
Enhancing Hospitality Service Delivery: Integrating IoT and AI for Guest Experience and Operational Efficiency

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Abstract:

Technological changes that alter the service delivery method of the hospitality industry have brought a new direction in this sector. The current study presents the integration of IoT and AI to improve the guest experience and increase the efficiency of hotel operations. IoT devices such as intelligent room control, wearable technology, and interconnected appliances can collect data anytime. At the same time, AI will be the vehicle to provide personalised recommendations, predictive maintenance, and automation with this data. With a solid review of case studies, industry reports, and evidence-based research, this paper will not only give insight into how IoT and AI come together to be a part of the interconnected system in a hotel but also provide a list of the application areas for hoteliers to consider. For example, in guest satisfaction ranking, predictive analytics can be used for demand forecasting, dynamic pricing, AI-supported real-time customer service via chatbots, and guest preference tracking. The results promised enhanced guest satisfaction, better energy management, and more resource optimisation. Still, they also pointed out some examples, such as data security, integration complexity, and the high cost of implementation, as the main problems. This study offers insightful tips for players in the hospitality industry to adapt and use the IoT and AI without hassles and thus make their service model more innovative, customer-centric, and efficient. Upcoming research projects could explore ethical considerations and the long-term sustainability impacts of these technologies in the hospitality sector.

Keywords: Internet of Things (IoT), Artificial Intelligence (AI), Hospitality Industry, Guest Experience, Operational Efficiency, Predictive Analytics.

1. Introduction

In recent years, it has become an exciting, highly customer-oriented industry in the hospitality sector, where operational efficiency and personalised experiences are always indispensable determinants of success. Global competition and the changing expectations of customers are forcing today's businesses to adopt new technological tools to boost their service delivery. This integration of the Internet of Things (IoT) and Artificial Intelligence (AI) is among them. The changes it might bring to the hospitality area are getting much attention. This interconnected data environment opens up opportunities to meet the preferences of the future

traveller demographic by creating an operational infrastructure that is efficient as well as adequate.

The network of connected and Internet-based devices is known as the Internet of Things (IoT). Real-time data capture, processing, and transmission are made possible by the devices' sensors and software, which enables instant automation and improved decision-making. IoT applications in the hospitality industry include keyless entry, smart lighting controls, thermostats, and guest wearable technology. Artificial intelligence, on the other hand, is a broader term that includes all forms of machine learning, natural language processing, and predictive analytics. It enables computers to simulate human intelligence, making valuable data

analysis discoveries. Predictive maintenance algorithms, recommendation systems, and AI chatbots are a few of the new AI frontline services that have genuinely improved quality and operational efficiency.

The confluence of IoT and AI opens up an innovative avenue in the hospitality sector. Businesses can offer personalised, seamless services that work more effectively when they use AI for analysis and act on real-time data collected by the Internet of Things. AI, for example, can examine the data obtained through IoT devices, automate tedious work, optimise energy consumption, and forecast visitors' preferences. Besides enabling hospitality operators to manage their resources more efficiently, this connection allows them to cut out expenses. Furthermore, it improved the visitor's experience overall. The most significant benefit of integrating IoT and AI is the provision of unique visitor experiences. Modern tourists place a higher premium on customised services that meet their unique wants and tastes. For instance, visitors can use IoT-enabled gadgets to control smart room controls and set their rooms' lighting, entertainment, and temperature according to their preferences. Data thus analysed helps an AI system anticipate future demand and provide localised attractions, cuisine options, and activity suggestions to increase the chances of happier visitors and increase return business.

The second critical area where the integration of IoT with AI is drastically impacting is related to operational efficiency. IoT-based devices constantly record environmental conditions and equipment efficiency, with AI systems having real-time inputs that can predict the probable need for maintenance to prevent malfunction. For example, smart sensors in HVAC systems identify anomalies and alert personnel for maintenance before a meltdown occurs, thus saving time and repair costs. AI-driven predictive analytics can also improve energy use, personnel levels, and inventory management, hence saving huge costs and promoting sustainability.

It is also worth noting how hospitality uses AI-empowered chatbots and virtual assistants. Employing natural language processing, they

provide instant, round-the-clock service to customers regarding reservations, complaints, and questionnaires. Chatbots can be valuable even further since they can extract real-time visitor preferences, the status of provided services, or room availability information from IoT sensors. This synergy frees human personnel to concentrate on more challenging and valuable duties besides increasing operational efficiency.

Demand forecasting and dynamic pricing are other hospitality IoT and AI integration applications. Using data that IoT-enabled sources have analysed by AI algorithms helps predict the demand and alter pricing strategies, providing the best competitive prices to visitors and optimising revenue opportunities. In this regard, hotels can be made to maximise available market opportunities with AI-based revenue management systems suggesting optimal room prices for busy periods and special events.

Even though integrating IoT and AI has several advantages, the hotel industry faces several drawbacks while using these technologies. The first one is data security and privacy. IoT devices collect private data regarding visitors, such as their payment information, preferences, and habits. It depends on maintaining client trust in protecting this data and following the legal regulations. For hospitality operators, especially smaller companies with fewer resources, the complexity of integrating IoT and AI technologies with current infrastructure may pose serious technical and financial difficulties.

Using AI to make decisions has ethical ramifications as well. For example, AI systems may wind up concealing results or promoting discrimination even if they provide individualised recommendations. These moral conundrums can be significantly reduced with the help of an efficient framework that directs the development and application of AI technology toward societal inclusion, justice, and responsibility.

The future of the hospitality industry looks bright despite these challenges because IoT and AI are integrated into it. With time, technology is expected to increase the scope of potential uses for these

advancements, which will further revolutionise the sector. Some emerging trends include IoT-enabled wellness solutions for personalised exercise and health programs, blockchain technology for safe and transparent data exchange, and AI-powered robotics for cleaning and concierge services. Besides that, those improvements will present the hotel companies with new development channels and room for differentiation amidst stiff competition.

2. Literature Review

2.1 Evolution of IoT and AI in Hospitality

IoT (Internet of Things) and AI (Artificial Intelligence) have transformed the hospitality industry, enabling innovative solutions to meet growing consumer expectations. The initial applications of IoT in hospitality were isolated innovative systems, such as keyless entry and basic environmental controls. However, with advancements in connectivity and data processing technologies, IoT has matured into a robust network of interconnected devices capable of real-time data collection and transmission. Conversely, AI has evolved from simple automation tools to sophisticated systems leveraging machine learning, natural language processing, and predictive analytics. IoT and AI now create intelligent ecosystems that enhance service delivery and operational efficiency. (Park, Lee, & Back, 2023). Integrating IoT applications in the hospitality sector enables innovative environmental enhancements and personalised guest experiences. By leveraging interconnected devices, such as smart room lighting and climate control, IoT gathers valuable data on guest preferences. AI then analyses these insights to predict needs and optimise services accordingly. In line with this concept, Anubala (2023) highlights predictive maintenance, inventory management, and energy efficiency as additional key applications of IoT in hospitality. Despite data security and system integration challenges, IoT and AI drive the industry toward hyper-personalisation and sustainability (Hassan, Rehmani, & Chen, 2019). This technological evolution is reshaping visitor experiences and redefining operational strategies in the hospitality sector.

2.2 Personalisation in Guest Experience

Personalisation is emerging as a critical element of exceptional guest experiences in hospitality operations. Today, travellers consider more services as personalised and tailor-made to their preferences; therefore, the effectiveness of IoT and AI technologies is indispensable. IoT devices can include smart room controls and wearable technologies, which enable guests to customise the atmosphere, controlling lighting, temperature, and entertainment systems to what they want and prefer at any moment. AI complements this by analysing guest behaviour and preferences to provide personalised dining, activities, and service recommendations. Wang (2024) emphasise that these capabilities enhance customer satisfaction and foster loyalty by creating unique and memorable experiences.

AI-driven recommendation systems and chatbots play a pivotal role in personalisation. For example, natural language processing enables chatbots to interact with guests in real time, offering suggestions based on their previous interactions and preferences (Suanpang & Pothipassa, 2024). These systems integrate with IoT devices to deliver highly personalised experiences, such as suggesting activities based on weather conditions and guests' preferences. Additionally, AI is a predictive tool, enabling hotels to anticipate guests' needs before they are explicitly expressed. AI enhances service efficiency and contributes to overall guest satisfaction.

Using IoT and AI to make everything more about making people want to return to the hotel and spend more money. Using IOT and AI is good for business. And guess what? As these techy things get even brighter, the hotels will get even better at making guests feel like VIPs (very important people) when they stay with them. It is all about keeping the tourists happy and ensuring they have the best time ever (Saraswat et al., 2023).

2.3. Operational Efficiency through Predictive Analytics

Predictive analytics, powered by IoT and AI, has become a cornerstone for achieving operational

efficiency in the hospitality industry. With devices such as smart sensors that enable IoT, hotels will observe environmental conditions, equipment performance, and real-time interactions with visitors. AI algorithms use this data to automatically repeat processes, optimise resource utilisation, and predict when maintenance, possibly through replacement, is required. Rane et al. (2023) assert that predictive maintenance reduces the cost of repair and equipment downtime by anticipating potential problems before they are critical. Energy efficiency is another area in which predictive analytics excels. Innovative systems with sensors through the Internet of Things significantly change lighting, heating, and cooling based on occupancy patterns, eliminating energy wastage. AI tools also optimise inventory management and workforce scheduling to allocate resources appropriately to match the demand level. According to Park, Lee, and Back (2023), predictive analytics enhances operational efficiency and supports the sustainability goals set for hospitality.

In addition, real-time data analysis allows hotels to spot trends and predict demand. Additionally, AI systems can predict seasonality or high booking seasons, allowing management to base personnel levels and pricing decisions on these forecasts. Such insights improve decision-making, boost profitability, and improve the entire visitor experience, claims Wang (2024).

2.4. AI-Powered Customer Service

Artificial Intelligence (AI) is revolutionising hotel customer service by enhancing efficiency and personalisation. Advanced computer programs like chatbots and virtual assistants leverage natural language processing (NLP) to engage in human-like interactions. Whether guests need assistance with room reservations or additional amenities, these AI-driven systems ensure prompt and seamless service at any time. This level of responsiveness is akin to having a dedicated personal concierge available around the clock.

According to Rosario and Dias (2024), artificial intelligence (AI) can process a wide range of data and produce highly customised solutions

appropriate for each user and their unique situation. This technological improvement is noticeably better compared to traditional customer care approaches that need lengthy phone waits or email responses. Additionally, it dramatically improves hotels' operating efficiency because they can now accommodate many visitors at once without feeling overloaded. Personalised information that is promptly provided improves client satisfaction, which raises the possibility of repeat business. It is possible to characterise this dynamic as one in which all parties get something from it.

AI-driven customer service's synergistic integration with the Internet of Things (IoT) further boosts its overall efficacy. For example, chatbots with AI capabilities can access and evaluate real-time data from IoT devices, such as the occupancy status of a room or the availability of various services. This enables businesses to give visitors precise and pertinent information, maximising the hospitality experience. This networked system demonstrates how technology and service can coexist harmoniously, enhancing the hotel's overall performance and its patrons' satisfaction. These technologies also allow for seamless personalisation; by analysing past interactions, AI systems can tailor recommendations to suit individual preferences, such as suggesting nearby attractions or offering customised room upgrades (Alsharif et al., 2024).

AI systems allow human workers to focus on more valuable, challenging tasks. According to Rane, Choudhary, and Rane (2023), AI-powered customer service is a crucial component of modern hospitality since it boosts operational effectiveness, reduces labour costs, and sets the bar for exceptional guest encounters.

2.5. Challenges in IoT and AI Integration

While integrating IoT and AI offers transformative opportunities for the hospitality industry, it also presents various challenges that must be addressed to realise its full potential. One of the primary concerns is data security and privacy. IoT devices collect vast amounts of sensitive guest data, including personal preferences, payment

information, and behavioural patterns. Ensuring the security of this data is critical to maintaining customer trust and complying with stringent data protection regulations like GDPR (Hassan et al., 2019). Additionally, the growing number of interconnected devices increases the risk of cyberattacks, requiring robust cybersecurity frameworks.

Integration of IoT and AI is also severely hampered by technical issues. Interoperability problems arise because many hotels' legacy systems are incompatible with cutting-edge IoT and AI technologies (Park, Lee, and Back, 2023). Significant financial investments are frequently needed to integrate new systems with existing infrastructure, which can be prohibitive for small and medium-sized businesses. Furthermore, it is still challenging to guarantee smooth connectivity between platforms, apps, and devices.

The deployment of AI algorithms is made more difficult by ethical issues. For example, AI-driven decision-making systems may inadvertently reinforce biases or operate in an opaque manner, which raises questions about equity and accountability (Saraswat et al., 2023). Finding a balance between automation and human interaction presents another challenge because an excessive dependence on technology might compromise the personalised connections that characterise hospitality.

Finally, implementation may be challenging due to employee resistance to change and organisational readiness. Even though it can be expensive and time-consuming, training employees to use IoT and AI technology efficiently is crucial. Wang (2024) emphasises that dealing with these issues calls for an all-encompassing approach that incorporates stakeholder cooperation, robust governance, and unambiguous ethical standards.

2.6. Emerging Trends and Future Directions

The future of guest experiences and operational strategies will be shaped by new developments in the hotel industry's ongoing integration of IoT and AI. One noteworthy trend is the employment of AI-powered robotics for housekeeping, food delivery,

and concierge services. These robots provide creative guest encounters and improve operational efficiency because of their sophisticated AI and IoT connectivity. Robots solve labour shortages and raise cleanliness standards, particularly in the post-pandemic era, as Alsharif et al. (2024) highlighted.

Blockchain technology is another emerging trend, particularly in securing IoT data and improving transparency in hospitality operations. Blockchain can enhance guest trust by providing immutable records of transactions and ensuring data integrity (Hassan et al., 2019). Identity verification, loyalty schemes, and smooth payment systems benefit greatly.

Wellness-focused solutions within the hospitality industry have experienced a burgeoning surge in popularity as hotels increasingly integrate advanced technologies such as artificial intelligence (AI) and the Internet of Things (IoT) to tailor fitness and health experiences for their clientele. In their most recent scholarly publication, Park and their collaborators (2023) explore the burgeoning phenomenon within the hospitality industry wherein the escalating expectations of guests for holistic well-being are accommodated through the thoughtful design of personalised environments. These spaces are predominantly distinguished by their spaciousness and ample natural light, complemented by a comprehensive array of wellness facilities. These innovative features include artificial intelligence (AI)-driven personal fitness coaching systems, lighting arrangements synchronised with circadian rhythms, and advanced air quality monitoring technologies. This multifaceted approach to hospitality caters to guests' physical well-being and bolsters their psychological and emotional health by offering a tailored and harmonious setting that is attuned to their unique requirements and inclinations. This technology integration exemplifies a significant advancement in the hospitality sector, where comprehensive guest welfare is now recognised as a key competitive differentiator and a fundamental component of service excellence.

Furthermore, the imperative of sustainability propels innovation within the industry. The

implementation of Internet of Things (IoT) technology, as discussed by Saraswat et al. (2023), facilitates the introduction of energy management systems that are empowered by AI algorithms to optimise resource utilisation. These innovative strategies contribute to cost reduction and align with environmental objectives, enhancing hospitality establishments' overall sustainability profile. The integration of AI also enables more nuanced demand forecasting and dynamic pricing models, which are instrumental in preserving financial viability while upholding customer satisfaction.

Looking ahead, Wang (2024) predicts that the expected growth of 5G network capabilities will have a significant impact on how the Internet of Things (IoT) and artificial intelligence (AI) converge in the hospitality industry. This technical advancement would facilitate quick data transfer and improve inter-device connectivity, giving visitors a more cohesive and upscale experience. However, as these trends continue to develop, it is evident that academic research must address the resulting issues, including data security, the moral ramifications of AI implementation, and workforce adaptation to these new technologies. Resolving these important issues is essential to IoT and AI's long-term integration and advancement within the hospitality industry.

3. Methodology

The Research methodology used to investigate the integration of artificial intelligence (AI) and the Internet of Things (IoT) in the hotel industry, a mixed-method approach was employed to understand the study problem thoroughly. The methodological approach integrates surveys and secondary data analysis to provide an impartial and fact-based perspective.

3.1 Research Design

The study uses a mixed-method approach combining qualitative and quantitative methods to address the research objectives. This approach comprehensively explores IoT and AI's practical applications and theoretical underpinnings in the hospitality sector. By triangulating data from different sources, the study aims to provide robust

and actionable insights for stakeholders in the industry.

3.2 Case Studies

3.2.1 Selection of Case Studies

The case study method was chosen to examine real-world applications of IoT and AI in leading hotel chains. Hotels that have successfully implemented IoT and AI technologies were selected based on the following criteria:

- Industry reputation and innovation in technology adoption.
- Availability of data on IoT and AI integration.
- Geographic diversity to capture global trends.

Examples of selected case studies include international hotel chains such as Marriott International, Hilton Hotels, and Roseate, all of which have made significant strides in incorporating IoT and AI into their operations.

3.2.2 Data Collection for Case Studies

Data for the case studies was collected through:

- **Interviews with Hotel Management** – Structured interviews were conducted with senior executives, IT managers, and operations staff to gain insights into the motivations, implementation processes, and outcomes associated with the adoption of IoT and AI technologies.

- **IoT and AI system observation:** The researcher examined technologies, including AI-powered customer support platforms, smart room controls, and predictive maintenance systems, during on-site visits.

- **Examining case files and internal reports:** Operational data and confidential reports shed light on the difficulties faced and quantifiable results attained.

3.2.3 Data Analysis for Case Studies

The results of the case studies offer qualitative insights into successful implementations, challenges, and best practices. A thematic analysis was performed to find recurrent patterns and themes across the chosen case studies. The key metrics examined are improvements in guest satisfaction,

operational efficiency, energy management, and cost savings.

3.3 Surveys

3.3.1 Survey Design

Structured surveys were designed to gather primary data and target two key stakeholder groups: hospitality professionals and guests. The surveys included a mix of closed-ended and open-ended questions to capture both quantitative data and qualitative feedback.

Survey for Hospitality Professionals

The survey for hospitality professionals focused on:

- Perceived benefits of IoT and AI technologies.
- Operational challenges and barriers to adoption.
- Impact of these technologies on service delivery and cost efficiency.

Survey for Guests

The guest survey aimed to understand the following:

- Perceptions of IoT and AI in enhancing their experience.
- Preferences for personalised services enabled by these technologies.
- Concerns related to data privacy and security.

3.3.2 Sampling Strategy

A purposive sampling strategy was employed to select respondents with relevant experience and knowledge. For hospitality professionals, the sample included managers and employees from various departments, such as front office, housekeeping, and IT. Guests were sampled from different demographic and geographic backgrounds to ensure diversity.

3.3.3 Data Collection for Surveys

The surveys were administered through online platforms and in-person distribution at selected hotels. The survey instruments were pre-tested with a small group of respondents before full-scale distribution to ensure reliability and validity. A total of 200 hospitality professionals and 300 guests participated in the surveys.

3.3.4 Data Analysis for Surveys

Quantitative survey data were analysed using statistical tools such as SPSS and Excel. Descriptive statistics (mean, median, mode) were calculated to summarise the data, while inferential statistics (e.g., regression analysis and chi-square tests) were used to identify relationships and trends. Qualitative responses were analysed using content analysis to identify key themes and insights.

3.4 Secondary Data Analysis

3.4.1 Sources of Secondary Data

Secondary data was collected from:

- **Industry reports:** Reports from organisations like Deloitte, McKinsey, and the World Travel and Tourism Council provided insights into market trends and benchmarks.
- **Academic publications:** Peer-reviewed journal articles and conference proceedings were reviewed to establish a theoretical foundation for the study.
- **Market research studies:** Data from research firms such as Statista and Markets and Markets was used to understand the adoption and impact of IoT and AI in the hospitality sector.

3.4.2 Data Analysis for Secondary Data

The secondary data was subjected to content analysis to identify trends, opportunities, and challenges related to IoT and AI adoption. Key areas of focus included:

- Application areas of IoT and AI in hotels.
- Benefits and limitations of these technologies.
- Case examples and success stories.

3.5 Ethical Considerations

Ethical considerations were integral to the research process to ensure the credibility and integrity of the study. Key measures included:

- **Informed consent:** Participants in the surveys and interviews were informed about the purpose of the study and their right to withdraw at any time.

- **Confidentiality:** Data collected from participants and case studies were anonymised to protect their privacy.

- **Data security:** Secure platforms were used for data collection and storage to prevent unauthorised access.

3.6 Limitations of the Methodology

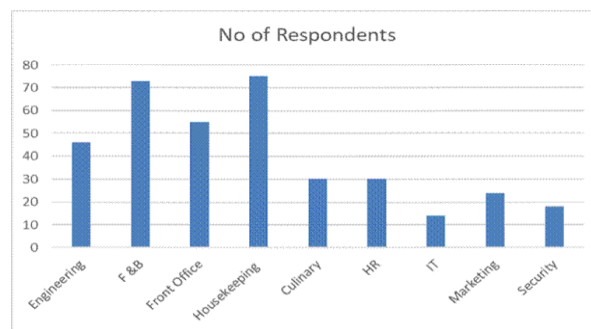
While the mixed-method approach provides a comprehensive perspective, certain limitations must be acknowledged:

4. Findings and Discussion

- **Case study generalizability:** Findings from specific hotel chains may not apply to all hospitality contexts.

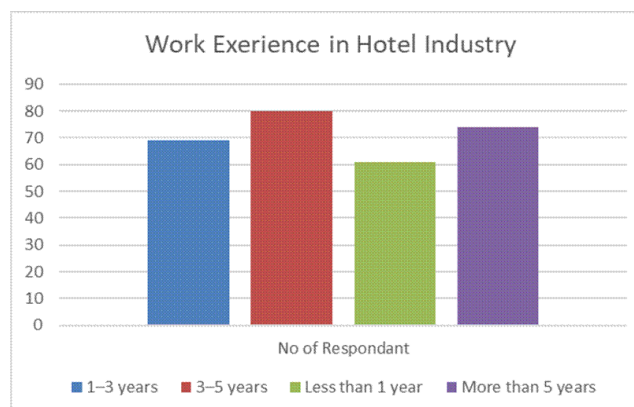
- **Survey biases:** Self-reported survey data may be subject to biases, such as social desirability bias.

- **Secondary data reliability:** Secondary data's accuracy depends on the sources' credibility.



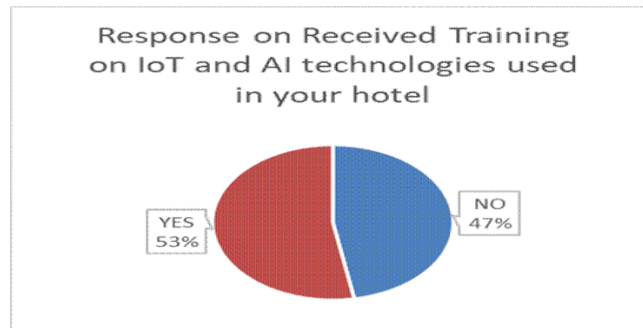
The graph shows the number of respondents from different departments. Housekeeping and F&B departments have the highest number of

respondents, followed by Front Office and Engineering. Departments like IT, Marketing, and Security have comparatively fewer respondents.



The graph shows the work experience of respondents in the hotel industry. Most respondents have 3-5 years of experience, followed by those

with more than 5 years. Fewer respondents have 1-3 years of experience, and the least number have less than 1 year of experience.



The pie chart shows the respondents' feedback on receiving training in IoT and AI technologies at their

hotel. About 53% of respondents confirmed receiving training, while 47% reported they had not received any training.

Perceived Benefits of IoT and AI

How beneficial do you find IoT and AI

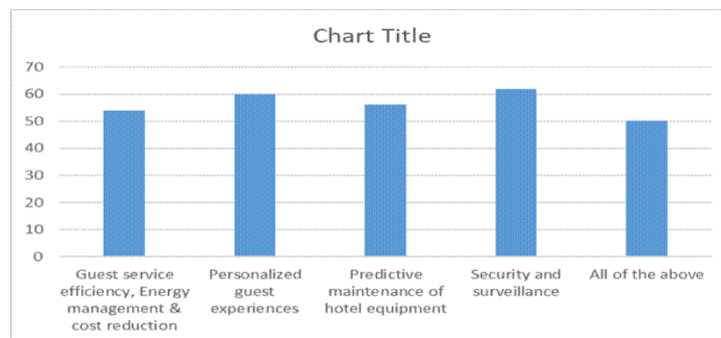
Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Valid N (listwise)	280	1	5	3.17	1.413

The descriptive statistics table summarizes the responses to the question "How beneficial do you find IoT and AI?" A total of 280 respondents participated in this survey. The ratings ranged from a minimum of 1 to a maximum of 5, indicating that while some respondents found IoT and AI technologies not beneficial at all, others considered

them extremely beneficial. The mean score was 3.17, suggesting that, on average, respondents found these technologies to be moderately beneficial. The standard deviation was 1.413, showing a considerable variation in responses, meaning that opinions among respondents were quite diverse regarding the benefits of IoT and AI.

Which areas have seen the most improvement due to IoT and AI



The bar chart highlights the key areas where IoT and AI technologies are perceived to bring the most benefits in the hotel industry. Among the different options, "Security and surveillance" received the highest number of responses, indicating that many respondents view enhanced security as a major advantage of these technologies. "Personalized

guest experiences" also scored highly, suggesting that tailoring services to individual guest preferences is another important benefit. "Predictive maintenance of hotel equipment" and "Guest service efficiency, energy management, and cost reduction" were also commonly acknowledged, reflecting the operational and financial improvements brought by technology. Lastly, a significant number of

respondents selected "All of the above," showing that many believe IoT and AI offer multiple,

simultaneous benefits across various hotel operations.

Do you believe IoT and AI technologies enhance guest satisfaction?

		Var			
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes, significantly	174	31.9	31.9	31.9
	Yes, to some extent	189	34.6	34.6	66.5
	No	183	33.5	33.5	100.0
Total		546	100.0	100.0	

The table summarizes the responses to the question, "Do you believe IoT and AI technologies enhance guest satisfaction?" Out of a total of 546 respondents, 31.9% (174 respondents) believed that IoT and AI technologies significantly enhance guest satisfaction. A slightly higher percentage, 34.6% (189 respondents), felt that these technologies

enhance guest satisfaction to some extent. Meanwhile, 33.5% (183 respondents) did not believe that IoT and AI have an impact on guest satisfaction. Overall, the results show a fairly even distribution of opinions, with a slight majority acknowledging at least some positive impact of IoT and AI technologies on guest experiences.

Operational Challenges & Barriers to Adoption

Challenges you have faced while using IoT and AI technologies

		Challenges_faced_while_using_IoT_and_AI_technologies Frequencies		
		Responses		Percent of Cases
		N	Percent	
1 ^a	Lack_of_proper_training	104	31.7%	41.1%
	System_malfunctions_technical_glitches	48	14.6%	19.0%
	Resistance_from_staff_to_adopt_new_technologies	53	16.2%	20.9%
	Privacy_and_security_concerns	67	20.4%	26.5%
	No_challenge	56	17.1%	22.1%
Total		328	100.0%	129.6%

a. Dichotomy group tabulated at value 1.

The operational challenges and barriers to the adoption of IoT and AI technologies in the hotel industry are clearly reflected in the survey findings. A significant proportion of respondents (31.7%) identified the lack of proper training as the major challenge, affecting 41.1% of the cases. This highlights a critical gap in preparing staff to effectively utilize these technologies. Additionally, privacy and security concerns were reported by 20.4% of respondents, showing ongoing worries about safeguarding guest and operational data. Resistance from staff to adopt new technologies was

another notable challenge, with 16.2% citing it, suggesting cultural and behavioral barriers within organizations. System malfunctions and technical glitches were reported by 14.6% of the participants, underlining the need for reliable and well-maintained systems. Interestingly, 17.1% of respondents indicated facing no challenges, suggesting that a portion of establishments have successfully integrated these technologies. Overall, the data reveals that while IoT and AI offer many benefits, significant operational and human-related hurdles still need to be addressed to fully realize their potential.

How frequently do you experience technical issues with IoT and AI systems?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Daily	52	9.9	18.6	18.6
	Weekly	56	10.7	20.0	38.6
	Occasionally	64	12.2	22.9	61.4
	Rarely	56	10.7	20.0	81.4
	Never	52	9.9	18.6	100.0
	Total	280	53.3	100.0	
Missing	System	245	46.7		
Total		525	100.0		

The table presents the frequency of technical issues experienced by users with IoT and AI systems, based on responses from 525 individuals. Out of the total, 280 participants (53.3%) provided valid responses, while 245 individuals (46.7%) did not answer the question, indicating a substantial portion of non-responses that could reflect limited exposure or interest in such technologies. Among the valid responses, the most common answer was "Occasionally," reported by 22.9% of respondents, suggesting that intermittent technical issues are the most frequent experience. Additionally, 20% each reported experiencing issues on a "Weekly" or

"Rarely" basis, while 18.6% faced them "Daily" and another 18.6% claimed they "Never" encountered issues. Notably, around 38.6% of the respondents face problems on a daily or weekly basis, highlighting a considerable prevalence of frequent technical disruptions. On the other hand, the same proportion (38.6%) reported rarely or never experiencing such issues, showing a balanced distribution in user experiences. Overall, while a significant number of users are dealing with regular issues, the high rate of missing responses suggests the need for broader digital literacy or improved communication regarding the use of IoT and AI technologies.

Do you feel confident in troubleshooting minor issues with IoT and AI

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes, I can resolve basic problems	141	26.9	50.4	50.4
	No, I always require IT support	138	26.3	49.3	99.6
	I have never encountered any issues	1	.2	.4	100.0
	Total	280	53.3	100.0	
Missing	System	245	46.7		
Total		525	100.0		

The table illustrates respondents' confidence in troubleshooting minor issues related to IoT and AI systems. Out of 525 total participants, 280 individuals (53.3%) provided valid responses, while a significant 245 participants (46.7%) did not respond to this question. Among those who answered, a slight majority—141 respondents (50.4%)—expressed confidence in resolving basic problems independently, indicating a reasonable level of self-sufficiency with technology. On the other hand, 138 respondents (49.3%) stated that they always require IT support when facing technical

issues, pointing to an almost equal proportion of users who depend on external assistance. Only one respondent (0.4%) reported never having encountered any problems at all. This near-equal split between self-reliant and support-dependent users suggests a need for more focused digital training or user-friendly support resources to help enhance users' confidence in troubleshooting. Additionally, the high percentage of non-responses may indicate a gap in awareness or familiarity with such technologies, which could be an area of concern for organizations promoting digital adoption.

On a scale of 1–5, how much have IoT and AI improved service delivery in your department?

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Service_improvement	280	1.00	5.00	2.9964	1.45789
Valid N (listwise)	280				

The table provides descriptive statistics for participants’ ratings on how much IoT and AI have improved service delivery in their departments, using a 5-point scale (1 = Not at all, 5 = Significantly). A total of 280 valid responses were analyzed. The mean rating is approximately 2.996, suggesting a moderate perception of improvement, just below the midpoint of the scale. The minimum and maximum values reported were 1.00 and 5.00, respectively, indicating that experiences vary

widely, from no improvement to significant improvement. The standard deviation of 1.45789 reflects a relatively high degree of variability in respondents’ views, suggesting differing levels of exposure, implementation, or impact of IoT and AI technologies across departments. Overall, while there is an average sense of moderate benefit from these technologies, the wide range of responses highlights the need for more consistent integration and optimization of IoT and AI tools to enhance service delivery effectively.

Have these technologies reduced your manual workload?

Workload_Impact

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes, significantly	90	17.1	32.1	32.1
	Yes, but only slightly	90	17.1	32.1	64.3
	No, my workload remains the same	100	19.0	35.7	100.0
Total		280	53.3	100.0	
Missing	System	245	46.7		
Total		525	100.0		

The table summarizes participants’ perceptions of whether IoT and AI technologies have reduced their manual workload. Out of 525 total respondents, 280 (53.3%) provided valid responses, while 245 (46.7%) did not answer this question. Among those who responded, 32.1% stated that these technologies have significantly reduced their workload, and an equal 32.1% indicated a slight reduction. This shows that nearly two-thirds of respondents (64.3%) have

experienced some degree of workload relief due to technological integration. In contrast, 35.7% of participants reported that their workload has remained unchanged, suggesting that the impact of IoT and AI on manual tasks may vary depending on roles, departments, or implementation levels. Overall, the data indicates a positive trend toward automation and efficiency, although a significant portion of the workforce has yet to feel the benefits in terms of workload reduction.

Has IoT and AI adoption led to cost savings in your department

Cost_Impact

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes, significantly	93	17.7	33.2	33.2
	Some savings	91	17.3	32.5	65.7
	No change	96	18.3	34.3	100.0
	Total	280	53.3	100.0	
Missing	System	245	46.7		
Total		525	100.0		

The table presents respondents’ views on whether the adoption of IoT and AI technologies has resulted

in cost savings within their departments. Out of a total of 525 participants, 280 individuals (53.3%) provided valid responses, while 245 (46.7%) did not

respond to the question. Among the valid responses, 33.2% indicated that the technologies have led to significant cost savings, while 32.5% reported some level of savings. Together, these responses suggest that approximately two-thirds (65.7%) of the respondents have observed at least some financial benefit from adopting IoT and AI systems. However, 34.3% of respondents noted no change in departmental costs, implying that in some cases, either the cost reductions have not materialized or the investment in such technologies has not yet yielded measurable financial returns. Overall, the data reflects a generally positive perception of IoT and AI's impact on cost efficiency, though it also highlights areas where further optimization or longer-term implementation might be needed to realize savings.

5. Conclusion

This study aimed to assess the awareness, benefits, and operational challenges of IoT and AI technologies in the hospitality industry. Drawing from responses across various hotel departments, the findings present a nuanced picture of the current state of technological adoption.

The data reveals a moderate level of adoption and perceived benefit, with the majority of respondents acknowledging improvements in areas such as security and surveillance, personalized guest services, and predictive maintenance. The average perceived benefit score of 3.17 (out of 5) and a similar rating for service delivery improvement (mean 2.996) reflect a cautiously optimistic sentiment, indicating that while IoT and AI technologies are bringing value, the full potential is yet to be realized.

A significant insight from the study is the training gap: 47% of respondents have not received training, and lack of training was the most cited operational challenge. This points to an urgent need for targeted capacity-building initiatives. Additionally, technical issues were a regular occurrence for many, with 38.6% of respondents facing them on a daily or weekly basis, while an almost equal number reported rare or no problems—suggesting disparities in system implementation or support

infrastructure. User confidence is another key area for development. While half of the respondents felt confident handling minor issues, the other half depended on IT support. This again signals the need for upskilling staff to ensure smoother technology integration.

From an operational standpoint, 64.3% reported a reduction in manual workload, and 65.7% acknowledged cost savings—showing that technological interventions are beginning to deliver tangible efficiency gains. However, a sizeable group (35–36%) did not perceive any changes, indicating that the rollout of such systems is uneven or still in early phases in certain contexts.

Overall, while the hospitality sector is embracing IoT and AI, challenges such as inadequate training, technical inconsistencies, and variable adoption across departments remain. For hotels to fully leverage the advantages of these technologies, a more strategic and inclusive approach to digital transformation is essential—one that includes consistent investment in infrastructure, comprehensive training, and a culture of innovation.

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