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THE PERCEPTION OF ARTIFICIAL INTELLIGENCE AND THE METAVERSE BY HOTEL MANAGEMENT IN MARKETING AND DATA MANAGEMENT: A CASE STUDY FROM POLAND

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Purpose: This paper aims to assess the potential application of AI and the metaverse in marketing and data management in hotels, as well as to identify areas where these technologies can support managerial activities.
Design/methodology/approach: Based on a literature review and quantitative research, the key aspects of using these tools are presented, considering both the challenges and the perspectives on their implementation in the hospitality sector. The following research questions were formulated: How does hotel management perceive the application of AI and the metaverse in marketing and data management? What challenges and perspective do hotel managers identify in the implementation of these technologies? The study was conducted using a diagnostic survey method via online platforms in 2024. It involved individuals in managerial positions, including directors and department heads in selected hotels in Poland.
Findings: The statistic analysis of the results shows that AI and the metaverse play a significant role in the hospitality industry. Managers appreciate the benefits of these technologies while also noting the potential difficulties related to their implementation.
Research limitations/implications: The study points to possible directions for future research that could contribute to a better understanding of the processes of building managerial trust in AI applications, both in the hospitality industry and other sectors. The main limitations include the relatively small and non-representative sample, limited to hotel managers in Poland, and the predominance of quantitative data, which may not fully capture the complexity of attitudes toward AI. Future studies should incorporate larger, more diverse samples and qualitative methods to provide deeper insights.
Practical implications: The study highlights the need for targeted education and training in digital competencies among hospitality managers to overcome barriers to AI adoption and improve implementation strategies.
Social implications: The findings may support a more socially responsible digital transformation by emphasizing the importance of building trust in AI technologies and considering cultural and demographic factors in the adoption process.
Originality/value: The study provides new, practical insights into specific areas of AI application and resistance within the hospitality sector, offering a basis for cross-sector comparisons and further research on AI use in service industries.

Keywords: artificial intelligence (AI); metaverse; marketing; data management; hospitality industry; management staff.
Category of the paper: Research paper.

1. Introduction

The hospitality industry faces challenges arising from dynamic market changes, increasing competition, and evolving customer expectations. It is also undergoing a significant transformation with the implementation of artificial intelligence (AI) technologies and the concept of the metaverse (Jabeen, Al Zaidi, Al Dhaheri, 2022). The global travel technology market, including AI, is growing rapidly, with intelligent hotel systems increasingly influencing service quality and customer satisfaction (Wang, 2022). The global travel technology market, including AI, is projected to grow by over 9% from 2010 to 2023 (Samala, 2022).

The ongoing digital transformation in hospitality has created new opportunities for automation, data analysis, and personalized services (Mariani, Borghi, 2023). AI-based chatbots and recommendation systems play a key role in personalizing service and enhancing service value (Casaló et al., 2025). Meanwhile, the metaverse represents a potential tool for conducting immersive marketing activities and creating virtual experiences for guests. These technologies not only improve hotel operations but also enhance customer satisfaction, which is crucial for maintaining competitiveness (Hapek, 2020). AI and the metaverse can significantly support hotel management, particularly in marketing and data management. However, their implementation poses technical, organizational, and legal challenges, requiring careful planning and adaptation strategies. Therefore, their practical applications in hospitality still require in-depth research (Dwivedi et al., 2024).

Research on AI applications in hotels is essential for understanding their impact on hotel operations and the benefits for both managers and guests (Kong et al., 2023; Pizam et al., 2022). Artificial intelligence has become a crucial tool in data analysis, process automation, and the personalization of hotel services (Mariani, Borghi, 2023). AI-driven generative chatbots and recommendation systems increasingly play a significant role in enhancing the value of hotel services (Casaló et al., 2025). Additionally, the concept of the metaverse opens new opportunities for immersive customer experiences and marketing campaigns, although its application in hospitality still requires further exploration (Dwivedi et al., 2024).

Understanding how hotel managers perceive and implement AI and metaverse technologies is vital for developing effective digital strategies. Misconceptions or lack of awareness about these tools may impede their adoption, limiting potential competitive advantages in an increasingly technology-driven market (De Cremer, Bianzino, Falk, 2023).

This study examines how hotel managers perceive the application of AI and the metaverse in marketing and data management, with a focus on identifying the challenges and opportunities associated with their implementation. It also seeks to address key research questions regarding how these technologies are viewed by hotel managers and the potential obstacles they foresee in integrating them into the hospitality industry. The following research questions were formulated:

- RQ1: How do hotel managers perceive the use of AI and the metaverse in marketing and data management?
- RQ2: What challenges and opportunities do hotel managers see in implementing AI and the metaverse in the hospitality industry?

This article addresses the issue of the use and trust in AI and metaverse tools among hotel management. Both in Poland and globally, there is a lack of research analyzing hotel managers' perceptions of artificial intelligence and the metaverse in the context of marketing and data management. Most available studies focus on technological aspects or on the perspective of customers and staff, while managers often lack sufficient knowledge about the opportunities and challenges related to the implementation of these technologies.

The goal of this study is to explore the role of AI and the metaverse in hotel marketing and data management, as well as to assess their perceived impact, potential benefits, and key challenges from the perspective of hotel management (Limna, 2022). The article aims to fill this gap by providing practical guidance and supporting informed strategic decision-making in the hospitality sector.

2. Foundations and Applications of AI and Metaverse in Hospitality

2.1. Concepts and Evolution of AI and Metaverse Technologies

Recent crises, such as the COVID-19 pandemic, have forced hotel companies and their guests to adopt advanced technologies that allow them to avoid direct physical interactions (Zaman et al., 2024; Bagozzi et al., 2022; Foroudi et al., 2023). Advances in fast communication and digital technologies have significantly influenced the development of interactions between humans and machines (Kamble et al., 2018). These interactions take place in virtual spaces and involve various entities, both human and digital. With the advent of Web 3.0, technologies such as Artificial Intelligence (AI), Virtual Reality (VR), and Augmented Reality (AR) have become ubiquitous and are applied in nearly every industry (Chen, 2023; Cicek et al., 2024; Filep et al., 2024; Gursoy et al., 2022). Generative Artificial Intelligence (GenAI) represents a modern form of artificial intelligence (AI), capable of autonomously generating digital content based on prompts provided by the user (De Cremer et al., 2023; Dwivedi et al., 2024). These advanced

technologies offer hotel guests engaging and dynamic experiences that can potentially increase interest and contribute to sales growth (Huang et al., 2019; Hoyer et al., 2022; Kong et al., 2024; Liu et al., 2024; Qiu et al., 2024).

Over the last few decades, many definitions of this phenomenon have emerged. AI is considered a field of science that seeks to explain and replicate intelligent behavior using computational methods (Schalkoff, 1990). It is also described as a "multidisciplinary engineering field" encompassing many other subdisciplines (Przegalińska, Oksanowicz, 2020). However, the most universal definition was provided in the studies of Urwin (2024), who defined AI as a tool created to assist or replace human thinking. It is assumed that key components of human intelligence include the ability to remember, perception of the surrounding world, reasoning (Sternberg, 2023), learning skills, problem-solving, and achieving goals in a changing and uncertain environment (Manning, 2020). In the context of computer science, AI is defined as the ability of machines to communicate with humans without revealing their non-human nature (Jiang et al., 2022). According to B. Marr (2016), AI can be divided into three main paradigms: Symbolic AI (GOFAI – Good Old-Fashioned AI; based on rules, logic, and symbols), Statistical AI (based on the analysis of large data sets, Machine Learning, ML), and Subsymbolic AI (Deep Learning, DL, or Reinforcement Learning, RL). Additionally, hybrid AI, connectionism, evolutionary AI, agent-based systems, and AI inspired by cognitive science are also mentioned (Dellermann et al., 2019; Kaufman, Gorman, 2023; Pileggi, 2023; Tomczyk, Brüggemann, Doligalski, 2024).

The international organization OECD (2019a) defines an AI system as a machine-based system that, for specific objectives, can make predictions, recommendations, or decisions, influencing real or virtual environments. AI has seven different use cases that can coexist within the same system: hyper-personalization, conversation and human interaction, applications using pattern and anomaly detection, recognition, goal-driven systems, predictive analytics and decision support, and autonomous systems.

According to the definition by the Council of the European Union (2022), the term "metaverse" comes from the words "meta" (meaning "beyond") and "universe". It is a real-time online network built on the integration of various technologies, such as blockchain, AI, and interactive sensing technologies (KPMG China, 2022). The metaverse is a "post-reality universe," a persistent, multi-user environment that merges physical reality with digital virtuality. It relies on the convergence of technologies that enable multisensory interactions, including VR and AR, creating immersive, socially connected environments (Mystakidis, 2022). The metaverse is a three-dimensional Internet (3D) experience that combines and blurs the boundaries between reality and virtuality (Hui, 2022), where users interact through avatars, make purchases using cryptocurrencies, and work remotely.

The AI market is expected to experience significant growth over the next decade. In 2024, total global corporate investment in AI reached nearly 184 billion U.S. dollars, marking an increase of almost 50 billion compared to 2023. This impressive trend is expected to

continue, with the market surpassing 826 billion U.S. dollars by 2030 (Statista, 2025a). Also, the global metaverse market size was estimated at USD 105.6 billion in 2025 and is projected to grow at a CAGR of 37.43%from 2025 to 2030. By 2030, it is projected that the metaverse market will have 2.6 billion users, and is expected to increase to 39.7%. The metaverse market is experiencing rapid growth globally, with nations such as the United States, China, and Japan at the forefront of technological innovations and user engagement (Statista, 2025b).

2.2. The potential of AI and Metaverse in the Hospitality Industry

An important element in the context of AI in hospitality is the significant potential of using digital technologies (Kopera, 2021). Over the past few years, artificial intelligence has become an extremely important tool used in hotel management (Mnyakin, 2023). It finds wide applications, improving both operational efficiency and guest experiences. Table 1 outlines the key areas of AI usage in hotels.

The development of AI is closely linked to rapid access to large volumes of diverse data, enabled by cloud computing and big data technologies. These tools allow AI to learn and effectively use acquired information (Łapczyński, 2020; Mnyakin, 2023). Digital data has become a new production factor influencing the development and competitiveness of companies, sectors, and nations (OECD, 2019b).

In hotels, AI is mainly used to analyze guest behavior and preferences, allowing for more effective, targeted marketing campaigns (Markowitz et al., 2023). Commonly used technologies include data analysis and business intelligence systems, customer review monitoring, payment automation, and PMS for managing reservations and inventory. Other tools include chatbots, virtual assistants (such as ChatGPT), humanoid and kitchen robots, AV and conference technologies, the Internet of Things (IoT), the metaverse (VR/AR), and autonomous or electric vehicles (Kong et al., 2023).

Hotel operators place the most trust in technologies that directly support hotel operations, such as reservation and online payment systems. In contrast, more advanced solutions like kitchen robots or VR/AR are met with greater skepticism, likely due to their lower familiarity and adoption in the industry (Yin et al., 2024).

The implementation of AI in the hospitality industry offers many opportunities and benefits for businesses, but also presents numerous challenges and concerns that managers must face. As AI continues to develop, its impact on the industry will grow, transforming traditional management methods into more modern and efficient ones (Limna, 2023; Marković, Janković, Zubović, 2020; Davenport et al., 2020). Although AI will not fully replace managerial positions, it can contribute to improving the quality of their work (Mnyakin, 2023).

Table 1.
Key areas of AI technology utilization in the hospitality industry

Areas	Description
Data Management	AI supports the analysis of interrelationships between data and other competencies, such as management skills or design.
Personalization of Guest Experience Services	AI analyzes data regarding customer needs, preferences, behaviors, and history in real-time. It provides personalized recommendations or loyalty programs, e.g., related to rooms, spa services, or restaurant preferences, increasing guest satisfaction. Hotels use AI to predict guest needs and preferences.
Process Automation	AI-based chatbots are conversational agents that can be integrated with a hotel's website or mobile app to handle guest queries, requests, and complaints. Chatbots and virtual assistants are used for check-ins, check-outs, meal bookings, recommendations, or ordering other services without staff interaction, reducing guest waiting times and increasing operational efficiency.
Guest Feedback Analysis	Processing guest feedback and ratings, identifying key areas for improvement, leading to service enhancement.
Revenue Management, Forecasting, Price Optimization	AI algorithms analyze internal and market data, predict demand, and optimize prices in real-time, adjusting offerings to the dynamic market and maximizing revenue. They conduct market segmentation, channel management, and competitor analysis.
Energy and Resource Management	Monitoring resource consumption, optimizing settings, reducing costs and environmental impact, reporting (e.g., ESG).
Security and Protection	Monitoring and protecting the premises, verifying suspicious activities, and identifying potential threats in real-time, e.g., video surveillance, facial recognition, access control, threat detection, and fraud detection.
Predictive Maintenance	AI is used to predict and prevent equipment failures or maintenance needs, reducing downtime, taking preventive actions, and improving operational efficiency, e.g., sensor networks, machine learning, real-time monitoring, and automatic notifications.

Source: own elaboration based on: Melnyk, Barna, 2022; Al-Hyari, Al-Smadi, Weshah, 2023, pp. 810-812; Kacar, 2023.

The rapid development of the tourism industry, along with the adoption of AI and machine learning, is reshaping the structure of the sector and hotel operations (Samala, 2022). Hotels increasingly rely on technology to improve service quality and guest satisfaction, from booking to checkout (Roy et al., 2020). AI enables service personalization, process optimization, and enhanced efficiency, playing a key role in guest satisfaction and loyalty, especially in luxury hotels (Jabeen et al., 2022; Nozawa et al., 2022). It can significantly influence and transform the guest experience (Bharwani, Mathews, 2021; Wang, 2022; Mariani, Borghi, 2023; Avula, Sithole, 2024).

AI is increasingly applied in customer service, marketing, and hotel operations (Limna, 2022). Marketing tools like recommendation systems, big data, and the metaverse support personalized offers and dynamic pricing (Al-Hyari, Al-Smadi, Weshah, 2023; Mariani, Borghi, 2023). High-quality intelligent systems also enhance operational efficiency and competitiveness (Hussein et al., 2022), highlighting AI's growing strategic role in hospitality (Al-Hyari, Al-Smadi, Weshah, 2023).

The literature also points to challenges and barriers that may affect the pace and scope of implementing these solutions, requiring careful analysis and the adaptation of implementation strategies to the specifics of the hospitality industry (Al-Hyari, Al-Smadi, Weshah, 2023; Mariani, Borghi, 2023). Concerns are raised regarding guest data privacy, security,

and integration with existing systems, which generates high costs for implementing the latest solutions (Hussein et al., 2022). Additional threats include questioning the effectiveness of AI and the credibility of generated information (hallucinations), as well as the limitations of algorithms, lack of creativity, empathy, and dexterity, and continuous learning that requires large amounts of data, including personal data (Lee, Qiufan, 2021). Currently, hotel management faces the challenge of building trust in AI both among customers and employees (Jia, Chi, Chi, 2025), as well as identifying the role of organizations and customers in shaping the ultimate effectiveness of AI in hotels (Chiang, Trimi, 2020).

3. Methods and Data Sources

The aim of this study is to analyze the perception of hotel managers, including their level of trust in artificial intelligence and metaverse technologies in the context of marketing and data management, as well as to identify the challenges associated with their implementation in the hospitality industry. The increasing role of AI in decision-making, process automation, and optimization of business strategies has prompted the authors to investigate the level of trust among hotel industry management in using this technology. There is an urgent need for research on the use and perception of AI in the daily tasks of managers, especially in the hospitality industry.

The study employs a quantitative survey method to analyze hotel managers' perceptions of AI and metaverse use in marketing and data management. It provides quantitative information about their adoption and the challenges associated with it (Woszczyna, Mania, 2023). The study was conducted using the Webankieta.pl platform. This method offers several advantages, including easy access for respondents, the ability to pose complex questions, flexibility in data collection, and respondent anonymity — all of which encourage honest answers and improve sample control, thereby enhancing the quality and reliability of the results (Jabeen et al., 2022).

The sample selection was purposive, meaning that population units were selected based on specific criteria (Miszczak, Walasek, 2013). In this context, the study adopts a quantitative approach, supported by statistical tools, which will allow for the assessment of the results and the analysis of respondents' attitudes toward preferences and trust in AI. The survey questionnaire was carefully designed to cover several areas, including variables related to the respondents' profile such as management level, education, work experience, workplace, hotel size (e.g., number of rooms), and hotel category (from 1 to 5 stars), according to the Polish classification of hotel facilities (i.e., hotels from 1-lowest star to 5-highest star). The classification of management levels was done according to Griffin's (2017), management levels model. The questionnaire also included variables specific to the study, such as the goals

of using AI tools in hotel work, trust in these technologies, and the benefits and difficulties associated with their use.

The survey included general and demographic questions, but due to space limitations, only six questions most relevant to the research topic were analyzed. Variables were measured using multi-point scales, including a 5-point Likert scale for trust and purpose of AI use, as well as 4- and 3-point scales for experience and proficiency with modern technologies.

The study was conducted in the first quarter of 2024. A total of 102 surveys were sent to hotels operating in Warsaw (capital of Poland), of which 88 were correctly completed, and only 35 managers had experience with AI solutions. Due to the lack of full representativeness of the sample, the study should be treated as exploratory. Nevertheless, it provides valuable information on the perception of AI technology among hotel managers, particularly in the context of their experiences and the level of trust in these technologies.

In the statistical analysis, distribution analysis of variables (frequencies and percentages) was performed. Opinions regarding the advantages of using AI (Q4) were used to assess the likelihood of its use. Odds ratios (OR) were developed using logistic regression models, where the dependent variable was the "frequency of AI tool use" (states: "using AI" and "not using AI" – lack of willingness, lack of knowledge, plans to use in the future). The results were presented as odds ratios (OR) and a 95% confidence interval (95% CI).

4. Research Results

4.1. The Respondent Profiles

The quantitative study involved 88 directors and department heads from selected hotels in Warsaw. Participation in the study was voluntary and anonymous. The managers represented three levels of management: Top Management (n = 33, 37.5%), including regional director, CEO, vice president, and hotel director; Middle Management (n = 42, 47.5%), including deputy director, chief accountant, department director/manager (e.g., HR, guest services, food and beverage, etc.); and Supervisory Management (n = 13, 15%), including executive chef and deputy, restaurant manager and deputy, shift supervisor, front desk manager, and housekeeping manager, etc.

The respondents were mainly managers with relatively short tenure, as 63.6% had 1 to 5 years of managerial experience, while fewer had over 10 years. In terms of education, 43.18% held a bachelor's degree, and 32.95% had a master's degree (Table 2).

Table 2.
Respondents profile characteristics (n = 88)

Profile characteristics		Number of respondents	Percentage (%)
Education	Primary	3	3,41%
	Secondary	18	20,45%
	Higher (Bachelor's)	38	43,18%
	Higher (Master's)	29	32,95%
Tenure in a Managerial Position *(in years)*	Up to 1 year	1	1,14%
	1 to 5 years	55	62,50%
	5 to 10 years	22	25,00%
	10 to 20 years	10	11,36%
Place of work: Hotel Classification in Poland	1 star	1	1,14%
	2 stars	1	1,14%
	3 stars	27	30,68%
	4 stars	36	40,90%
	5 stars	14	15,90%
	Other, specify	9	10,23%
Place of work: Hotel Size (*number of rooms*)	Up to 50 rooms	2	2,27%
	Up to 100 rooms	11	12,5%
	Up to 150 rooms	19	21,59%
	Up to 200 rooms	27	30,68%
	Over 200 rooms	29	32,95%
Technological Proficiency	Low	17	19,32%
	Medium	58	65,90%
	High	13	14,77%
Experience with AI Technology	No experience	15	17,04%
	Low	18	20,45%
	Medium	47	53,41%
	High	8	9,09%

Source: own research.

Nearly one-third worked in large hotels with over 200 rooms, with others employed in hotels of smaller sizes. Most managers represented 4-star (41%) and 3-star (30.7%) hotels, with fewer from 5-star hotels and uncategorized establishments. The surveyed hotel managers demonstrated relatively low experience with AI technology and limited proficiency in using various advanced technologies (Table 2).

4.2. The Extent of AI Technology Usage by the Hotel Managers

To reach the target group, an initial diagnosis of the scale of AI technology usage among hotel management staff was conducted. In response to the first question (Q1) "Do respondents use AI technology for both personal and professional purposes?", out of 102 managers, only 35 (39.7%) used AI technology. Among the remaining 43 managers (48.8%), none had used this technology yet, and 17 respondents (19.3%) had only heard about AI. Seven respondents (7.95%) expressed a willingness to use AI solutions in the near future.

Based on the statistical analysis using logistic regression models, the respondents' opinions were examined regarding the likelihood of using these tools, based on characteristics such as "experience with AI technology" and "technological proficiency." It was found that "low" experience with AI technology resulted in a 79.2% lower chance of using AI solutions compared to high technological experience (OR: 0.208; 95% CI: 0.03-0.96). Similarly, those

who rated their technological proficiency as "low" had an 80.8% lower chance of using AI solutions than those with "high" technological proficiency (OR: 0.192; 95% CI: 0.04-0.84). On the other hand, individuals rating their technological proficiency as "average" had a 64.5% lower chance of using AI compared to those with "high" technological proficiency (OR: 0.355; 95% CI: 0.10-0.94).

In the next question (Q2), respondents were asked to indicate the purpose of using AI solutions in their work. Hotel management staff most frequently used these tools in marketing, particularly for marketing communication, with nearly 55% of respondents "strongly agreeing" with this statement (Table 3). The following areas (with the highest number of top ratings) included: service offer planning, recommendation systems, demand forecasting, service and guest experience personalization, and promotional campaign design. The lowest ratings were given by managers who used AI technology for customer service quality control and improvement, as well as for price management.

Table 3.
Goals of AI tool usage by the hotel managers (%) (n = 35)

Goals	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Marketing Communication (ads, brochures)	2,33%	2,33%	5,56%	35,17%	54,61%
Service offer planning	7,41%	7,41%	5,56%	37,04%	42,59%
Recommendation systems	7,41%	14,81%	11,11%	25,93%	40,74%
Demand forecasting	11,11%	11,11%	11,11%	29,63%	37,04%
Service offer personalization	3,71%	7,41%	11,11%	44,44%	33,33%
Guest service personalization	6,25%	6,25%	8,33%	46,25%	32,92%
Promotional campaign design	14,81%	7,41%	7,41%	44,44%	25,93%
Price management	20,84%	12,5%	12,5%	33,33%	20,83%
Customer service quality Control and Improvement	12,5%	16,67%	13,89%	27,78%	29,17%

Source: own research.

Regarding the next question (Q3) in the survey: "Do you believe that the metaverse (technology using AR/VR goggles) can help promote and sell offerings?", more than half of the respondents (almost 55% of 88 hotel managers) answered positively (yes). Only 19 respondents (21.59%) disagreed with this statement, while 21 respondents (approximately 24%) were undecided. The logistic regression analysis revealed that individuals who did not believe that the metaverse (technology using AR/VR goggles) could help promote and sell offerings had a 144.4% higher chance of using AI tools compared to those who answered 'yes' (OR: 2.444; 95% CI: 1.22-7.26).

The next stage of the analysis was the evaluation of the benefits resulting from the use of AI tools (Q4) by hotel managers. Among the highest-rated advantages of AI technology, managers identified more effective advertising campaigns (Table 4). This was the only case where the highest ratings dominated – 51.43% of respondents selected the answer "strongly agree". Also highly rated (with a significant lead in "agree" responses) were: improved personalization of the offer, easier data analysis, and targeted advertising. Similarly, demand

and trend forecasting, email marketing automation, more efficient use of the marketing budget, and monitoring competition were highly rated.

Table 4.
Benefits of AI utilization in hotel managers' assessment (%)(n = 35)

Benefits	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
More effective advertising campaigns	0%	8,57%	11,43%	28,57%	51,43%
Easier data analysis	0%	5,71%	14,29%	54,29%	25,71%
Improved personalization of offers	2,86%	5,71%	8,57%	60%	22,86%
Targeted advertising	0%	0%	31,43%	42,86%	25,71%
Demand and trend forecasting	2,86%	2,86%	14,29%	57,14%	22,86%
More efficient use of marketing budget	0%	5,71%	22,86%	51,43%	20%
Email marketing automation	2,86%	8,57%	14,29%	51,43%	22,86%
Monitoring competition	0%	2,86%	25,71%	45,71%	25,71%
Enhanced analysis of customer reviews	0%	17,14%	25,71%	31,43%	25,71%

Source: own research.

The next stage of this analysis was the assessment of the challenges and prospects related to the implementation and use of AI in hotels (Q5). The most significant barrier (with the highest number of "strongly agree" responses) was primarily the lack of qualified AI specialists, which posed a significant problem for the organization (table 5). Similarly, managers noted that the implementation of AI in the company is difficult due to the absence of a clear strategy, and managers require constant access to up-to-date knowledge about new trends and possibilities related to the use of these technologies. Adapting to the rapid pace of changes in the AI field and its applications, especially in ensuring ethical and responsible use of AI within the company, was also challenging. On the other hand, the hotel managers surveyed strongly agreed that investing in AI-driven solutions would bring long-term benefits to the hotel (80% positive acceptance) and that understanding and using AI technology is currently crucial for the future of the hospitality industry (over 77% positive acceptance). Furthermore, AI can improve customer service efficiency (over 75% positive acceptance). However, nearly half of the respondents are concerned that AI technologies may negatively affect the quality of customer service.

Table 5.
Challenges and opportunities in the implementation of AI technology in the evaluation of hotel managers (%) (n = 35)

Challenges / Opportunities	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Lack of qualified AI specialists is a problem in our organization	0%	11,43%	22,86%	20%	45,71%
Implementing AI in the company is difficult due to the lack of a clear strategy	5,71%	20%	17,14%	22,86%	34,29%
Managers need constant access to up-to-date knowledge about new trends and possibilities related to AI	2,86%	8,57%	20%	34,29%	34,29%

Cont. table 5.

Understanding and using AI is crucial for the future of the hospitality industry	2,86%	8,57%	11,43%	42,86%	34,29%
Investing in AI will bring long-term benefits to the hotel	2,86%	5,71%	11,43%	65,71%	14,29%
Implementing AI technology can increase the efficiency of customer service	2,86%	14,29%	17,41%	40%	25,71%
Automation using AI may negatively affect the quality of customer service	0%	25,71%	28,57%	37,14%	8,57%

Source: own research.

In summary, the data presented in Table 5 illustrate a clear dichotomy in the attitudes of hotel managers. While there is a strong conviction regarding the strategic necessity and long-term benefits of AI, the practical implementation is significantly hindered by human resource gaps and strategic uncertainty. These findings suggest that for AI to be successfully integrated into the Polish hotel industry, technological investment must be accompanied by specialized training and the development of robust ethical frameworks.

5. Discussions

The technological revolution that we are currently observing and co-creating is crucial in shaping the future (Atkinson et al., 2020; Woszczyna, Mania, 2023). AI technologies are becoming increasingly critical and inevitable in hotel management. They are capable of autonomously generating digital content based on data provided by the user in real-time (De Cremer et al., 2023; Dwivedi et al., 2024). Unlike traditional systems, this technology encompasses systems that have the ability to learn, integrate information, and adapt (Huang, Rust, 2021). This enables advanced personalization and evolution (Casaló et al., 2025).

The research showed that only 39.7% of hotel managers use AI technology, indicating a relatively low level of its adoption within the hotel industry. However, in Poland, there is a gradual increase in the use of advanced AI-powered information systems in businesses. According to the KPMG report (2023), 15% of Polish organizations were already using AI technology, with an additional 13% planning to implement it by the end of 2023.

According to the results of the own research, the low level of technological experience among hotel managers in the field of AI significantly reduces the chances of applying these tools compared to individuals with more experience. The analysis of technological proficiency indicates that individuals who assess their proficiency as low have fewer opportunities to utilize AI technology, highlighting the importance of technological skills in adapting to new solutions. Meanwhile, Poles perceive themselves as proficient in technology. According to the latest survey by Pracuj.pl, as many as 72% of respondents positively assess their digital competencies, i.e., the ability to effectively use technology, including devices, the Internet, and programs and

applications. Despite this overall technological proficiency, the implementation of advanced solutions, such as AI, faces barriers in certain sectors, including hospitality (Lendtech, 2024).

The above results suggest that the low level of experience and technological proficiency among hotel managers may stem from a lack of proper training, fear of new technologies, or resistance to change, which hinders the implementation of innovations in the hotel industry. Additionally, many technology leaders struggle to keep up with the rapid pace of technological changes. This sense of lagging may lead to hasty investment decisions, carrying the risk of high costs and exacerbating technological backlogs (KPMG, 2024). On the other hand, a higher level of technological proficiency and experience promotes greater openness to utilizing AI tools. This may result from a greater comfort in handling technology and a better understanding of its potential benefits for improving operational efficiency. Managers with higher technological competencies are more likely to implement AI solutions, which may be due to their greater inclination towards innovation and awareness of the benefits derived from their use (e-hotelarz.pl, 2023; KPMG, 2023).

The managerial staff in the hotels studied most frequently used AI tools primarily for marketing communication, service offering planning, recommendation systems, demand forecasting, guest service personalization, and promotional campaign design. The lowest ratings were given by managers who used AI technologies for customer service quality control and improvement, as well as for price management. Similarly, the research by Haleem et al. (2022) shows that the management team primarily uses AI technologies in marketing to better understand guest preferences, personalize offers, optimize advertising campaigns, and improve communication with customers. Effective use of customer knowledge allows for better offer customization and the building of strong relationships, leading to greater guest satisfaction, loyalty, and higher booking rates.

Among the benefits of using AI solutions, hotel managers identified: more effective advertising campaigns, easier data analysis, improved personalization of the offer, and targeted advertising. Similarly, demand and trend forecasting, email marketing automation, more efficient use of the marketing budget, and monitoring competition were highly rated. The benefits of using this technology enable improvements in guest satisfaction and loyalty, especially in the luxury hotel segment (Jabeen et al., 2022; Nozawa et al., 2022), which means that AI applications in the hospitality industry can enhance or transform guest experiences (Prentice et al., 2020; Bharwani, Mathews, 2021; Wang, 2022; Mariani, Borghi, 2023; Avula, Sithole, 2024). As a result, AI technology has become a key element in improving operational efficiency, service quality, and increasing hotel revenues (Jabeen et al., 2022; Limna, 2022; Pizam et al., 2022; Singh et al., 2022; Mariani, Borghi, 2023). Among other things, solutions that streamline data and operations management, including machine learning, chatbots, virtual assistants, smart mobile apps (MobApps), the Internet of Things (IoT), robots, and building management systems, contribute to service automation, improved energy efficiency, and the optimization of hotel processes (Pizam et al., 2022; Casaló et al., 2025).

Consumers, when making travel decisions, choose from hotels with different features. Innovations in automation technology change these options and consumer experiences. Knowledge of the acceptance of these technologies is key for marketers, travel agencies, and hotels as it affects their adoption and usage (Ukpabi, Karjaluoto, 2017). Furthermore, AI-based evaluation systems provide more accurate and objective results than traditional methods (Wang, 2022). They also allow for price strategy optimization, offer personalization, and increase customer engagement (Al-Hyari, Al-Smadi, Weshah, 2023; Mariani, Borghi, 2023). Increasing attention is being paid to marketing-supporting technologies, such as VR/AR or the metaverse, which offer engaging and dynamic experiences to hotel guests and can contribute to increased interest and sales (Hoyer et al., 2022; Huang et al., 2019; Kong et al., 2024; Liu et al., 2024; Qiu et al., 2024). The importance of integrating technology with traditional hospitality practices is emphasized to provide guests with a personalized and unforgettable experience (Bharwani, Mathews, 2021).

In the context of data analysis, BI, and Metaverse (VR/AR) technologies, the survey results were not spectacular, with only about 40% positive responses. However, more than half of hotel managers believed that the metaverse could support the promotion and sales of offerings. Logistic regression analysis showed that those who did not believe that the metaverse and AR/VR technologies could help with promotion and sales had a higher chance of using other AI tools compared to those who answered "yes". This suggests that individuals skeptical about the metaverse's potential in promotion and sales may be more open to alternative technologies, like AI, and more likely to implement them in their marketing or operational activities. Metaverse technology is often associated with games, as it initially developed mainly within the context of virtual worlds and online games (e.g., Second Life, Minecraft). Over time, the metaverse has come to be seen as a space with wide applications, including marketing, trade, education, and tourism. In marketing, it has become a platform attracting companies that want to reach younger generations and engage consumers interactively. Examples such as virtual stores, events, and in-game ads show the growing potential of the metaverse, especially in the context of AR/VR technology (McKinsey.com, 2022; e-hotelarz.pl, 2023; Akim, 2024).Through the metaverse, people can experience cooking and preparing meals in restaurants, virtual flights, hotel suites, tours, business meetings, and conferences (Tul-Krzyszczuk, 2022). According to the McKinsey report (2022), the importance of these technologies in marketing is growing. The metaverse provides a new space for brands, allowing them to engage consumers in an innovative way and develop internal capabilities and brand innovations in new directions. Additionally, the metaverse has the potential to become a new primary marketing channel, transforming the way brands connect with audiences in the digital world (Akim, 2024). In Poland, there are also noticeable investments in the metaverse, mainly in the services, banking, and retail sectors. According to estimates from Meta, the Polish metaverse market could reach a value of between 5 and 10 billion euros by 2035 (bankier.pl, 2024). Virtual experiences will not completely replace real customer experiences in hospitality.

According to the research by Gursoy, Malodia, and Dhir (2022), while visual and auditory stimuli are relatively easy to replicate, recreating taste and smell stimuli in the metaverse is still not possible.

The analysis of the challenges and prospects related to AI implementation in hotels revealed several key difficulties. The biggest barrier was the lack of qualified AI specialists and the absence of a clear strategy for implementing these technologies. Managers also emphasized the need for continuous access to up-to-date knowledge about AI trends and its ethical use. Therefore, to minimize risks, it is essential to ensure proper data security against attacks, provide employee training, and offer post-implementation support (Wang, 2022). While the surveyed managers recognize the long-term benefits of investing in AI, especially in improving customer service efficiency, some expressed concerns that the use of AI technologies could negatively impact the quality of customer relationships in certain cases. On one hand, AI can increase guest satisfaction through personalized expectations and faster service, thereby improving operational efficiency and gaining a competitive edge in the market. On the other hand, high-quality service, including interpersonal relationships, is crucial for guest loyalty, which presents a challenge for hoteliers in implementing new technologies. Therefore, it is essential that employees are well-prepared to effectively use AI technologies, which will help improve the quality of guest service. To overcome the challenges of AI implementation, a gradual introduction of this technology will be necessary, based on education, transparency, and ensuring user comfort and security (Prentice et al., 2020; Nam et al., 2021).

6. Conclusions and Further Research

The study found that the implementation of AI technology in the hospitality industry remains at a relatively low level, despite managers recognizing its potential benefits. This points to adoption barriers such as a lack of technological competence, resistance to change, ethical concerns, and insufficient implementation strategies. In the context of global trends, where AI is becoming a key element in operational management, the hospitality industry in Poland faces the challenge of adapting these solutions more quickly.

From a practical perspective, the study emphasizes the importance of education and training for management in new technologies. A high level of digital competence leads to greater openness to innovation and a better understanding of its potential benefits. The results also suggest the need for more comprehensive AI implementation strategies that address both technological and organizational aspects, minimizing resistance to change.

The analysis showed that managers most frequently use AI in marketing, service personalization, and demand forecasting, but less so in service quality management or pricing policy. They also appreciate AI's support in data management. This points to the need for further

research on the factors influencing the level of AI use in different aspects of hotel operations. From a broader perspective, the study's results may have implications for other service sectors (e.g., tourism or retail), where AI technology can improve operations and increase business competitiveness. Furthermore, the findings could serve as a basis for comparative research between different service industries in terms of AI use.

In terms of future research, it is important to delve into trends in AI development and its long-term impact on operational efficiency and customer relationships. There is a need to analyze how AI affects guest loyalty and satisfaction during hotel stays. Additionally, it would be valuable to examine the impact of demographic and cultural factors on the acceptance and use of AI by hotel management. Future studies may also focus on ways to overcome implementation barriers and build trust in AI technologies among managers and employees in the service sector. An interesting research direction could also be the variation in attitudes and readiness to implement AI depending on the type of hotel. Due to limitations in quantitative data, future research should consider qualitative methods, such as in-depth interviews or focus groups, to obtain more detailed information on managers' attitudes and experiences.

In conclusion, the study provides valuable insights for practitioners and decision-makers in the hospitality industry, suggesting the need for increased investment in the development of technological competencies and the creation of effective AI implementation strategies. Ongoing digitization and AI development create new opportunities for the industry, and their proper use can contribute to improving service quality, increasing competitiveness, and enhancing guest satisfaction.

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