	1	7	3.714	1.853
Environmental performance evaluation	1	7	4.094	1.797

Table 3: Descriptive Statistics (Cont.)

Variable	Min	Max	Mean	Std Dev
Financial performance	3	7	4.873	0.899
Sales volume	3	7	4.984	1.129
Operating profit	2	7	4.778	0.958
ROI	3	7	4.873	0.975
Operating cash flow	3	7	4.857	0.965

Regarding the financial outcomes, the results showed that sales volume had the highest level of improvement compared to other financial indicators, with an average score of 4.984. However, it is important to note that the standard deviation of sales volume was also the highest, at 1.129.

In order to group these hotels based on their levels of adoption of EMA tools, a hierarchical cluster analysis was conducted. Based on the results, presented in Table 4, two groups of green hotels were identified: Extensive and Limited.

Table 4: Cluster Analysis Results

Cluster	N	Mean	Std Dev
Cluster 1: Extensive	47	4.617	1.080
Environmental budgeting		4.872	1.191
Environmental cost accounting		4.362	1.187
Environmental life-cycle assessment		4.404	1.469
Environmental performance evaluation		4.830	1.274
Cluster 2: Limited	16	1.609	0.689
Environmental budgeting		1.500	1.033
Environmental cost accounting		1.313	0.479
Environmental life-cycle assessment		1.688	1.302
Environmental performance evaluation		1.938	1.389

Forty-seven hotels were grouped in the Extensive cluster, which had an average score of 4.617. The results aligned with the overall findings regarding the use of EMA tools, indicating that environmental budgeting and environmental performance evaluation were the most frequently adopted tools. Although this cluster extensively embraced EMA, the frequency of use of EMA tools remained at a moderate level.

On the other hand, the Limited cluster comprised 16 hotels and showed an average score of 1.609. Although this cluster demonstrated a low level of EMA tool adoption, environmental performance evaluation was the most frequently used tool, with a score of 1.938. Notably, environmental cost accounting was the least used tool in both clusters.

Given the relatively small sample size, the ordinal nature of the Likert-scale measures, and the non-normal distribution of several variables, non-parametric statistical techniques were employed. The Mann–Whitney U test was applied to examine differences in financial performance between the identified clusters. This test is appropriate for comparing groups when variables are ordinal and distributional assumptions for parametric methods are not met, and it allows for the assessment of meaningful differences without requiring normally distributed data (Kamis et al., 2021; Nachar, 2008). Consistent with the study's exploratory design, the analysis does not aim to establish causal effects, but rather to provide baseline evidence on the association between EMA adoption intensity and financial outcomes among proactive green hotels. In this study, mean ranks of EMA tool utilisation and financial performance indicators were compared across the two clusters.

G*Power was used for power analysis, with inputs set to a large effect size, a 0.05 significance level, and 0.8 statistical power. The results indicated that the available samples were sufficient to detect a meaningful difference. The power analysis confirmed a high likelihood of detecting a meaningful effect, given the strong difference in the use of EMA tools between the clusters.

The results indicated that utilising different levels of EMA tools contributed to varying levels of overall financial performance, with a z-statistic value of –2.436 and a p-value of 0.015. Therefore, the research hypothesis was accepted at a significance level of five percent. As shown in Table 5, the mean rank of the Extensive cluster was higher than that of the Limited cluster.

Table 5: Mann-Whitney U test by Financial Performance Outcomes

Financial outcomes	Clusters	Mean rank	Mann–Whitney U	Z	P-Value
Financial performance	C1: Extensive	34.60	207	–2.436	0.015
	C2: Limited	21.80			
Sales volume	C1: Extensive	33.34	226	–1.468	0.142
	C2: Limited	25.73			
Operating profit	C1: Extensive	35.17	180	–3.023	0.002
	C2: Limited	20.00			
ROI	C1: Extensive	34.28	222	–2.276	0.023
	C2: Limited	22.80			
Operating cash flow	C1: Extensive	34.34	219	–2.340	0.019
	C2: Limited	22.60			

Regarding specific financial performance outcomes, the results demonstrated differences in operating profit, ROI, and operating cash flow between the clusters. The mean rank of the Extensive cluster was higher than that of the Limited cluster. Sales volume was the only indicator that did not show a significant difference between the clusters, with a z-statistic of -1.468 and a p-value of 0.142.

DISCUSSION

The results of the descriptive analysis indicate that environmentally friendly hotels in Thailand implement EMA tools at moderate levels. This finding aligns with Passetti et al. (2014), who examined the use of EMA tools as part of sustainability accounting in developed countries with high environmental sustainability standards. In the Thai hotel industry, even green hotels show limited adoption of EMA tools. Although previous studies highlight the benefits of EMA for environmental management and organisational performance (Burritt et al., 2019; Gunarathne et al., 2021; Schaltegger & Zvezdov, 2015), many Thai hotels have yet to fully recognise its strategic value for financial and environmental outcomes. This observation is consistent with Gibassier and Palmeiro (2020), who emphasised that EMA remains underutilised across various industries, including hospitality, partly due to the lack of awareness and involvement of financial executives in environmental decision-making.

Several key factors may explain the limited adoption of EMA tools in environmentally proactive hotels. One factor is the recent development of environmental accounting, which has created a knowledge gap among hotel management accountants (Ascani et al., 2021). Many lack the technical skills needed to apply EMA in practice. Traditional management accounting focuses on financial and

non-financial aspects of core business activities, whereas EMA necessitates additional skills in tracking and analysing environmental impacts. In the Thai hotel context, this gap may prevent management accountants from integrating environmental data into decision-making processes.

Another factor might be the limited involvement of management accountants in sustainability initiatives (Ascani et al., 2021; Mokhtar et al., 2016; Passarini et al., 2014). Although accountants normally provide financial data for business planning, they are often excluded from environmental strategy discussions. This reduces the perceived importance of EMA. Without their input, key opportunities are missed, especially in cost analysis and resource planning for waste, energy, and water management. In these areas, EMA can offer clear financial insights. For example, in waste management, EMA helps quantify savings from recycling and reduction programs. In energy use, EMA supports monitoring of consumption patterns and the adoption of efficient technologies, such as LED lighting or renewable energy. In water conservation, EMA assists in evaluating investments in low-flow fixtures and efficient systems, reducing both costs and resource use.

A third barrier is the hesitation of top management to invest in EMA systems. This is because they are unsure about how effective these systems really are (Qian et al., 2018). These systems often require financial and time commitments. Without clear evidence of return on investment, managers may be reluctant. Addressing this concern involves showing how EMA contributes to cost savings, risk reduction, and stronger competitive positioning, especially in a sector where efficient resource use directly affects profits. Building confidence in these benefits is essential to support wider adoption.

Stakeholder pressure also plays a key role in driving EMA adoption. Firms that face stronger demands from customers, investors, or regulators are more likely to implement EMA (Kaur & Lodhia, 2018). In Thailand, however, many hotels may focus on visible sustainability efforts, such as certifications, rather than internal accounting practices. This trend suggests that while stakeholder interest supports environmental action, EMA adoption still depends on internal commitment and clear regulatory guidance.

The results of the Mann–Whitney U test further reveal that higher EMA adoption is associated with improved financial outcomes, extending the findings of Deb et al. (2023). This pattern is consistent with prior hospitality and service-sector research discussed in the literature review, which suggests that the financial effects of EMA adoption tend to be more pronounced in cost-related performance measures than in revenue outcomes.

The association between EMA adoption and financial performance may be explained by several factors. First, hotels with advanced EMA frameworks have access to detailed environmental cost and resource data, allowing for more informed decision-making regarding energy use, waste reduction, and operational efficiency. By using environmental data strategically, hotels might be able to identify cost-saving opportunities, optimise resource allocation, and lower operating costs. In turn, this can lead to higher operating profits, improved cash flow, and increased return on investment.

Second, hotels with comprehensive EMA tools are better positioned to manage environmental risks, including regulatory non-compliance and potential liabilities. Proactive risk management in this area can result in substantial long-term cost savings. Third, compliance with environmental standards, such as the Green Leaf Certification, helps hotels avoid fines and legal penalties, thereby strengthening their financial position. Fourth, EMA adoption may lower the cost of capital, as hotels that follow sustainable practices can access green financing options or benefit from reduced interest rates offered by environmentally focused lenders (Minor International, 2024).

In contrast, the absence of a significant difference in sales volume between hotels with Extensive and Limited EMA adoption aligns with earlier empirical evidence suggesting that revenue-related benefits of EMA are more context-dependent and may materialise less directly than cost-related effects. In Thailand's hospitality sector, guest decisions are influenced more by visible sustainability practices than by internal accounting tools. This aligns with Le et al. (2024), who found that CSR initiatives, especially those observable to consumers, such as eco-certifications and community engagement, strengthen brand loyalty and competitive positioning. While EMA systems support operational efficiency and cost savings, their indirect effect on revenue may depend on how well hotels use EMA insights to shape and communicate tangible sustainability actions. As such, the financial benefits of EMA may be fully realised only when combined with targeted stakeholder engagement strategies.

This finding highlights the importance of effective communication in the competitive hospitality market, particularly in Thailand, where eco-tourism is expanding. To maximise the benefits of EMA, hotels should pair internal sustainability efforts with clear and transparent environmental messaging. As previous studies suggest (Fraj et al., 2015; Singjai et al., 2018), consumer preferences are shaped more by how hotels communicate their sustainability initiatives than by the technical details of their EMA systems.

The findings should be interpreted in light of the 2016 data collection context. Since that time, Thai hotels have experienced major environmental and operational shifts, including post-pandemic disruptions, accelerated digital transformation, and a more formalised sustainability and ESG landscape. These developments may have influenced how hotels implement and leverage EMA tools in more recent periods. Accordingly, the present results are best interpreted as baseline evidence on EMA adoption among proactive green hotels prior to these structural changes, providing a reference point for future comparative or longitudinal research and for the interpretation of the practical implications discussed below.

Implications

From a practical perspective, this study shows that EMA implementation in the hotel industry offers positive returns, especially in resource management and cost reduction. Hotels adopting EMA can achieve dual benefits: stronger sustainability and better financial performance. EMA data can pinpoint resource-intensive operations, such as energy use in air conditioning and water consumption in laundry services. By using these insights to adopt smart energy systems and optimise water recycling, hotels can cut costs while enhancing their sustainability credentials.

The findings also have important policy implications for Thailand's hotel industry. First, there is a need for targeted training programs that equip management accountants and hotel managers with the knowledge and skills required for effective EMA implementation. Second, policymakers could introduce financial incentives, such as tax credits, subsidies, or low-interest loans, to support hotels in adopting EMA systems and investing in broader sustainability initiatives. Third, establishing recognition programs for hotels that successfully implement EMA could foster industry-wide competition and promote environmental responsibility. Additionally, mandating the disclosure of environmental impact data could further drive EMA adoption, leading to improved environmental performance and market positioning.

This study contributes to the growing EMA literature by providing empirical evidence on its adoption and financial impact within Thailand's hotel industry. It also extends the application of the RBV by demonstrating that EMA functions as a strategic resource, offering valuable insights for cost control and regulatory compliance, remaining rare due to its limited adoption, being difficult to imitate because of the required expertise, and being non-substitutable by traditional accounting systems.

Furthermore, the findings highlight the influence of consumer perceptions on hotel sustainability practices. While EMA plays a key role in internal resource management, its financial impact becomes more significant when combined with visible sustainability initiatives. To maximise EMA's strategic value, hotels should convert sustainability efforts informed by EMA into actions that engage guests. Public reporting of energy savings, visible waste reduction efforts, and the inclusion of sustainability messages in marketing can strengthen brand reputation, attract environmentally conscious travellers, and enhance financial performance.

CONCLUSION

This study examines the adoption and impact of EMA in environmentally proactive hotels in Thailand, revealing that while EMA tools are implemented at moderate levels, their full potential remains underutilised. This pattern aligns with findings from developed countries, where firms committed to sustainability do not always prioritise EMA. However, EMA's benefits—such as improved resource

allocation, risk mitigation, and strategic decision-making—underscore its importance for both environmental and financial performance.

Despite its advantages, several challenges hinder EMA adoption, including management accountants' limited environmental expertise, their lack of involvement in sustainability initiatives, and scepticism among top management regarding EMA's effectiveness. Nevertheless, hotels with higher EMA adoption achieve better financial outcomes, reinforcing the need for greater awareness of EMA's strategic value. Notably, EMA adoption does not significantly impact sales volume, suggesting that consumers are more influenced by visible environmental initiatives than by the internal application of EMA tools. This highlights the importance of integrating EMA within broader sustainability strategies while effectively communicating green efforts to stakeholders.

To further enhance the robustness and cumulative value of research in this area, future studies could expand the sample size to enable the application of more advanced statistical techniques and the inclusion of additional control variables. It should also be noted that the financial performance measures in this study rely on managers' perceptual assessments relative to competitors. These measures capture perceived competitive performance and do not represent audited or objective financial figures. While the present study provides baseline empirical evidence on EMA adoption among proactive green hotels, subsequent research may build on these findings by incorporating more recent data and alternative performance measures where feasible.

In particular, examining the post-COVID-19 landscape could offer valuable insights into whether recent disruptions have accelerated EMA adoption as part of broader resilience and risk-management strategies. Future studies may also explore key drivers of EMA implementation—such as regulatory frameworks, competitive pressures, stakeholder expectations, and organisational culture—to deepen understanding of how EMA evolves over time and to inform policy development and industry best practices.

Overall, strengthening EMA adoption in Thailand's hotel industry presents an opportunity to align sustainability with financial performance. By integrating EMA into their strategic frameworks, hotels can optimise resource use, enhance cost efficiency, and reinforce their position in an increasingly eco-conscious market. Collaboration among industry stakeholders and policymakers will be crucial in fostering a more sustainable and competitive hospitality sector, ensuring long-term environmental and economic benefits.

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