





SPECIAL FOCUS PAPER

AI-Powered Mobile Applications in Hotels: Guest Personalization, Operational Efficiency, and Sustainability

Amila Ishanthi H. M.¹  ,
Neetu Jain² ,
Manpreet Kaur³ 

¹Rushford Business School,
Lucerne, Switzerland

²Bharati Vidyapeeth (Deemed
to be University) Institute of
Management and Research,
New Delhi, India

³SOIL School of Business
Design, Gurugram, India

dba1037@rushford.eu

ABSTRACT

Hotels are adopting artificial intelligence (AI)-enabled mobile apps to provide more personalized and responsive guest experiences while concurrently working toward greater efficiency and sustainability. To date, hospitality research has highlighted technical feasibility over holistic perspectives of managerial benefit, guest acceptance, and sustainable performance implications. This paper aims to provide greater context on these three areas through a qualitative systematic literature review with thematic synthesis of secondary research. Data sources include peer-reviewed journal articles, industry publications, and publicly available evidence from hotels published within the last five years. Results from thematic analysis revealed three outcome areas with prevalent literature. AI-enabled mobile applications are commonly associated with frictionless guest experiences enabled by digital guest journeys from start to finish. Capabilities include, but are not limited to, guest pre-arrival personalization, mobile check-in/out, digital keys and smart-room controls, requests and payments, loyalty program integration, and chatbots with AI learning capabilities. Second, there is supporting evidence that AI-enabled mobile applications can drive efficiency through automation of low-level guest interactions, better coordination of response efforts, and quantifiable productivity improvements. Additional impacts on operational efficiency are cited through digital workflows and AI-enabled energy management. Lastly, AI-mobile services can allow for enhanced guest convenience/personalization with fewer resources. Caveats revealed benefits include preparation for implementation such as organizational readiness, change management, employee training, rollout strategy, and responsible data practices. Overall, AI-mobile technology has potential to be a strong value-add and differentiation/sustainability tactic for luxury hotels if used in conjunction with staff.

KEYWORDS

artificial intelligence (AI), mobile applications, personalization, hospitality, guest experience, digital transformation, sustainability

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1 INTRODUCTION

Travelers today want their experience when traveling to be elevated. An elevated guest experience is one that is personalized, seamless, and responsive. Many hotels are looking towards technology to both create better experiences for guests and increase efficiencies in hotel operations. Artificial intelligence (AI)-powered mobile applications have been used to create personalized experiences for guests, allow guests to communicate with the hotel in real time, and automate hotel operations.

Recent studies have shown that the global AI in hospitality and tourism market size was valued at USD 15.69 billion in 2024. It is projected to reach USD 58.29 billion by the 2029 end, registering a CAGR (Compound Annual Growth Rate) of approximately 30% [1]. Furthermore, research has shown that hotels who have implemented an enterprise-wide AI system have shown an increase in guest satisfaction as well as an increase in hotel operational performance. This showcases how hotels have been strategically implementing AI mobile applications [2].

While there has been an increase in hotels adopting AI into their daily operations. There has been limited research on the overall value of AI from a business perspective. Currently, research has been done on the technical application of AI. While some research has been done on customers' perceptions of AI, there has been no overall review of AI in terms of guest experience and operational optimization. Also, how these applications can aid in sustainable efforts.

This research used qualitative secondary research. The information was gathered from academic journals, industry articles, and hotel case studies. This research aims to establish a general understanding of the role of AI-enabled mobile applications in providing personalized guest experiences and operational decision-making across various hospitality sectors.

The remainder of the paper includes a literature review that summarizes prior research related to AI, mobile technologies, and hospitality operations. The research methodology section then provides a detailed description of the research approach, followed by findings and discussion. Finally, the paper concludes with a summary of the implications of the research results for managers and recommendations for future research.

2 LITERATURE REVIEW

2.1 AI applications in the hospitality industry

Artificial intelligence technology solutions used across hospitality organizations for customer-facing and back-office purposes range from chatbots/virtual assistants to demand forecasting/revenue management systems, recommendation engines, sentiment analysis, computer vision, robotic process automation, and others. Many AI systems in hotel organizations adopt natural language processing, machine learning, and deep learning technologies to automate manual tasks and assist hotel managers with decision-making [3], [4].

Research published previously demonstrates that organizations across the hospitality sector adopted AI technology to become faster at responding to customers' needs and requests, become smarter at pricing, and reduce operational costs [5]. Specifically, research demonstrated that AI-powered revenue management systems based on machine learning have helped hotels better adapt their pricing decisions

to changing demand patterns, competition, and booking pace, thus reporting better financial outcomes after adoption. Previous research has supported the use of AI-driven revenue management systems for price optimization and increased revenue performance among hotels. Furthermore, researchers have looked at AI-based monitoring and security systems for operational efficacy.

2.2 Mobile technology as hospitality service platform

Mobile apps have been established as one of the key platforms through which hotels service their customers. Mobile apps allow hotel guests 24/7 access to various hotel services that range from mobile check-in/check-out and digital room keys to room service ordering platforms, concierge support channels, and even options to pay directly using mobile devices. Mobile apps have been found to have a positive impact on the perceived convenience of hotel service offerings, experiential value, and overall satisfaction. Research indicates mobile apps enhance the perceived convenience of hotel service offerings, experiential value, and overall satisfaction. Recent studies have focused on determining drivers of guests' intentions to book digital hotel services [6]. Likewise, Kumar's research discusses how mobile channels allow value co-creation using technologies like chatbots and seamless payment experiences. Mobile affordances facilitate more than just service consumption but can be leveraged strategically with the guest journey in mind [7].

Integration of mobile apps and IoT technologies allows hotels to offer guests personalized control over certain features within hotel rooms using smartphone devices (e.g., turning lights on/off, adjusting room temperature, and streaming entertainment content). Mobile applications can also serve hotels as platforms to engage with guests beyond their stay, using loyalty rewards and discounts, personalized marketing offers, or even providing digital reviews of hotel service experiences.

2.3 Personalization strategies in hotel operations

Personalization has become one of the most important strategic differentiators within the hotel industry because customers increasingly expect businesses to recognize them as individuals with unique preferences and behaviors. Providing customers with a personalized experience means understanding who they are based on prior stays, booking history, past spending behavior, or current requests or inquiries. Successful personalization of the guest hotel experience involves obtaining, analyzing and utilizing guest data in order to offer timely, helpful, and personalized suggestions, messages, and service offerings throughout guest interactions with hotel employees and channels [8], [9].

Recent advancements in AI allow hotels to collect data about their customers in both structured and unstructured forms, helping them better recognize customers as individuals and automate personalized offerings using machine learning technologies. Although personalization in hotels has many advantages, there have been mixed research findings regarding customers' acceptance of hotels collecting and utilizing their data for personalization purposes. Studies show that many customers are concerned about privacy and how their data is going to be used. Acceptance of data sharing and personalization is highly dependent on trust hotel customers have in a hotel brand as well as perceived benefits they receive from allowing hotels to collect their data [10].

2.4 Sustainability through digital solutions

Hotel adoption of mobile technologies enabled with artificial intelligence can also help hotels become more sustainable and environmentally friendly. Research has shown that going paperless through adopting automation and other digital solutions helps hotel organizations go green. Another key area of adopting green initiatives within hotels supported by AI includes reducing energy spend. Operational tasks such as turning lights and heating or cooling on/off based on time of day and customer occupancy can be automated with AI, allowing hotels to reduce their energy consumption and cost [11].

Research published previously has found that adopting sustainability-focused activities may not negatively impact hotel profit margins. The study demonstrates that hotel sustainability initiatives and higher profits are not mutually exclusive and can go hand-in-hand, meaning adopting green initiatives can actually help hotels save money [12].

3 MATERIALS AND METHODS

3.1 Research design and philosophical foundations

This qualitative systematic literature review (SLR), utilizing thematic synthesis of secondary data sources, is based on an interpretative philosophical stance. The study will use this philosophical stance because it allows the researcher to focus on understanding meanings and contextual influences as opposed to formulating universally generalizable laws. Prior systematic literature reviews in digital hospitality research have used structured review approaches.

This qualitative methodology will allow the researchers to explore how and why AI-enabled mobile technologies are being utilized by hospitality organizations. The use of quantitative data from secondary sources will provide illustrations of both the trends and statistics associated with the adoption of AI-enabled mobile technologies as well as the reported performance impacts. This approach will support an assessment of how AI-powered mobile applications add value to hotels within digitized hospitality environments.

To increase the validity and relevancy of this study's findings, both academic and industry research have been evaluated. Academic research offers researchers a theoretical and empirical foundations to base their research off. Industry publications and case studies offer researchers real-world implementations of AI-enabled mobile technologies.

3.2 Data collection procedures

Secondary research consisting of academic journal articles, industry publications, and publicly available case studies was completed to gain an understanding of AI-enabled mobile technology adoption across the hospitality sector. An emphasis has been placed on sourcing material that has been published in the past five years to ensure that fast-paced digital and AI innovations are captured.

The research team accessed peer-reviewed research through academic journal databases that centered on topics such as AI, mobile applications, guest personalization, operational efficiencies, and sustainable hotel operations. In addition to

academic research, hospitality industry publications from consultancies, hotel groups associations, and technology companies were reviewed to help explain and add context to the findings noted with the implementation of AI-enabled mobile technologies.

Case studies of publicly available international hotel brands were examined using sustainability reports, industry news articles, and vendor documentation. News articles from hospitality and technology-related news platforms were also consulted to facilitate the capturing of current events, thus allowing for triangulation among the academic, industry, and practitioner-based sources.

3.3 Data analysis procedures

The selected literature was analyzed using thematic synthesis to identify and synthesize the common themes that exist across the various studies [13]. Familiarization with the literature was initially performed via repetitive readings of the literature, in which key concepts that relate to AI enabled mobile applications in hospitality were determined.

Codes were developed for concepts that included the type of AI applications being employed, mobile services being provided, the way personalization is achieved, the impact on operational and sustainability issues, and the barriers to the implementation of these applications. The codes were iteratively grouped together at a higher level, resulting in higher-level themes that formed the basis for the analysis. To minimize bias in the analysis process, the findings were compared cross-study, and more weight was assigned to those themes that had evidence supporting them from multiple studies.

3.4 Scope, limitations, and ethical considerations

This review paper discusses how AI-powered applications assist in guest personalization, operational efficiencies, and guest sustainability within hotel operations. While AI-powered applications are utilized throughout properties of all categories and service models, this research aims to focus on luxury hotels. This is because luxury hotels typically have higher digital maturity and implementation of other mobile service capabilities. Many insights found below can be generalized to broad-scale hotels but may look different depending on the level of implementation and impact.

Limitations: This review paper used secondary research as its foundation. This made it limited to only published implementations and reported results. Some KPI (Key Performance Indicators) data may not have been publicly reported, and struggles during implementations were not always published. Because AI tools and capabilities are constantly advancing, some findings may be time-sensitive. Although we tried to limit the extent of these issues, this paper included research from academic journals and industry literature. We also tended to focus on newer research when available.

Ethical Concerns: Throughout our research we did not collect any primary data or have any human subjects. Any information we collected was secondary information that did not disclose personal data or information that could lead to someone's identity. The author had no conflicts of interest and worked to make sure that all information was reported correctly and cited correctly and that all viewpoints were considered.

AI Declaration: Artificial intelligence-assisted applications were used during the production of this document. Applications such as ChatGPT, ChatPDF, and Quillbot were used. They were used to correct grammar issues and help with formatting, clarity, and readability of this document. The content, analysis, interpretations, and conclusions of this paper are made by the author. The author read and edited the whole paper as it is now presented and understands the responsibility that comes with its submission.

The author declares that there is no conflict of interest associated with this research.

4 RESULTS

4.1 AI-enabled mobile application features

Results of the SLR reveal that mobile applications used by hotels leverage artificial intelligence to perform various tasks before, during, and after a guest's stay. In general, mobile applications across hotels offering digital guest experiences include AI-driven features that personalize guest communications before arrival, facilitate mobile check-in/check-out, enable digital room keys, allow guests to control room features, request hotel services, digitally pay bills, participate in loyalty programs, and use chatbots to interface with hotels.

Chatbots, also called virtual assistants, are one of the primary features supported by AI identified in the literature. Several previous studies suggest that between 60 and 70% of standard guest questions and requests can be fielded by AI-enabled chatbots [14]. Conversation AI is predicted to shift from text to voice. Studies have demonstrated that perceived usefulness, ease of use, and trust have important impacts on adoption of conversational agents. Privacy is a concern users have with conversational AI; hotel managers should ensure their hotel's data practices are clear [15]. Simplistically, chatbots allow hotels to support guests 24/7 while simultaneously easing demand for front desk and concierge staff.

In many cases, studies also report that mobile applications used by hotels include multilingual capabilities. The literature reports that by supporting communications across languages using AI-powered language translators, hotels experience fewer guest misunderstandings, which can lead to increased guest satisfaction, particularly for hotel brands with international appeal that cater to guests from various cultures.

4.2 Operational efficiency and cost outcomes

Results from academic journals, consulting firm articles, and industry blogs show that hotel operations experience improved efficiency and cost savings by leveraging AI through mobile applications. Automating tasks typically completed by hotel staff through chatbots, mobile requests, and AI-enabled phone support has been shown to increase speed, improve efficiencies, and lighten the load on service staff.

Labor efficiencies appeared to be one of the most reported impacts of AI across the sample. Automation of tasks typically relegated to front desk staff allows hotels to reduce overall staffing needs while achieving better levels of service during periods of high demand. Reported improvements in response times and employee productivity have been linked to mobile guest interactions and AI-assisted operations [2].

Response times also appear in many of the articles reviewed. AI-enabled mobile hotel applications can allow guests to request services from a central location,

reducing the number of emails or phone calls made by hotel guests and decreasing the time to service. Improvements in operational speed are thought to support better service coordination by triaging guest requests [16].

Digital requests also translate to reduced printing and paperwork. Moving guest operations to digital workflows allows hotels to automate various functions, such as guest arrivals and departures and request fulfillment, which translates to less printing and managerial effort. Benefits relating specifically to AI have been mentioned within sectors such as energy management. Hotels are beginning to implement AI with their heating, ventilation, and air conditioning (HVAC) systems to cut energy costs when no one is in the room. One hotel chain experienced energy expense savings of 20–30% after implementing AI thermostats [17].

Overall, articles mentioned that AI-enabled mobile applications can lead to operational efficiencies in multiple categories of business. The level of impact varies based on the size of the organization, current digital maturity, and extent of implementation.

4.3 Guest experience and sustainability outcomes

Improved guest experience was another reported outcome that surfaced many times throughout the data. Articles repeatedly mentioned improved conveniences, time savings, and accessibility when describing the benefits AI-enabled mobile applications had for guests. Digital check-ins, mobile requests, and AI-enabled chatbots were discussed as ways these technologies reduce friction for guests throughout their stay. Studies have found that AI-based mobile apps in hospitality are used to deliver standardized service, better coordinate standardized guest interactions, and allow resources to be used efficiently while still preserving employee satisfaction's connection to customers' perceived satisfaction.

One subtheme of improved guest experience was personalization. Articles discussed how AI-enabled mobile applications allow hotels to record guest preferences throughout their stay and implement learned preferences when they return. Customer case studies illustrated that room settings, automatic service offerings, and guest communication can create frictionless experiences for returning customers.

Articles lastly mentioned improvements in sustainability created by these technologies. Studies have found that by digitizing guest requests and transactions hotels are able to positively impact their consumption metrics such as energy, water, and paper usage [18]. By implementing mobile-friendly technologies that reduce or remove the need for paper, hotels can operate more efficiently while positively impacting the environment.

5 DISCUSSION

5.1 Strategic relevance of AI-powered mobile applications in luxury hospitality

Luxury hospitality is facing increasing competition in terms of physical assets such as rooms, amenities, and locations, which are becoming less unique. Thus, digital-enabled personalization offers a potential long-term competitive advantage through data-enabled service design and guest experience management [19]. The study's results show that AI-powered mobile apps have the potential to increase

operational efficiency, guest satisfaction, and sustainable service provision in the luxury hotel industry. Literature on AI-powered mobile applications in hospitality, indicates that they support standardized service delivery, improve coordination of standardized guest interactions, and optimize resources [20]. Thus, AI can be used as a practical way to achieve a competitive advantage, rather than being just an experimental technology [21].

Results from hotels in the UAE show that AI mobile applications help guests plan their trips, access the reception, and request items in their rooms. They also allow employees to multi-task, react quickly, and align staffing and strategies to goals [22]. As the number of international travelers increases and cultural diversity in guest profiles grows, conversational AI tools, such as multilingual chatbots and virtual assistants, will play a significant role in creating time-efficient, accurate, and culturally sensitive communication [23]. Conversational AI tools can also help expand service capacity beyond legacy solutions such as bilingual staff members and printed language guides.

National and city-wide tourism policies can also support AI adoption in hospitality when they include mandates for smart city infrastructure and AI resources. Studies show that smart tourism ecosystems, spurred by policy, allow hotels to deploy mobile-first services like keyless entry, mobile concierge, and AI guest engagement experiences faster. Literature also shows that hospitality leaders must be mindful of hospitality luxury standards, as AI may decrease some human touches from hotel guest experiences by streamlining processes [20]. Literature shows that AI implementations should be focused on automating repeatable tasks and back-office processes while guests continue to see value from human hospitality workers when receiving services [24].

From an operations and profitability standpoint, investing in mobile services with AI technology could benefit luxury hotels in the long run by standardizing guest experiences, increasing operational efficiencies, and meeting sustainability initiatives [25]. Previous research has found that there can be a competitive advantage in adopting AI for your hotel, not just by improving key performance metrics but by using AI to enhance your service delivery and hotel operations [26]. Infrastructure readiness, alignment to corporate strategy, and organizational learning are just some of the factors that can influence a hotel's ability to implement AI successfully [25].

5.2 Guest experience transformation and personalization paradox

This research identifies various paradoxes that arise in luxury hotel guest experiences due to AI-enabled mobile applications. On one hand, digital platforms provide guests with speed, convenience, and personalized interactions; however, guests may also see AI-enabled services as a threat to their data privacy, human interaction, and perceived authenticity of service. Therefore, guest responses to AI-enabled services vary, and some guest segments may be dissatisfied with AI-enabled service models when those models are either mandatory or too automated.

The literature suggests that luxury hotels should implement hybrid service models that combine technological efficiency with human-centered hospitality. Data gathered from digitally transformed hotels show that while AI-powered apps improve speed, personalization, and orchestration of service for routine interactions, human associates are still needed for high-touch services, emotional connection, and labor-intensive service recovery. Providing both digital and human channels will enable hotels to deliver luxury service as well as cater to all guest needs.

Guest trust in personalization is highly dependent on how well hotels communicate about their data usage and provide guests with the ability to make choices about their own data. When guests perceive themselves to have control over their data, AI-enabled personalization is more likely to be seen as a service feature that adds value rather than as a potential threat to their data privacy. The trust that guests place in personalized services is mostly conditional on the efficacy of the communication of the hotels in terms of data utilization; concomitantly, the institution's brand image and the achievement of customer satisfaction are pivotal determinants in the development of enduring loyalty relationships [27].

5.3 Sustainability as dual benefit rather than cost

The study's results also demonstrate that AI-enabled mobile applications can shift the perception of sustainability from a cost burden to a source of operational efficiency and strategic value. AI technologies enable sustainable business practices through efficient energy and water usage monitoring as well as decreasing waste and inefficiencies that can occur from manual processes. Through smart building technologies, predictive monitoring systems, and AI-powered resource management technologies, hotels can mitigate their environmental impact before it occurs whilst maintaining quality of service standards.

Literature also shows that there is a correlation between the extent to which sustainability is implemented and its ability to generate economic value. For instance, minimal adoption of digital technologies will still create duplicative work if existing systems remain in place. Implementing a mobile check-in option alone will only result in minimal efficiency gains if staff are still using legacy systems [28]. Luxury hotels should instead look to develop a holistic digital strategy that aligns sustainability initiatives with operations processes and guest offerings. Furthermore, delivering sustainability messaging through a mobile application offers luxury hotels an opportunity to encourage guests to partake in sustainable practices and drive brand awareness and stakeholder value.

5.4 Implementation of frameworks and change management

Findings from the analysis showed that AI-enabled mobile application adoption was highly dependent on frameworks for implementation and change management.

In most cases where technological adoption fails, it can be attributed to poor employee training, lack of change management practices, and/or testing and tweaking of new systems before going live. Employee concerns and morale around how new technology will affect their job security and day-to-day tasks must be considered when looking to implement AI-enabled mobile applications in luxury hotels.

For instance, frameworks that include employee training initiatives throughout implementation phases have been shown to alleviate some of the risks when implementing AI-enabled mobile applications in luxury hotels [29]. Many large-scale luxury hotel groups will pilot digital initiatives in certain environments before implementing new technology across all properties. Forming strategic partnerships with technology vendors who have previous experience within the hospitality industry can also help ensure successful technology implementation by allowing the vendor to help integrate systems with your current infrastructure, provide technical support, and offer support after systems go live [30]. Employee concerns and morale

about the impact of new technology on job security and day-to-day operational responsibilities need to be considered appropriately when implementing AI-enabled mobile applications in luxury hotels [31].

6 CONCLUSION

The purpose of this investigation was to determine how AI-based mobile apps have impacted the degree to which guest preferences are being met through the hotel industry. The goal was to identify how these technologies are used, what types of impacts occur on hotel operations, and what the future trends might be for hotel management. Research studies, which were reviewed previously, provide evidence of the significant potential for AI-based mobile apps to increase the level of labor productivity, improve guest satisfaction, and contribute to the sustainability of hotel operations. Results of studies have included reducing the time-consuming elements of certain tasks for employees; improving response times for guest requests; using paperless forms of communication; and providing better control over energy usage through the integration of smart automation systems.

It is also important to note that in addition to understanding what AI-based mobile apps can do, successful implementation of AI rests upon three other factors. These being an organization's readiness to adopt new technology, how well the technology is implemented, and how well the organization adapts to changes brought on by technology. Characteristics of organizations who implement digital transformation successfully include focusing on employee education, having digital and non-digital channels for customers to connect with the organization, being transparent about the data they collect from customers, and implementing new technology gradually. One of the key findings of this literature review is that hotels can utilize digitalization to provide sustainable services that also function under profitable business models.

Topics that can be researched further include digital transformation's long-term effects on the hospitality industry, how guests of different cultures perceive AI-enabled services, and how technology positively and negatively affects stand-alone hotels in comparison to large hotel chains. Further research can be conducted on what emerging AI capabilities have to offer the hospitality industry.

Technology will continue to advance, and its applications in the hospitality industry will evolve; however, the success of hotels in the future will be dictated by each organization's ability to utilize technology to provide guest experiences that are human-centered. There are many benefits that AI-based apps can provide hotel guests, but AI will never replace the human interaction that is crucial to providing hospitable service. Hotels that view technology as a tool to enrich the guest experience rather than a substitute for humanity will benefit most from digital advancements.

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8 AUTHORS

Amila Ishanthi H. M. is a DBA researcher at Rushford Business School, Switzerland, focusing on artificial intelligence, mobile technologies, and digital transformation in hospitality. She holds a master's degree in tourism and hospitality management and has professional experience in hospitality operations and property management. Her research interests include AI-enabled guest experience systems, operational efficiency, and sustainability in hotel environments, with emphasis on practical managerial applications (E-mail: dba1037@rushford.eu).

Dr. Neetu Jain is an Associate Professor of economics at Bharati Vidyapeeth (deemed to be a university) Institute of Management and Research New Delhi, India. With over 20 years of rich experience in academics and research, she has contributed extensively to teaching, research, and mentoring students, demonstrating strong expertise in economic analysis and management education (E-mail: neetu.jain@bharativedyapeeth.edu).

Dr. Manpreet Kaur serves as Associate Professor of accounting and finance and research chairperson at SOIL School of Business Design, Gurugram. She holds a PhD from IIT Delhi and is a gold medalist from GGSIPU. Her research spans international finance, corporate finance, fintech, and analytics, with numerous publications in reputed national and international journals and over 18 years of academic and research experience (E-mail: manpreet.kaur@schoolofbusinessdesign.com).