

REVENUE MANAGEMENT REINVENTED: LEVERAGING TECHNICAL KNOW-HOW TO UNLOCK HOTEL EFFICIENCY

Abstract

 **Karam Zaki, PhD,**
Professor of Business Administration
Business Administration Department,
College of Science Humanities,
Shaqra University,
Saudi Arabia;
Faculty of Tourism Hotels,
Fayoum University,
Egypt
E-mail: kzaki@su.edu.sa

Purpose – Revenue management (RM) is no longer just a tool for optimizing revenue but a strategic framework for driving net profits and sustainable growth. This study reimagines RM in green hotels as a dynamic, innovation-driven process, leveraging digitalization to create smarter, data-driven decision-making ecosystems. It explores the role of RM enablers—organizational culture (OC), demand prediction (DP), distribution networks (DN), competition analysis (CA), tailored pricing (TP), and regular evaluations (RE)—in boosting hotel efficiency. Additionally, it investigates how technical know-how (TKH) acts as a catalyst, mediating the link between RM practices and hotel efficiency.

Methodology/Design/Approach – A multiple case study approach was applied, targeting green hotels in Saudi Arabia. Data were collected through 405 self-designed questionnaires distributed among hotel executives. Data envelopment analysis (DEA) was employed to calculate hotel efficiency scores. The random forest (RF) algorithm was utilized as a machine learning tool to predict model performance and identify feature importance metrics. Finally, structural equation modeling (SEM) was used to test the proposed hypotheses and mediation effects.

Findings – The study identified a significant positive relationship between RM enablers and hotel efficiency. TP, DP, and CA emerged as the most influential enablers, with high contributions to model accuracy and node purity. While, OC, DN, and RE showing limited effects. Machine learning analysis confirmed the predictive accuracy and feature importance of the proposed model. The mediation analysis revealed that TKH strengthens the relationship between RM actions and hotel efficiency.

Originality of the research – This study integrates advanced machine learning techniques with RM enablers to provide a comprehensive framework for enhancing hotel efficiency. It highlights the mediating role of TKH, offering new perspectives for RM literature.

Keywords Revenue management, technical know-how, efficiency, green hotels, machine learning, random forest.

Original scientific paper

Received 09 February 2025

Revised 03 April 2025

07 May 2025

Accepted 17 May 2025

<https://doi.org/10.20867/thm.32.1.9>

INTRODUCTION

In an era marked by rapid technological advancements and evolving consumer expectations, the hospitality industry faces unprecedented challenges in maintaining operational efficiency and competitive advantage (Zaki, 2025). Grounded in Social Exchange Theory (SET), we posit that norms of reciprocity and trust within an organization foster a supportive organizational culture (OC) that motivates employees to engage with Revenue Management (RM) initiatives, addressing the convergence of dynamic market forces, such as fluctuating demand patterns and the increasing complexity of distribution channels. This SET-driven culture necessitates innovative approaches to efficiency optimization. Revenue management (RM) strategies, encompassing technical pricing, distribution processes, and competitive positioning, have emerged as critical levers for achieving this goal. However, the effectiveness of these strategies hinges on the interplay between organizational capabilities and technical know-how (TKH), a dimension often overlooked in traditional efficiency frameworks (Kumar et al., 2024).

In the hospitality sector, particularly within hotels, RM is a carefully developed strategic approach aimed at maximizing total revenue and improving operational efficiency by optimizing pricing structures and inventory in line with varying consumer demand (Schwartz et al., 2024). According to SET, employees are more likely to reciprocate organizational support—through training, recognition, and open communication—with proactive adoption of RM practices, thereby strengthening the link between RM actions and efficiency. This advanced practice is essential for enhancing hotel performance and ensuring long-term economic viability in a competitive marketplace (Zaki, 2022). The complex interplay between RM actions and operational efficiency in hotel settings involves several elements, including innovative pricing strategies, precise demand forecasting methods, and the effective use of dynamic distribution channels that adjust to real-time market conditions (Guillet & Chu, 2021).

Current research concerning digital transformation in general, and technical know-how (TKH) particularly primarily concentrates on advanced economies, where technological infrastructure is notably developed and enterprises enjoy enhanced access to resources (Bilgihan & Ricci, 2024). Although an increasing volume of literature has scrutinized the effects of TKH on business operations, particularly regarding technology adoption and innovation, a significant portion of this research neglects the distinctive context of hotels in developing nations such as Saudi Arabia (Alrawadieh et al., 2021). Furthermore, there exists

a paucity of insights into how elements such as technical proficiency, innovative technical approaches, and business networks interact to shape the digitalization transitioning process within these environments.

By aligning RM initiatives with TKH enterprises, hospitality establishments can utilize technological advancements more effectively to focus on innovation, enhance operational efficiency, and elevate their competitive stance in the digital landscape. SET underscores that a strong OC—characterized by mutual trust and equitable exchanges—serves as the bedrock for synchronizing TKH and RM efforts, ensuring that technical initiatives are embraced and sustained. This synchronization is essential for ensuring that TKH initiatives are executed efficiently to achieve the anticipated results (Sarwar et al., 2024). This congruence will manifest in digital transformation through various stages, including improved alignment and increased efficiency.

This study seeks to address this gap by employing a dual-method approach that integrates machine learning—via random forest (RF) regression—and structural equation modeling (SEM) to investigate the predictors of hotel efficiency. By analyzing the roles of tailored pricing (TP), demand prediction (DP), competition analysis (CA), and other key variables, the research not only identifies actionable drivers of efficiency but also explores the mediating influence of TKH in optimizing RM strategies. This innovative methodological approach provides a holistic understanding of efficiency dynamics, offering both theoretical advancements and practical solutions for the hospitality sector.

The findings presented herein aim to contribute to the broader discourse on sustainable and competitive hotel management by emphasizing the pivotal role of SET-informed integrated RM strategies and technical expertise. Through this lens, the study aspires to equip hotel managers, policymakers, and industry stakeholders with actionable insights for navigating the complexities of modern hospitality operations while fostering a culture of continuous innovation and excellence.

1. LITERATURE REVIEW

1.1. Supported theory

Social exchange theory (SET) suggests that individuals participate in interactions after evaluating the associated costs and benefits (Meira & Hancer, 2021). Within SET, the norms of reciprocity and trust generate a supportive organizational culture (OC) that motivates employees to engage in desired behaviors. In the realm of hotel RM, SET implies that when employees perceive fair exchanges—through recognition, feedback, and shared goals—they are more likely to adopt and effectively apply RM strategies. Accordingly, OC operates as the SET-based mechanism that fosters reciprocity (employees reciprocate organizational support with proactive RM actions) and builds trust (confidence in management's decisions and systems), ultimately shaping efficiency outcomes.

Accordingly, we posit that a strong SET-driven OC reinforces employees' willingness to participate in precise demand forecasting, effective distribution methods, and tailored pricing strategies (Zaki, 2022), because they expect equitable return for their efforts. Conversely, a deficient OC erodes trust and inhibits the norm of reciprocity, leading to resistance or superficial compliance with RM initiatives (Mohammed & Guillet, 2024). Therefore, integrating SET into our framework highlights OC as both a direct driver of hotel efficiency (through enhanced RM practice adoption) and as a baseline condition enabling technical know-how to mediate RM–efficiency linkages.

1.2. Revenue management and hotel's efficiency

Within the context of the hospitality industry, specifically in hotels, RM represents a systemic strategic system—not merely a set of isolated practices—that seeks not only to maximize overall revenue but also to enhance operational efficiency through the careful optimization of pricing structures and inventory levels in response to the inherent fluctuations in consumer demand (Okumus, 2004; Schwartz et al., 2024). Talón et al. (2014) identify RM culture as the most critical success factor, serving as the integrative force that aligns each component into a coherent, mutually reinforcing system. The implementation of this sophisticated practice is of paramount importance as it plays a crucial role in bolstering hotel performance metrics and ensuring long-term economic sustainability within a highly competitive market landscape (Zaki, 2022; Zaki & Qoura, 2019). The intricate relationship that exists between RM practices and operational efficiency in hotel environments is undeniably multifaceted, encompassing a variety of components such as innovative pricing strategies, accurate demand forecasting techniques, and the efficient utilization of dynamic distribution channels that adapt in real time to market conditions (Guillet & Chu, 2021). Below, one can find a delineation of the key aspects that significantly contribute to the multifaceted RM concept and understanding of this vital relationship:

First, organizational culture (OC) is more crucial than substantial investments in cutting-edge tools and systems (Vinod, 2024). Beyond technology investments, a strong RM culture ensures that forecasting, pricing, distribution, and evaluation operate in concert (Talón et al., 2014). RM strategies will be effective when guests at the hotel experience fairness (Yeoman, 2024). The challenge lies in grasping customers' perceptions of product value and accurately aligning product pricing, allocation, and availability with each customer segment. The extent of fairness perceived by customers significantly influences their satisfaction and reviews. Customer satisfaction and perceptions of pricing fairness vary according to cultural context. The

extensive use of data raises concerns regarding customer security. The introduction of artificial intelligence, automated services, and robotics encounters internal resistance to embracing the latest technologies. Organizational dedication and support are crucial for maintaining a cooperative workplace atmosphere (Kuokkanen, 2024). It is imperative to provide training for hotel managers to promote infrastructure that facilitates a seamless RM system (Lee et al., 2024).

Second, demand prediction (DP) is crucial for hotel revenue management. Accurate forecasts ensure smooth operations, preventing both customer dissatisfaction from unmet demand and costly overcapacity. Understanding and anticipating demand segments based on reservation history is key to managing capacity effectively (Moula et al., 2024). However, many hotels still rely on experience rather than quantitative methods for forecasting. This is despite evidence that mathematical models can effectively predict demand in sectors like catering and hospitals (Zaki, 2022). Modern RM systems often incorporate sophisticated forecasting and pricing strategies, such as dynamic pricing, early booking discounts, and overbooking, to optimize revenue and manage capacity effectively (Webb et al., 2024).

Third, in view of distribution networks (DN), multichannel distribution strategies—spanning mobile apps, OTAs, and direct booking platforms—must be aligned with forecasting and pricing modules to optimize inventory allocation (Qian et al., 2020). To effectively manage inventory and maximize revenue, hotels should adopt a multi-channel distribution strategy instead of relying on a single booking channel (Binesh et al., 2024).

Fourth, strategic positioning depends on competitive insights that feed back into forecasting accuracy and pricing rules, ensuring that hotels can adjust offers in response to rivals' moves (Tian et al., 2024). Different strategies suit different hotels. After analyzing competitors, hotel managers should review their budgets to ensure they are cost-effective (Webb et al., 2024). Fifth, tailored pricing (TP) is a critical aspect of hotel revenue management. Dynamic pricing algorithms must draw on demand forecasts, competitive data, and distribution constraints to set optimal rates, while maintaining price equity for customer satisfaction (Dubé et al., 2024). Dynamic pricing strategies, such as offering different prices for different seasons or customer segments, are essential for optimizing revenue and managing inventory. While dynamic pricing can improve profitability, it's crucial to maintain price equity to ensure customer satisfaction (Pons et al., 2024). Modern RM systems leverage technology like AI to personalize pricing for each customer based on their history, location, and other data, creating a more tailored and customer-centric approach (Adanse et al., 2024).

Sixth, regular evaluations (RE) are crucial for assessing the effectiveness of RM strategies. Hotel managers should regularly evaluate key performance indicators like occupancy rates, average room rates, and RevPar to track profitability. Budget comparisons and employee incentives for upselling and cross-selling are also important elements of this process. This stage of review is particularly critical during pandemics, as they can significantly impact revenue and operations (Nicolau et al., 2024). Notably, research on hotel efficiency focuses on how effectively hotels utilize their resources. Efficiency can be categorized as “allocative” and “technical.” Technical efficiency measures how well a hotel uses its inputs (like staff and resources) to maximize its output (like occupancy and revenue) (Zaki & Qoura, 2019). While traditional methods like financial ratios can provide some insights, advanced techniques like *Data Envelopment Analysis (DEA)* have become more popular for measuring efficiency, allowing for benchmarking and comparisons between hotels. This study focuses on technical efficiency, measured using DEA (Tewari & Arya, 2024). Our systemic RM framework posits that RM culture mediates the interplay among DP, DN, CA, TP, and RE, yielding emergent improvements in technical efficiency. To support this claim, the following related sub-hypotheses are put forth:

- H1: OC has a positive effect on hotel's efficiency.
- H2: DP has a positive effect on hotel's efficiency.
- H3: DN has a positive effect on hotel's efficiency.
- H4: CA has a positive effect on hotel's efficiency.
- H5: TP has a positive effect on hotel's efficiency.
- H6: RE has a positive effect on hotel's efficiency.

1.3. The role of technical know-how in the RM-hotel's efficiency relationship

The evolving global business environment, characterized by increased digitalization, calls for a thorough reevaluation of international business practices. Although Saudi Arabia is progressing in its digital transformation, there is a notable scarcity of academic research focusing on digitalization in the hospitality sector (Zaki et al., 2025). Gaining insight into the advancement of digital technologies is essential for expediting international business operations within the service industry (Bilgihan & Ricci, 2024). Digitalization serves as a fundamental catalyst for service sector growth, enhancing communication and interactions between service providers and their customers (Alrawadieh et al., 2021). A major obstacle faced by hotels in Saudi Arabia is the necessity for a proficient workforce equipped with robust technical skills (Hasan et al., 2024; Zaki, 2025). The process of acquiring knowledge is critical for the development of products and services, especially in emerging markets (Panigrahi et al., 2024). An adept workforce is vital for the effective application of digital technologies, with research indicating that metaverse environments can enhance social interactions, boost service responsiveness, and encourage collaborative innovation (AlQershi et al., 2020).

Moreover, drawing on SET, we argue that a strong, trust-based RM culture encourages employees to invest in TKH, reciprocating organizational support with proactive skill development (AlQershi et al., 2020; Ramachandran et al., 2024). Incorporating sustainability into business strategies can stimulate innovation and tackle social and environmental challenges (Carlisle et al., 2021). Additionally, the correlation between innovation and performance is particularly evident in the manufacturing sector (Games et al., 2024). By making technical know-how a central element of their business strategies, hotels in Saudi Arabia can improve their competitive edge, contribute to economic development (Alwakid et al., 2021), and secure a sustainable competitive advantage by effectively recognizing and seizing market opportunities (Abusalma, 2021). Therefore, the next hypothesis is suggested:

H7. Technical know-how has a positive effect on hotel's efficiency.

Technical know-how acts as a critical mediator between revenue management practices and hotel efficiency. Under a supportive OC characterized by reciprocity and trust, employees acquire and apply advanced technical capabilities more readily, empowering hotels to implement sophisticated strategies, leading to improved operational performance and financial outcomes. Key technical capabilities include market segmentation, demand forecasting, and capacity allocation. These capabilities are essential for optimizing revenue management practices and are facilitated by advanced data analytics and IT systems. Market segmentation and demand forecasting, enabled by technical know-how, allow hotels to accurately predict demand and adjust pricing strategies accordingly (Sullivan & Wamba, 2024). Furthermore, technical expertise in capacity allocation enables hotels to dynamically adjust prices based on demand fluctuations, maximizing room occupancy and revenue (Vives & Jacob, 2023). The use of sophisticated pricing models, facilitated by technology, allows hotels to set optimal prices that reflect market conditions and customer willingness to pay.

The integration of IT systems enhances data collection, processing, and analysis, leading to more informed decision-making and improved operational efficiency (Pereira & Cerqueira, 2022). However, the complexity of implementing and maintaining advanced IT systems—and the ethical considerations of dynamic pricing—must be managed through continuous organizational support and transparent communication, reinforcing SET's norms of trust and reciprocity (Kumar et al., 2024). From the above literature, it is hypothesized that:

H8. Technical know-how mediates the relationship between RM actions and hotel's efficiency.

2. METHODOLOGY

2.1. Sample, measurement, and data collection

This study examines key managerial personnel in eco-friendly hotels who have obtained certifications for implementing sustainable practices. According to the ETIC Hotels database, there are a total of 59 eco-friendly hotels in Saudi Arabia, comprising 22 five-star and 37 four-star establishments (ETIC Hotels, 2024). The majority of these hotels are concentrated in the eastern region, particularly in Al Khobar, which is where most of the hotels selected for this study are located. The selection process for the Saudi hotels was thorough and involved careful consideration, ultimately including all 59 hotels in the analysis. A self-reported survey was distributed via email to hotel managers, accompanied by a warm message outlining the study's aims. Participation in the survey was voluntary, and hotel managers forwarded it to their department heads, encouraging them to complete it. In total, the survey was sent to 500 individuals. Of these, 405 valid responses were received, making the response rate an impressive 81%. Data collection took place during the summer of 2024.

The development of this research was informed by established scale measures from prior studies, with modifications made to the wording to better align with the specific research objectives (Zaki, 2022). In order to keep the RM scale concise and reduce the potential for response bias due to fatigue, careful consideration was given (Aboramadan & Karatepe, 2021). All RM actions were evaluated using a 5-point Likert scale featuring a structure of 4*6. The survey included 4 items for OC, 4 items for DP, 4 items for DN, 4 items for CA, 4 items for TP, and 4 items for RE. Additionally, the understanding of technical know-how was assessed through 4 items as recommended by (Jibril et al., 2024).

To figure out the sample characteristics, we found that out of the 405 hotel executives from eco-friendly hotels in Saudi Arabia, 79% were male and 21% were female. The age distribution revealed that 60% of participants were under 30 years old, while 30% were between 30 and 40 years, and 10% were over 40 years. A notable 70% of respondents had between 5 to 10 years of experience in the industry. In terms of educational qualifications, 40% of the participants held a bachelor's degree, while the most common education level was a diploma, accounting for 30%. The remaining respondents had higher educational qualifications.

2.2. Data analysis

The data for this study was derived from questionnaire-based perceptions and data envelopment analysis (DEA) calculations for efficiency ratios. Initially, the analysis employed JASP 19.2, leveraging its machine learning capabilities to run a random

forest (RF) model. This step aimed to predict model performance and assess feature importance metrics (Dursun-Cengizci & Caber, 2024; Herrera et al., 2024; Wang, 2021). RF is particularly well-suited for capturing non-linear relationships, making it ideal for predictive analyses, as opposed to purely inferential goals.

Following this, structural equation modeling (SEM) was utilized to examine the relationships within the measurement model, aligning with the recommendations of Zaki (2022). This combination of methodologies enabled us to generate predictions and evaluate model accuracy with a new dataset, adhering to (Shmueli et al., 2019)'s guidelines. The decision to integrate SEM, supported by JASP, was informed by its proven effectiveness in managing complex models with multiple indicators, even when sample sizes are relatively small (Hair et al., 2021).

This approach was particularly relevant for our study, which seeks to uncover the intricate connections between RM actions and hotel efficiency. By capitalizing on JASP's robust suite of tools, including machine learning capabilities, we conducted a thorough and methodologically sound evaluation of our model's predictive power. This integrated analysis ensured a comprehensive exploration of the relationships underpinning hotel efficiency.

3. RESULTS

3.1. Random forest regression results

The Random Forest regression model employed in this study demonstrates robust performance in predicting efficiency, leveraging its ensemble structure and inherent ability to handle non-linear relationships. The model was built with 70 decision trees, a relatively standard configuration that ensures stable predictions without overfitting. By using two features at each split, the model maintains diversity across trees while mitigating the risk of overfitting. The dataset was partitioned into training (n=259), validation (n=65), and testing (n=81) subsets, following a sound strategy to ensure model reliability.

The model (Table 1) achieved low mean squared error (MSE) values for both the validation (0.01) and test datasets (0.011), indicating high accuracy in predictions and strong generalization capabilities. Additionally, the out-of-bag (OOB) error of 0.008 corroborates the model's ability to generalize well to unseen data. This aligns with the optimization of the model based on the OOB MSE, confirming its reliability.

In terms of performance metrics, the model reports an MSE of 0.011, which reflects minimal average squared error between predicted and actual values. The scaled MSE of 0.883, being less than 1, suggests that the model captures a significant portion of the variance in the target variable. The root mean squared error (RMSE) of 0.105 provides an interpretable measure of error in the same unit as the dependent variable. Meanwhile, the mean absolute error (MAE) of 0.061 signifies that, on average, predictions deviate only slightly from actual values. The mean absolute percentage error (MAPE) of 9.14% indicates that the model's predictions are within acceptable error margins for practical applications. The R^2 value of 0.706 suggests that 70.6% of the variance in the dependent variable is explained by the independent variables, underscoring the model's strong predictive capability.

Feature importance analysis reveals that among the six independent variables, three stand out as the most influential predictors of efficiency: TP, DP, and CA. TP emerges as the most critical feature, demonstrating the highest mean dropout loss (0.082) and the greatest increase in node purity (0.218), underscoring its significant predictive power. DP follows closely as the second most important feature, with a notable node purity increase of 0.21 and a dropout loss of 0.077, highlighting its substantial impact on the model. CA also exhibits strong predictive relevance, with a node purity of 0.179 and a dropout loss of 0.076. In contrast, RE, DN, and OC contribute less to the model's predictive accuracy, with DN and OC being the least impactful.

In conclusion, the RF model performs well, with low error metrics and substantial explanatory power. Key predictors such as TP, DP, and CA offer actionable insights, making them critical variables for improving efficiency. Practically, these results suggest that stakeholders should focus on enhancing processes or systems related to TP and DP, as these have the highest potential to drive improvements in efficiency. The findings provide a strong foundation for further analysis and strategic decision-making to optimize performance.

Table1: **Model summary of RF regression (Total =405)**

Trees	Features per split	n(Train)	n(Validation)	n(Test)	Validation MSE	Test MSE	OOB Error
70	2	259	65	81	0.01	0.011	0.008

Note. The model is optimized with respect to the *out-of-bag mean squared error*.

Model Performance Metrics

	Value
MSE	0.011
MSE(scaled)	0.883
RMSE	0.105
MAE / MAD	0.061
MAPE	9.14%
R ²	0.706

Feature Importance Metrics

	Mean decrease in accuracy	Total increase in node purity	Mean dropout loss
TP	0.002	0.218	0.082
DP	0.001	0.21	0.077
CA	0.001	0.179	0.076
RE	4.077×10^{-4}	0.128	0.074
DN	2.368×10^{-4}	0.127	0.071
OC	4.375×10^{-4}	0.1	0.069

Note. Mean dropout loss, defined as root mean squared error (RMSE) is based on 50 permutations.

Source: Own work

3.2. SEM (measurement and structure model) findings

The evaluation of the reflective measurement model involves several key criteria, including the assessment of outer loadings and the significance of indicators, as well as reliability and validity measures. Specifically, we examine Cronbach's alpha (α) and composite reliability (CR) for reliability, alongside average variance extracted (AVE) for convergent validity, and the Heterotrait-Monotrait Ratio (HTMT) for discriminant validity.

To begin with, all outer loadings meet or exceed the threshold of 0.60, with values ranging from 0.808 to 0.938, and a significance level below 0.001. Table 2 demonstrates that the measurements employed in this study display robust reliability, as all loadings are above 0.60. Although a factor loading of 0.70 is often recommended, it is important to note that factors with loadings below this threshold should not be discarded without careful consideration of their impact on the overall reliability of the construct. Additionally, maintaining communalities between 0.60 and 0.70 is advised (Becker et al., 2023). Next, the reliability and validity assessments reveal that the values for α , CR, and AVE surpass the suggested cut-off levels of 0.82, 0.86, and 0.77, respectively, indicating strong reliability and convergent validity. Finally, all HTMT values for the constructs remain significantly below the critical threshold of 0.85, as outlined by Henseler et al. (2015), thus confirming discriminant validity, as shown in Table 3.

Table 2: **Measurement model**

OC				
Indicators	Loading	Cronbach's alpha	CR	AVE
The hotel actively promotes the adoption of revenue management strategies.	0.914	0.892	0.93	0.82
Our corporate revenue management team stays current with the latest revenue management techniques.	0.907			
Our corporate team recognizes the importance of customer feedback regarding product value and pricing.	0.809			
Our corporate standards advocate for staff to eliminate organizational barriers that hinder innovation.	0.808			
DP				
The hotel cancels reservations in case of overbooking.	0.926			
This hotel evaluates current reservation trends against historical data.	0.923	0.920		
We acknowledge the advance notice provided for reservations across different market segments.	0.938		0.95	0.86
We assess upcoming events that may impact the environment and society.	0.927			
DN				
The corporate team evaluates the status of various distribution channels.	0.918			
They identify the most cost-efficient channels simultaneously.	0.919			
Guests have the option to make reservations through the hotel's website.	0.938	0.916	0.95	0.86
This corporate team reacts swiftly to market changes and competitors.	0.937			
CA				
Our hotel recognizes its competitors.	0.904			
We assess and compare the pricing strategies of our rivals.	0.867			
We examine the market segments derived from various distribution channels.	0.856	0.848	0.91	0.77
We evaluate the profit contribution of each market segment.	0.854			
TP				
We are dedicated to implementing pricing strategies tailored to different customer segments.	0.918			
We promote bundled offers for accommodations and catering services.	0.909			
Our approach takes into account various factors, including distribution channels, market competition, budget constraints, and customer demand.	0.927	0.907	0.93	0.83
We utilize the Best Available Rate (BAR) model to ensure our pricing remains competitive and appealing.	0.926			

RE				
We assess the profitability gained through the implementation of revenue management strategies, focusing on occupancy rates, average daily rates, and RevPAR (Revenue Per Available Room).	0.928			
We conduct daily reviews of revenue outcomes against performance objectives to ensure alignment.	0.924	0.896	0.92	0.82
We analyze actual results versus budgeted figures to identify any discrepancies.	0.900			
We provide incentives to promote increased reservations.	0.835			
Technical know-how (TKH)				
unperformed employees of technical know-how applications limits hotel's adoption of digitalisation.	0.926			
I think the cost of high technology applications affects hotels.	0.928	0.887	0.93	0.82
I think inadequate technical personnel affects hotels.	0.854			
The high cost of technical staff has affected hotel services.	0.853			

Source: Own work

Table 3: HTMT results

Constructs	OC	DP	DN	CA	TP	RE	TKH
OC							
DP	0.510						
DN	0.826	0.670					
CA	0.559	0.715	0.530				
TP	0.826	0.670	0.826	0.670			
RE	0.559	0.715	0.530	0.559	0.715		
TKH	0.859	0.815	0.830	0.659	0.715	0.830	

Source: Own work

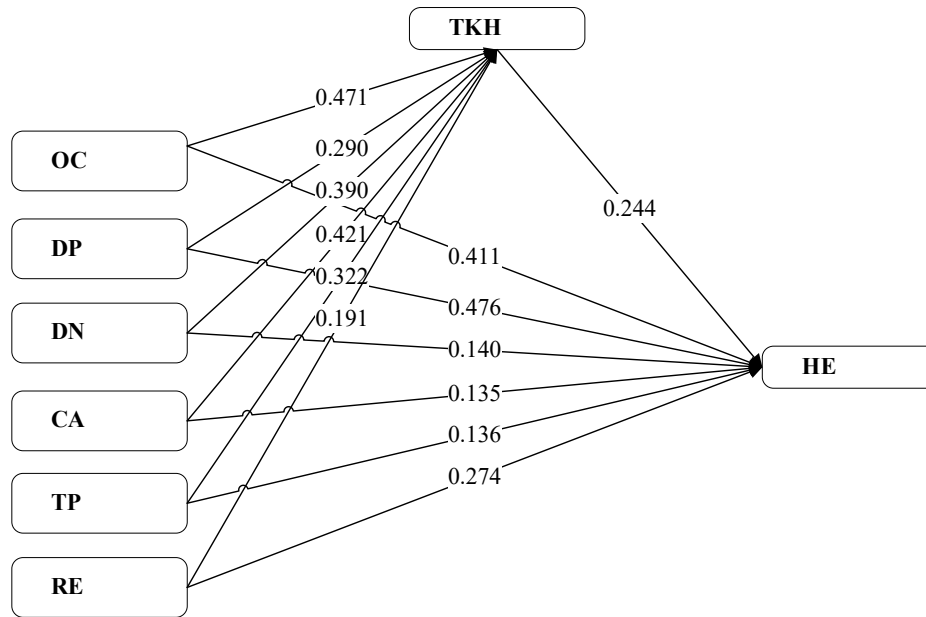
The results presented in Figure 1 and Table 4 provide valuable insights into the hypothesized relationships under investigation.

Hypothesis 1: There is a significant and positive relationship between OC and hotel efficiency, as indicated by a path coefficient (β) of 0.411. This finding suggests that OC has a substantial positive impact on the efficiency of hotels. The associated t-value of 8.283 and a p-value of 0.000 validate the statistical significance of this relationship, highlighting OC's considerable role in enhancing hotel efficiency.

Hypothesis 2: Similarly, DP exhibit a strong and significant positive effect on hotel efficiency, with a path coefficient (β) of 0.476. The t-value of 18.496, paired with a p-value of 0.000, underscores the importance of effective DP initiatives in fostering hotel efficiency. **Hypothesis 3:** The relationship between DN and hotel efficiency is also found to be positive and significant, with a path coefficient (β) of 0.140. A t-value of 13.426 and a p-value of 0.000 further confirm that DN significantly contributes to improving hotel efficiency, emphasizing the crucial role of dynamic distribution strategies in pricing. Additionally, hypotheses H4 through H6 are supported, with respective path coefficients of $\beta = 0.135, 0.136, \text{ and } 0.274$, all accompanied by a p-value of 0.000.

The assessment of the structural model offers further insights through the evaluation of R^2, F^2, Q^2 , and Variance Inflation Factor (VIF) values in relation to the model factors. The R^2 value of 0.508 reveals that OC and TKH together explain 50.8% of the variance in hotel efficiency, demonstrating strong predictive capability. The F^2 value of 0.395 indicates a large effect size, suggesting that all relevant model actions significantly contribute to hotel efficiency. The Q^2 value of 0.568 reflects the model's predictive relevance. Additionally, all VIF scores above 3.520 suggest no serious concerns with multicollinearity among the variables (Hair et al., 2021).

Figure 1: Structure model



Source: Own work

Table 4: Results of structural model

Path	Beta	T statistics	P values	Decision
OC → HE	0.411	8.283	0.000	Supported
DP → HE	0.476	18.496	0.000	Supported
DN → HE	0.140	13.426	0.000	Supported
CA → HE	0.135	10.320	0.000	Supported
TP → HE	0.136	17.258	0.000	Supported
RE → HE	0.274	15.249	0.000	Supported
Mediating Effect				
RM composite → TKH → HE	0.191	6.737	0.000	Supported

Source: Own work

This research emphasizes the considerable impact of RM actions on HE and highlights the mediating role of TKH in this relationship. To investigate this mediating effect, the study employs a non-parametric bootstrapping approach at a 1% significance level, along with Variance Accounted For (VAF) to measure the extent of the mediating influence (Hair et al., 2021). The findings indicate a significant indirect effect of RM actions on HE via TKH, with a coefficient of $\beta=0.24$ and a p-value less than 0.01. This evidence supports hypotheses H7 and H8, confirming the importance of TKH in enhancing hotel efficiency through effective RM strategies.

DISCUSSION AND CONCLUSIONS

Conclusions

This study provides comprehensive insights into the predictive and explanatory capabilities of the Random Forest (RF) regression model and structural equation modeling (SEM) in assessing hotel efficiency. The RF model demonstrates exceptional predictive accuracy, evidenced by low Mean Squared Error (MSE = 0.011) and root mean squared error (RMSE = 0.105), alongside a substantial explanatory power ($R^2 = 0.706$). Among the six predictors examined, TP, DP, and CA emerge as the most impactful variables influencing efficiency. These results offer actionable guidance for managerial decision-making in the hospitality sector. Complementary findings from SEM analysis reveal that a SETdriven organizational culture (OC), DP, DN, and technical know-how (TKH) significantly and positively affect efficiency. Notably, TKH—nurtured through reciprocal trust and support—is identified as a vital mediator translating integrated RM practices into performance outcomes. Collectively, these results highlight the importance of integrating advanced pricing strategies, robust distribution systems, and technical knowledge within a trustbased RM culture to achieve operational excellence in the hotel industry.

Theoretical implications

This research contributes to the growing body of literature on hotel efficiency and operational optimization through several theoretical advancements. First, it bridges a critical gap by demonstrating the interplay between technical knowhow and revenue management strategies in driving hotel performance, anchored in SET's norms of reciprocity and trust, thereby advancing our understanding of dynamic capabilities within the hospitality domain. Unlike conventional methods that assess performance in hospitality domain through subjective criteria (Herzallah et al., 2025), this study utilizes a more objective framework for evaluation. Second, the application of machine learning—specifically the RF model—provides a nuanced understanding of nonlinear relationships that traditional methods may overlook, thereby enriching efficiency theories. Third, the inclusion of TKH as a mediating factor reinforces the significance of human and technical capital in operational processes, extending the SET framework by showing how organizational support fosters reciprocal technical engagement. Finally, this study's dualmethod approach—combining RF and SEM—offers a methodological contribution by setting a standard for integrating predictive and explanatory modeling in service industry research.

Practical implications

The findings of this study provide actionable insights for hotel managers and industry stakeholders. First, the identification of TP, DP, and CA as the most significant predictors enables managers to allocate resources effectively toward pricing innovation and distribution efficiency. For instance, hotels can adopt dynamic pricing models and advanced distribution systems to optimize revenue streams. Second, the critical role of TKH as a mediator underscores the need for continuous investment in staff training and technological infrastructure within a SETinformed OC that rewards skill development and mutual trust. By addressing gaps in technical expertise and highcost barriers, hotels can enhance their operational efficiency and competitive positioning. Third, the validation of RM strategies as pivotal efficiency drivers emphasizes the importance of integrating analytics and forecasting tools into decisionmaking processes, supported by transparent communication and reciprocal organizational support. Finally, policymakers can leverage these insights to design frameworks and initiatives that promote sustainable and efficient practices in the hospitality sector, fostering broader economic and environmental benefits through trustbased organizational policies.

Limitations and future research

Despite its significant contributions, this study has certain limitations that present opportunities for future research. First, the dataset used, while comprehensive, is geographically specific, limiting the generalizability of the findings to other cultural and economic contexts. Future studies should expand the scope by examining diverse international settings and testing SET's applicability across cultures. Second, while the RF model and SEM provide robust insights, incorporating additional variables such as customer satisfaction, environmental sustainability, and market trends could further enrich the analysis. Third, the crosssectional nature of the data limits the ability to capture temporal dynamics; longitudinal studies guided by SET could explore how reciprocity and trust evolve and impact efficiency over time. Lastly, the role of emerging technologies such as artificial intelligence and blockchain in enhancing TKH and RM strategies remains an underexplored area. Future research should investigate these technologies' potential to revolutionize efficiency optimization in the hospitality industry, with attention to how SETdriven OC can facilitate technology adoption.

ACKNOWLEDGEMENT

The author would like to thank the Deanship of Scientific Research at Shaqra University for supporting this work.

REFERENCES

- Aboramadan, M., & Karatepe, O. M. (2021). Green human resource management, perceived green organizational support and their effects on hotel employees' behavioral outcomes. *International Journal of Contemporary Hospitality Management*, 10, 3199–3222. <https://doi.org/10.1108/IJCHM-12-2020-1440>
- Abusalma, A. (2021). The role of strategic innovation for sustainability of businesses during the covid-19 pandemic. *Management Science Letters*, 1991–1998. <https://doi.org/10.5267/j.msl.2021.3.010>
- Adanse, J., Khayiya, R., & Maranga, V. (2024). Influence of optimal room occupancy strategies on revenue maximisation during slack periods in selected 3- to 5-star hotels in Ghana. *Research in Hospitality Management*, 14(1), 57–69. <https://doi.org/10.1080/22243534.2024.2357035>
- AlQersh, N. A., Diah, M. L. B. M., Latiffi, A. B. A., & Ahmad, W. N. K. W. (2020). Strategic innovation and competitive advantage of manufacturing SMEs: The mediating role of human capital. *Quality Innovation Prosperity*, 24(3), 70–89. <https://doi.org/10.12776/qip.v24i3.1493>
- Alrawadieh, Z., Alrawadieh, Z., & Cetin, G. (2021). Digital transformation and revenue management: Evidence from the hotel industry. *Tourism Economics*, 27(2), 328–345. <https://doi.org/10.1177/1354816620901928>
- Alwakid, W., Aparicio, S., & Urbano, D. (2021). The influence of green entrepreneurship on sustainable development in Saudi Arabia: The role of formal institutions. *International Journal of Environmental Research and Public Health*, 18(10), 5433. <https://doi.org/10.3390/ijerph18105433>
- Becker, J.-M., Cheah, J.-H., Gholamzade, R., Ringle, C. M., & Sarstedt, M. (2023). PLS-SEM's most wanted guidance. *International Journal of Contemporary Hospitality Management*, 35(1), 321–346. <https://doi.org/10.1108/IJCHM-04-2022-0474>
- Bilgihan, A., & Ricci, P. (2024). The new era of hotel marketing: Integrating cutting-edge technologies with core marketing principles. *Journal of Hospitality and Tourism Technology*, 15(1), 123–137. <https://doi.org/10.1108/JHTT-04-2023-0095>
- Binesh, F., Belarmino, A. M., van der Rest, J.-P., Singh, A. K., & Raab, C. (2024). Forecasting hotel room prices when entering turbulent times: A game-theoretic artificial neural network model. *International Journal of Contemporary Hospitality Management*, 36(4), 1044–1065. <https://doi.org/10.1108/IJCHM-10-2022-1233>

- Carlisle, S., Zaki, K., Ahmed, M., Dixey, L. and McLoughlin, E. (2021). The imperative to address sustainability skills gaps in tourism in Wales. *Sustainability*, 13(3), 1161. <https://doi.org/10.3390/su13031161>
- Dubé, J., Lapointe, A., Martel, V., Placide, M. B., & Torres Ospino, I. V. (2024). Hotel room pricing and economic benefit for local economies: Evidence from Canada. *Tourism Review*. <https://doi.org/10.1108/TR-03-2024-0229>
- Dursun-Cengizci, A., & Caber, M. (2025). Using machine learning methods to predict future churners: An analysis of repeat hotel customers. *International Journal of Contemporary Hospitality Management*, 37(1), 36-56. <https://doi.org/10.1108/IJCHM-06-2023-0844>
- ETIC Hotels. (2024). *Ethical and sustainable hotels in Saudi Arabia*. <https://etic-hotels.com/saudi-arabia>
- Games, D., Siwi Agustina, T., Lupiyoadi, R., & Kartika, R. (2024). An examination of spiritual capital and innovation: Insights from high-growth aspiration entrepreneurs in a developing economy. *Journal of Small Business and Enterprise Development*, 31(4), 705-723. <https://doi.org/10.1108/JSBED-12-2022-0504>
- Guillet, B. D., & Chu, A. M. C. (2021). Managing hotel revenue amid the COVID-19 crisis. *International Journal of Contemporary Hospitality Management*, 33(2), 604-627. <https://doi.org/10.1108/IJCHM-06-2020-0623>
- Hair, J. F., Hult, G. T. M., Ringle, C. M., Sarstedt, M., Danks, N. P., & Ray, S. (2021). An introduction to structural equation modeling. Hair, In J. F., Hult, G. T. M., Ringle, C. M., Sarstedt, M., Danks, N. P., & Ray, S. (Eds.), *Partial least squares structural equation modeling (PLS-SEM) Using R* (pp. 1-29). Springer. https://doi.org/10.1007/978-3-030-80519-7_1
- Hasan, A., Alenazy, A. A., Habib, S., & Husain, S. (2024). Examining the drivers and barriers to adoption of e-government services in Saudi Arabia. *Journal of Innovative Digital Transformation*, 1(2), 139-157. <https://doi.org/10.1108/JIDT-09-2023-0019>
- Henseler, J., Ringle, C.M. and Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the academy of marketing science*, 43, 115-135. <https://doi.org/10.1007/s11747-014-0403-8>
- Herrera, A., Arroyo, A., Jiménez, A., & Herrero, Á. (2024). Forecasting hotel cancellations through machine learning. *Expert Systems*, 41(9), e13608. <https://doi.org/10.1111/exsy.13608>
- Herzallah, A. M., Iriqat, R. A., Hamed, M. H., Zaki, K., & Elnagar, A. K. (2025). Green synergy in hospitality: Unveiling the nexus between environmentally sustainable practices and hotel green performance. *International Journal of Hospitality Management*, 131, 104301. <https://doi.org/10.1016/j.ijhm.2025.104301>
- Jibril, A. B., Amoah, J., Panigrahi, R. R., & Gochhait, S. (2024). Digital transformation in emerging markets: The role of technology adoption and innovative marketing strategies among SMEs in the post-pandemic era. *International Journal of Organizational Analysis*. <https://doi.org/10.1108/IJOA-05-2024-4509>
- Kumar, S., Kumar, V., Kumari Bhatt, I., Kumar, S., & Attri, K. (2024). Digital transformation in tourism sector: Trends and future perspectives from a bibliometric-content analysis. *Journal of Hospitality and Tourism Insights*, 7(3), 1553-1576. <https://doi.org/10.1108/jhti-10-2022-0472>
- Kuokkanen, H. (2024). Strategic levers of revenue management: A three-dimensional model to categorize industries. *Journal of Revenue and Pricing Management*, 23(4), 369-376. <https://doi.org/10.1057/s41272-024-00484-8>
- Lee, E., Kim, J., Shin, S., & Koo, C. (2024). Unlocking revenue: Psychological pricing effect for airlines' upselling strategies. *International Journal of Hospitality Management*, 119, 103720. <https://doi.org/10.1016/j.ijhm.2024.103720>
- Meira, J. V. de S., & Hancer, M. (2021). Using the social exchange theory to explore the employee-organization relationship in the hospitality industry. *International Journal of Contemporary Hospitality Management*, 33(2), 670-692. <https://doi.org/10.1108/IJCHM-06-2020-0538>
- Mohammed, I., & Guillet, B. D. (2025). Heuristics and biases in human-algorithm interaction and hotel revenue management override decision-making. *International Journal of Contemporary Hospitality Management*, 37(2), 358-379. <https://doi.org/10.1108/ijchm-02-2024-0288>
- Moula, H. S., Yaghoubyan, S. H., Malekhosseini, R., & Bagherifard, K. (2024). Customer type discovery in hotel revenue management: A data mining approach. *Journal of Revenue and Pricing Management*, 23(3), 238-248. <https://doi.org/10.1057/s41272-024-00474-w>
- Nicolau, J. L., Xiang, Z., & Wang, D. (2024). Daily online review sentiment and hotel performance. *International Journal of Contemporary Hospitality Management*, 36(3), 790-811. <https://doi.org/10.1108/IJCHM-05-2022-0594>
- Okumus, F. (2004). Implementation of yield management practices in service organisations: Empirical findings from a major hotel group. *The Service Industries Journal*, 24(6), 65-89. <https://doi.org/10.1080/0264206042000299185>
- Panigrahi, R. R., Singh, N., & Muduli, K. (2025). Digital technologies and food supply chain: A scoping view from 2010 to 2024. *International Journal of Industrial Engineering and Operations Management*, 7(2), 150-174. <https://doi.org/10.1108/IJIEOM-05-2024-0030>
- Pereira, L. N., & Cerqueira, V. (2022). Forecasting hotel demand for revenue management using machine learning regression methods. *Current Issues in Tourism*, 25(17), 2733-2750. <https://doi.org/10.1080/13683500.2021.1999397>
- Pons, S. T., Noone, B., & Johns, M. (2024). Integrated revenue strategy for the park hotel: A data-driven approach to strategy development and evaluation. *Journal of Hospitality & Tourism Cases*, 13(1). <https://doi.org/10.1177/21649987231221476>
- Qian, J., Law, R., Wei, J., Shen, H., & Sun, Y. (2021). Hotels' self-positioned image versus customers' perceived image: A case study of a boutique luxury hotel in Hong Kong. *Tourism Review*, 76(1), 198-211. <https://doi.org/10.1108/TR-02-2019-0078>
- Ramachandran, S., Ugokwe, C. K., Latiff, K., & Ibrahim, M. R. (2024). Continued innovation beyond COVID-19 crisis: Toward mitigating the challenges in the tourism and hospitality industry. *Journal of Tourism Futures*. <https://doi.org/10.1108/JTF-10-2023-0221>
- Sarwar, Z., Gao, J., & Khan, A. (2024). Nexus of digital platforms, innovation capability, and strategic alignment to enhance innovation performance in the Asia Pacific region: A dynamic capability perspective. *Asia Pacific Journal of Management*, 41(2), 867-901. <https://doi.org/10.1007/s10490-023-09879-4>
- Schwartz, Z., Ma, J., & Webb, T. (2024). The MSapeMER: A symmetric, scale-free and intuitive forecasting error measure for hospitality revenue management. *International Journal of Contemporary Hospitality Management*, 36(6), 2035-2048. <https://doi.org/10.1108/IJCHM-01-2023-0088>
- Shmueli, G., Sarstedt, M., Hair, J. F., Cheah, J.-H., Ting, H., Vaithilingam, S., & Ringle, C. M. (2019). Predictive model assessment in PLS-SEM: Guidelines for using PLSPredict. *European Journal of Marketing*, 53(11), 2322-2347. <https://doi.org/10.1108/EJM-02-2019-0189>
- Sullivan, Y., & Wamba, S. F. (2024). Artificial intelligence and adaptive response to market changes: A strategy to enhance firm performance and innovation. *Journal of Business Research*, 174, 114500. <https://doi.org/10.1016/j.jbusres.2024.114500>
- Tewari, S., & Arya, A. (2024). Analyzing the efficiency of the Indian hotel industry using the Malmquist DEA approach. *Benchmarking: An International Journal*, 31(9), 2839-2870. <https://doi.org/10.1108/bij-05-2022-0286>
- Talón-Ballester, P., González-Serrano, L. and Figueroa-Domecq, C. (2014). A model for evaluating revenue management implementation (MERMI) in the hotel industry. *Journal of Revenue and Pricing Management*, 13, 309-321. <https://doi.org/10.1057/rpm.2013.47>
- Tian, F., Wang, Z., Yang, Y., & Mao, Z. (2024). How market structure and market power shape hotel price discrimination – Evidence from big data. *Tourism Economics*. <https://doi.org/10.1177/13548166241281757>
- Vinod, B. (2024). What is the future of competitive revenue management in the travel industry? *Journal of Revenue and Pricing Management*, 23(4), 377-379. <https://doi.org/10.1057/s41272-024-00489-3>
- Vives, A., & Jacob, M. (2023). Sources of price elasticity of demand variability among Spanish resort hotels: A managerial insight. *Journal of Hospitality and Tourism Technology*, 14(2), 137-153. <https://doi.org/10.1108/JHTT-11-2020-0298>
- Wang, Q. (2021). How does multi-attribute decision-making drive Hong Kong inbound Chinese tourists' online hotel choice? – A random forest analysis [Unpublished doctoral dissertation]. Hong Kong Polytechnic University. <https://theses.lib.polyu.edu.hk/handle/200/11563>
- Webb, T., Lee, M., Schwartz, Z., & Vouk, I. (2024). Beyond accuracy: The advantages of the k-nearest neighbor algorithm for hotel revenue management forecasting. *Tourism Economics*, 30(5), 1216-1236. <https://doi.org/10.1177/13548166231201199>
- Yeoman, I. (2024). Using revenue management to make business decisions. *Journal of Revenue and Pricing Management*, 23(1), 1-2. <https://doi.org/10.1057/s41272-024-00473-x>
- Zaki, K. (2022). Implementing dynamic revenue management in hotels during Covid-19: Value stream and wavelet coherence perspectives. *International Journal of Contemporary Hospitality Management*, 34(5), 1768-1795. <https://doi.org/10.1108/IJCHM-08-2021-1043>
- Zaki, K. (2025). Enabling hotel circularity via Industry 4.0 innovations for enhanced hotel performance: Insights from Saudi Arabia and Egypt. *Journal of Hospitality and Tourism Insights*, 8(3), 915-936. <https://doi.org/10.1108/JHTI-03-2024-0223>

Zaki, K., Abdelghani, A.A., Ahmed, H.A., Abdelfadel, T., Abusalim, E., Ahmed, K., Abuzaid, A.E. and Elnagar, A.K. (2025). Work decently: AI-driven marketing strategies for a competitive edge in tourism. *Research Journal in Advanced Humanities*, 6(1).
<https://www.royalliteglobal.com/advanced-humanities/article/view/1970>

Zaki, K., & Qoura, O. (2019). Profitability in Egyptian hotels: Business model and sustainability impact. *Research in Hospitality Management*, 9(2).
<https://doi.org/10.1080/22243534.2019.1689698>

Please cite this article as:

Zaki, K. (2026). Revenue Management Reinvented: Leveraging Technical Know-How to Unlock Hotel Efficiency. *Tourism and Hospitality Management*, 32(1), 123-134, <https://doi.org/10.20867/thm.32.1.8>



Creative Commons Attribution – Non Commercial – Share Alike 4.0 International