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Smart Technologies Shaping the Future of the Hotel Industry in Developing Countries: A Post-Covid Review

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Abstract: *This paper aims to identify the optimal smart technologies and AI-driven solutions for the hotel industry, with a particular emphasis on their contribution to the broader digital transformation of business operations. The research examines the state of the art as of September 2024 using a mixed-methods approach, combining a systematic review and design thinking. The review spans studies from 2020 to 2024, characterized by rapid advancements in AI and smart technology, partly driven by the post-Covid digital transformation. The findings are related to a growing global demand for AI-powered smart technology solutions in the hotel industry, motivated by different reasons such as operational efficiency, customer experiences, and streamlined management processes. The adoption of these technologies in developing countries is affected by some specific economic, cultural, and regulatory factors and remains aligned with global digitalization trends. The study brings attention to continuing important concerns, such as data privacy and security, financial constraints, and cultural factors that affect technology acceptance and integration. These insights provide a foundation for examining the potential of integrating smart technologies within Albania's hotel industry landscape.*

1. INTRODUCTION

The rapid adoption of smart technologies in the global hotel industry has become a significant driver of operational efficiency and customer satisfaction Liu, H. (2024). Key technologies include AI, the Internet of Things (IoT), machine learning, and automation systems Kaur et al. (2024). The use of AI, IoT, and machine learning has revolutionized the sector, making smart hotels the new standard for service excellence Kim et al. (2020). The hospitality industry, traditionally slow in adopting new technologies, underwent rapid changes post-Covid, with smart technologies and AI becoming vital tools to enhance operational efficiency and improve customer experience Yu and Hsu (2024). Developed countries led the charge in adopting these innovations, but developing countries face unique economic, regulatory, and cultural challenges that influence the rate and manner of technology adoption Gajić et al. (2024). The pandemic has risen the demand for contactless solutions in hotels, particularly in regions where health and safety have become primary concerns. As noted by (Yu & Hsu, 2024; Pillai et al., 2021), hotels are increasingly investing in AI-powered systems that can perform tasks such as automated check-ins, room service deliveries via robots, and contactless payments, offering safer guest experiences post-pandemic (Yu & Hsu, 2024; Pillai et al., 2021). The introduction of these innovations comes along with some challenges. Hotels in developing countries have to navigate problematic issues related to data security and privacy, and the high costs associated with building, implementing and maintaining these technologies (Leko 2021; Infante-Moro et al., 2021). Despite these obstacles, the potential benefits of smart technologies for hotels in developing countries are considerable. The highlights of Negro (2022) show ways on how the smart hotels can support environmental initiatives by reducing carbon footprints and improving resource management.

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2. MATERIALS AND METHODS

This paper explores the literature through a mixed-methods approach, combining a systematic review of the existing literature with a design thinking methodology. A mixed-methods approach was employed, including a systematic literature review and design thinking workshops with stakeholders from the hotel industry. The review spans publications from 2020 to 2024 to capture recent advancements in AI and smart technology. Design thinking sessions involved experts from developing countries, allowing for a tailored analysis of their unique challenges and opportunities (Kim et al., 2020; Han et al., 2021).

The research question of the paper relates to how the current state of smart technology adoption in the hotel industry is, particularly in developing countries, and to identify both opportunities and barriers associated with implementing these technologies in resource-constrained environments.

The systematic review focuses on peer-reviewed journal articles, conference papers, and industry reports published between 2020 and 2024. This time frame was selected due to the surge in research and technological advancements following the COVID-19 pandemic, which accelerated the adoption of automated and non-contacted services in the hotel industry (Yu & Hsu, 2024; Li et al., 2021). Relevant studies were identified through searches in academic databases, including IEEE Xplore, ScienceDirect, Web of Science, and Google Scholar. The search terms included: "Smart hotels, AI in hospitality. IoT in hotels, Contactless hotel services, Blockchain in hospitality, Smart technology adoption in developing countries". The inclusion criteria were:

- **First Criteria**: Studies published between 2020 and 2024.
- **Second Criteria**: Articles focusing on the adoption of smart technologies in the hotel industry, including AI, IoT, robotics, blockchain, and other emerging technologies.
- **Third Criteria**: Research that addressed the economic, social, or operational aspects of technology adoption, especially in developing countries.

Studies were not included if they did not specifically address smart technology adoption in hotels or were not related to the post-COVID era. A total number of 90 studies were included in the review, offering a comprehensive view of the current trends, challenges, and future prospects for smart technology in the hotel sector (Leko 2021; Infante-Moro et al., 2021). Alongside the systematic review, this paper incorporates a design thinking approach to better understand the human-centered challenges of adopting smart technologies in hotels, especially in developing countries. The design thinking procedure incorporates five key stages. The first stage, empathize, involves gaining insights from existing literature about the needs and challenges faced by hotel operators and guests regarding smart technology adoption Han et al. (2021). In the second stage, define, specific barriers to adoption are identified, such as financial constraints, data privacy concerns, and cultural resistance Negro (2022). The third stage, ideate, focuses on brainstorming potential solutions, including lower-cost technology models or training programs to enhance staff and guest comfort with technology (Katartis et al., 2023; Yu & Hsu, 2024). During the fourth stage, prototype, conceptual models are developed to explore how smart technologies like AI, IoT, and robotics can be integrated into existing hotel infrastructures, particularly in developing countries (Negro 2022; Infante-Moro et al., 2021). Finally, the test stage evaluates potential solutions using insights from the literature, as no primary data collection was conducted.

The design thinking approach added a user-centered dimension to this analysis, focusing on the practical challenges and opportunities for adopting smart technologies in developing countries.

3. RESULTS AND DISCUSSION

The findings from the systematic review reveal that AI-powered systems such as chatbots, predictive maintenance, and smart room automation have streamlined guest services and reduced operational costs Yu and Hsu (2024). Hotels are increasingly using AI to provide personalized guest experiences by analyzing guest preferences and optimizing room environments (Li et al., 2021; Yu & Hsu, 2024). IoT-enabled devices allow hotels to monitor resource usage in real time and automatically adjust services based on guest preferences (Shani et al., 2023; Torre et al., 2023). This has not only enhanced guest comfort but also improved energy efficiency, contributing to sustainability initiatives Poullas and Kakoulli (2023). High initial costs for technology implementation are a significant barrier, particularly for smaller hotels that struggle with financial constraints Gajić et al. (2024). Furthermore, cultural attitudes towards technology, where certain guest populations may not fully trust or feel comfortable with AI-driven solutions, pose another obstacle Li et al. (2021). Despite these challenges, smart technologies offer significant opportunities for hotels in developing countries. IoT-based energy management systems can help reduce operating costs—particularly in regions where energy expenses are high—while maintaining guest satisfaction Ferreira (2023). AI-powered virtual technologies and customer service solutions, as evidenced by Li et al. (2021) help reduce labor downsizing by automating routine tasks.

3.1. Barriers to Adoption in Developing Countries

While the benefits of smart technologies are evident, their adoption in developing countries faces several barriers. The review identified key challenges, particularly for small- and medium-sized hotels.

The first challenge is financial constraints. Many hotels in developing regions struggle with the high costs of implementing and maintaining smart technologies. Initial investments in IoT infrastructure, AI systems, and robotics can be prohibitive for smaller hotels, and these costs are further compounded by ongoing expenses for software updates and maintenance (Infante-Moro et al., 2021; Gajić et al., 2024).

The second challenge involves data privacy and security concerns. In developing countries, these concerns have emerged as significant barriers to the adoption of IoT and AI systems. Guests are often apprehensive about how their personal data is collected, stored, and used by smart systems, further complicating trust in these technologies Leko (2021).

The third challenge is cultural resistance, particularly the reluctance to engage with automated systems due to fears of losing the human touch in hospitality services. This resistance is especially strong among older generations (Leko, 2021; Gajić et al., 2024).

Financial constraints, data privacy concerns, and regulatory issues are significant obstacles (Çeltek, 2023; Hadi Saputro et al., 2023). Additionally, cultural resistance to replacing human interaction with AI-driven systems remains a challenge in some regions Domanski (2020).

3.2. Potential Solutions for Overcoming Barriers

The application of the design thinking framework to the review provided some potential solutions for deliberating on the barriers to adopting smart technologies in developing countries. The

solutions also include affordability, building trust through education and cultural adaptation. To overcome these challenges, the literature suggests the following strategies, partnerships with local providers and government incentives and subsidies.

One of the key challenges identified was the cost of implementing smart technologies. A potential solution is to develop low-cost versions of these technologies that are specifically tailored for smaller hotels in developing countries Yu and Hsu (2024). Infante-Moro et al., (2021) argue that smaller hotels in developing regions often cannot afford the initial investment required to implement IoT or AI systems**.** The ongoing maintenance and software upgrades needed to keep these systems operational represent an addition to the financial burden according to Gajić et al. (2024)**.** Partnerships with local technology providers could also help reduce costs by offering regionally adapted solutions.

Addressing privacy and security concerns is another crucial aspect. Hotels could implement educational programs to build trust among guests regarding the use of smart technologies. These programs could focus on data security and demonstrate how guests' personal information is protected Barkel et al. (2021)**.** Leko (2021) highlights how privacy concerns can significantly impact guest trust in smart technology, particularly in regions where cybersecurity frameworks are not well developed**.** To build trust and address the data usage concerns, hotels should focus on making as more transparent the data usage. For that hotels need to be transparent about how guest data is collected, stored, and used. Clear and accessible privacy policies can help reassure guests that their personal information is being handled responsibly Ivanov et al. (2022). Hotels also need to invest in cybersecurity, so ensuring that smart systems are secure is crucial for protecting both guest information and hotel operations. Investing in cybersecurity measures can help prevent data breaches and bolster guest confidence in using smart hotel services Ivanov et al. (2022).

The literature also highlights cultural resistance as a key barrier to the adoption of smart technologies in developing countries. In many regions, guests expect a high level of personal interaction as part of the hospitality experience, which is seen as being at odds with the automated, contactless services enabled by smart technologies Gajić et al. (2024)**.** To avoid the problem of cultural resistance, hotels need to adopt a hybrid approach where technology complements human interactions rather than replacing them entirely. Therefore, AI-powered systems can be used to manage routine tasks, allowing human resources to focus on personalized guest services **(**Zhang et al., 2024; Sujood & Siddiqui, 2024)**.**

Developing partnerships with local technology providers can help reduce costs by creating region-specific solutions. These providers may be able to offer more affordable products and services that are customized to the needs of local hotels Gajić et al. (2024)**.**

Another probable solution involves government support through subsidies and tax incentives for accommodation structures that adopt sustainable technologies. By providing financial assistance, governments can help hotels offset the costs of implementing smart technologies, which in turn could foster broader adoption Yu and Hsu (2024).

One suggested solution to the challenges mentioned above is the implementation of hybrid models, where technology complements rather than replaces human interaction. Examples include AI-powered systems can handle routine tasks like check-ins or room service, allowing staff to focus on more personalized aspects of hospitality Li et al. (2021). This approach can help retain the human touch that many guests value, while also reaping the efficiency benefits of automation. Additionally,

guest education plays a crucial role in overcoming resistance to technology. By educating guests on the benefits of smart systems—such as enhanced safety, convenience, and sustainability—hotels can foster greater acceptance of these innovations Infante-Moro et al. (2021).

3.3. Sustainability Impact of Smart Technologies

One of the notable findings from the review is the potential of smart technologies to support sustainability in the hotel industry. Several studies emphasize how IoT-enabled systems and AI can support hotels reduce their environmental impact by optimizing resource use energy management and waste reduction. IoT-enabled systems, as smart thermostats and automated lighting, allow hotels to monitor and control energy. This has led to energy reductions in carbon emissions, which are critical for hotels in resource-constrained regions Ahmed El-Said et al. (2024). AI-driven predictive analytics help hotels optimize resource use such as reduce food waste by managing inventory more effectively Ahmed El-Said et al. (2024). By predicting guest behavior and preferences, hotels can guide their services toward minimizing inefficiencies in areas like housekeeping.

A key advantage of smart technologies highlighted in the review is their ability to support sustainability initiatives in the hotel industry. IoT systems that monitor and control energy consumption have been shown to reduce energy usage, making hotels more environmentally friendly Poullas and Kakoulli (2023). AI-powered analytics can also optimize resource allocation, reducing waste in areas such as food service and housekeeping, Negro (2022).

4. CONCLUSION

This paper has explored the potential of smart technologies to transform the hotel industry, particularly in developing countries. The different dimensions of analyzing technology adoption include enhancing operational efficiency, improving guest experiences, and supporting sustainability efforts. The findings show that technologies such as AI, IoT, and robotics offer important benefits, including automation of routine tasks, personalized guest services, and improved energy management (Yu & Hsu, 2024; Infante-Moro et al., 2021). These benefits are particularly valuable in resource-constrained environments, where operational efficiency and sustainability are critical (Poullas & Kakoulli 2023; Negro 2022). Despite the benefits mentioned earlier, the adoption of these technologies in developing countries faces several key barriers. Financial constraints remain a major challenge for small- and medium-sized hotels, which often lack the resources to invest in advanced technology systems Infante-Moro et al. (2021). Concerns over data privacy and cybersecurity pose significant obstacles, particularly in regions where regulatory frameworks are underdeveloped Leko (2021). Cultural resistance to the use of smart systems also complicates the adoption process, as guests in many developing countries may be reluctant to engage with automated services that replace personal interaction Gajić et al. (2024).

The application of a design thinking framework to the literature review provided several potential solutions to these challenges. These include the development of affordable, region-specific technologies, government subsidies, and guest education programs that build trust in smart systems while retaining the human element in hospitality (Leko, 2021; Yu & Hsu, 2024).

Additionally, hybrid models that combine automation with personalized service may offer a balanced approach to overcoming cultural resistance Li et al. (2021). In order to overcome the difficulties mentioned in the literature, the successful integration of smart technologies in developing countries will require tailored strategies that address local financial, cultural, and regulatory challenges.

Government incentives and public-private partnerships could play a crucial role in reducing the costs of technology adoption, while stronger data protection laws are needed to address privacy concerns. Furthermore, hotels must focus on educating both staff and guests about the benefits of smart technologies to foster greater acceptance (Leko 2021; Infante-Moro et al., 2021).

While technological innovations offer enhanced operational efficiency and customer experience, economic, cultural, and regulatory barriers must be addressed to realize their full potential. *For Albania's hotel industry, strategic adoption of these technologies could foster greater competitiveness and efficiency, provided that ongoing concerns like data privacy and financial limitations are managed effectively.*

In conclusion, smart technologies represent a powerful tool for modernizing the hotel industry in developing countries. However, their successful adoption depends on overcoming significant barriers related to cost, privacy, and cultural expectations. Future research should focus on exploring context-specific solutions that can be adapted to the requests of different hotels in these regions, while continuing to evaluate the long-term impacts of smart technologies on hotel profitability, guest satisfaction, and sustainability.

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Any use of generative AI in this manuscript adheres to ethical guidelines for use and acknowledgment of generative AI in academic research, as outlined in this manuscript. Each author has made a substantial contribution to the work, which has been thoroughly vetted for accuracy, and assumes responsibility for the integrity of their contributions (Porsdam Mann et al., 2024).

References

Ahmed El-Said, O., Elhoushy, S., Smith, M., & Youssif, M. (2024). Crisis-driven innovation in hospitality: How do international hotel chains innovate to recover from a global crisis?, *International Journal of Hospitality Management*, Volume 120, https://doi.org/10.1016/j.ijhm.2024.103758

Barkel, C., Kurgun, H., & Groen, B. (2021). Blockchain in the hospitality and tourism industry. In C. Cobanoglu, S. Dogan, K. Berezina, & G. Collins (Eds.), *Hospitality & tourism information technology* (pp. 1–28). USF M3 Publishing. https://www.doi.org/10.5038/9781732127593

Çeltek, E. (2023). Analysis of Smart Technologies Used in Smart Hotels. *Journal of Business Research*, *15* (4), 2880–2892. https://doi.org/10.20491/isarder.2023.1754

Domanski, M. (2020). The concept of a smart hotel and its impact on guests' satisfaction, privacy and the perception of the service quality (Dissertation). Retrieved from https://urn.kb.se/resolve?urn=urn:nbn:se:sh:diva-41848

Ferreira, V. B. (2023). The impact of IoT-enabled energy management systems on hotel operating costs and sustainability outcomes [Dissertação de mestrado, Iscte - Instituto Universitário de Lisboa]. Repositório Iscte. http://hdl.handle.net/10071/31756

Gajić, T., Ranjbaran, A., Vukolić, D., Bugarčić, J., Spasojević, A., Đorđević Boljanović, J., Vujačić, D., Mandarić, M., Kostić, M., Sekulić, D., Bugarčić, M., Drašković, B. D., & Rakić, S. R. (2024). Tourists' Willingness to Adopt AI in Hospitality—Assumption of Sustainability in Developing Countries. *Sustainability*, *16*(9), 3663. https://doi.org/10.3390/su16093663

Hadi Saputro, S., Arninda, A., Firmansyah, F., & Munawir, M. (2023). Application of Smart Technology in Marketing Strategy Development: An Overview of the Hotel Industry in Bali. *International Journal of Management Science and Information Technology*, *3*(2), 217–225. https://doi.org/10.35870/ijmsit.v3i2.1491

Han, D., Hou, H., Wu, H., & Lai, J. H. K. (2021). Modelling Tourists' Acceptance of Hotel Experience-Enhancement Smart Technologies. *Sustainability*, 13(8), 4462. https://doi.org/10.3390/su13084462

Infante-Moro, A., & Infante-Moro, J. C., & Gallardo-Pérez, J. (2021). Key Factors in the Implementation of the Internet of Things in the Hotel Sector. *Applied Sciences*, 11(7), 2924. https://doi.org/10.3390/app11072924

Ivanov, S. H., Webster, C., Stoilova, E., & Slobodskoy, D. (2022). Biosecurity, crisis management, automation technologies and economic performance of travel, tourism and hospitality companies – A conceptual framework. *Tourism Economics*, 28(1), 3-26. https://doi.org/10.1177/1354816620946541

Katartis, K., & Skordoulis, M., & Panagopoulou, D., & Chalikias, M., & Sidiropoulos, G., & Ntanos, S. (2023). Guests' Perceptions of Smart Technology Security and Privacy: The Case of Hotels in Athens Metropolitan Area. Strategic Innovative Marketing and Tourism. 10th ICSIMAT. (pp 939–946). DOI: 10.1007/978-3-031-51038-0_101

Kaur, A., Goyal, S., & Batra, N. (2024). Smart Hospitality Review: Using IoT and Machine Learning to Its Most Value in the Hotel Industry. 2024 International Conference on Automation and Computation (AUTOCOM). https://doi.org/10.1109/autocom60220.2024.10486158

Kim, J. J., Lee, M. J., & Han, H. (2020). Smart Hotels and Sustainable Consumer Behavior: Testing the Effect of Perceived Performance, Attitude, and Technology Readiness on Word-of-Mouth. *International Journal of Environmental Research and Public Health*, 17(20), 7455. https://doi.org/10.3390/ijerph17207455

Leko, E. J. (2021). Travelers' Perception of SMART Technologies in Hotel Industry (Final thesis). Dubrovnik: RIT Croatia. Retrieved from https://urn.nsk.hr/urn:nbn:hr:229:707617

Li, M., & Yin, D., & Qiu, H., & Bai, B. (2021). A systematic review of AI technology-based service encounters: Implications for hospitality and tourism operations. *International Journal of Hospitality Management*, 95. https://doi.org/10.1016/j.ijhm.2021.102930

Liu, H. (2024). An Exploration of Customer Experience Design Innovation in Tourism and Hospitality Industry Driven by Emerging Technologies. *Applied Mathematics and Nonlinear Sciences*, vol. 9, no. 1, Sciendo, https://doi.org/10.2478/amns-2024-1362

Negro, P. (2022). The Smart Hotel: a contactless and digital journey towards sustainability in Malta. The Online Open Access Repository of the Institute of Tourism Studies (Malta).

Pillai, G. S., Haldorai, K., Seo, S. W., & Kim, G. W. (2021). COVID-19 and hospitality 5.0: Redefining hospitality operations, *International Journal of Hospitality Management*, Volume 94, https://doi.org/10.1016/j.ijhm.2021.102869

Porsdam Mann, S., Vazirani, A. A., Aboy, M., Earp, B. D., Minssen, T., Cohen, I. G., & Savulescu, J. (2024). Guidelines for ethical use and acknowledgement of large language models in academic writing. *Nature Machine Intelligence, 6*(11), 1272-1274. https://doi.org/10.1038/s42256-024-00922-7

Poullas, M. S., & Kakoulli, E. (2023). IoT for Sustainable Hospitality: A Systematic Review of Opportunities and Challenges for the Hospitality Industry Revolution. 2023 19th International Conference on Distributed Computing in Smart Systems and the Internet of Things (DCOSS-IoT), 740-747. https://doi.org/10.1109/dcoss-iot58021.2023.00116

Shani, S., Majeed, M., Alhassan, S., & Gideon, A. (2023). Internet of Things (IoTs) in the Hospitality Sector: Challenges and Opportunities. In: Goar, V., Kuri, M., Kumar, R., Senjyu, T. (eds) Advances in Information Communication Technology and Computing. Lecture Notes in Networks and Systems, vol 628. Springer, Singapore. https://doi.org/10.1007/978-981-19-9888-1_6

Sujood, B. N., & Siddiqui, S. (2024). Consumers' intention towards the use of smart technologies in tourism and hospitality (T&H) industry: a deeper insight into the integration of TAM, TPB and trust, *Journal of Hospitality and Tourism Insights*, Vol. 7 No. 3, pp. 1412-1434. https://doi.org/10.1108/JHTI-06-2022-0267

Torre, D., Chennamaneni, A., & Rodriguez, A. (2023). Privacy-Preservation Techniques for IoT Devices: A Systematic Mapping Study. *IEEE Access, 11*, 16323-16345. https://doi.org/10.1109/access.2023.3245524

Yu, C. H., & Hsu, T.-K. (2024). Empirical Impact of AI Smart Hotel Technological Services on Consumer Attitudes: A Comparison Before and After the COVID-19 Pandemic. *Journal of Global Tourism Research*, 9(1).

Zhang, Q., Khan, S., Khan, S. U., Khan, I. U., & Mehmood, S. (2024). Tourist Motivations to Adopt Sustainable Smart Hospitality: An Innovation Resistance Theory Perspective. *Sustainability*, 16(13), 5598. https://doi.org/10.3390/su16135598