Artificial intelligence in hospitality and tourism: Insights from industry practices, research literature, and expert opinions

Abstract

Given the substantial impacts of artificial intelligence (AI) on the hospitality and tourism industry, it is crucial to examine how AI will change this industry's future. We collected extensive data to analyze global AI trends and predict the future of AI. Our dataset consisted of 1,407 news articles from five prestigious hospitality and tourism outlets along with 22 AI-related review articles from the databases of hospitality/tourism journals and the mainstream marketing literature. After examining multiple data sources via natural language processing, the results were further verified by an academic panel and a senior management panel. Our findings present a detailed picture of AI development and applications along with predictions regarding its place in the industry. Finally, we outline a research agenda that addresses key issues for stakeholders in hospitality and tourism: individuals, including customers and employees; organizations and businesses; and public policymakers and governments.

Keywords artificial intelligence, evolution, future, hospitality, tourism

Highlights

- Used multiple data sources through natural language processing
- Described the state of AI development and applications
- Examined how AI will change the hospitality and tourism industry
- Identified fruitful research directions for academics and practitioners

INTRODUCTION

Fueled by technological innovations, AI plays a particularly pronounced role: it is characterized by machines that exhibit humanlike intelligence and has become an integral element of organizational operations (Huang & Rust, 2022). AI also continues to guide activities centered on customer value (Chi et al., 2022; Gaur et al., 2021). According to Statista (2022), the global AI market—valued at about US$327.5 billion—has enjoyed ongoing expansion thanks to substantial investment. A survey of business leaders highlighted sales and marketing as major areas for AI implementation, with 24% of U.S. firms reportedly using these technologies; 60% were expected to implement it by 2022 (MIT Technology Review Insights, 2020).

The hospitality and tourism industry has experienced a remarkable shift due to AI-related advances (e.g., Law et al., 2019; So et al., 2022). AI applications can facilitate services contingent on social interaction. Relevant tasks involve answering customers' questions at restaurants (e.g., Liu, 2022), helping airline passengers navigate airports (e.g., Chi et al., 2022), giving travel recommendations (e.g., Shi et al., 2021), and serving guests at hotels (e.g., Kim et al., 2022). AI's ability to access vast amounts of data—together with its enhanced computational power, context recognition, and emotional sensitivity—enables hospitality and tourism organizations to offer tailored services. Service providers can streamline their operations, lower costs, increase capabilities, and provide superior customer service in hospitality and tourism (Mariani & Borghi, 2021; Tuomi et al., 2021). Overall, AI is a game-changer that stands to transform the production of goods and services and overhaul best practices.

As AI infiltrates the hospitality and tourism industry, scholars have begun investigating topics such as using AI algorithms to address problems in various areas, including management, operations, and marketing (e.g., Law et al., 2019; Liao et al., 2021). Researchers have also addressed AI's psychological effects on customers (e.g., Chi et al., 2022; Kim et al., 2022), its

impacts on employment and society (e.g., Ivanov et al., 2019; Li et al., 2019), and the strategic implications of AI implementation (e.g., Tuomi et al., 2021; Tussyadiah, 2020). However, contributions have been limited to describing past and current AI applications (e.g., Doborjeh et al., 2021; Huang et al., 2021; Lv et al., 2022). While AI data and expertise are expected to be core sources of competitive advantage and to produce winner-takes-all marketplaces (Wirtz et al., 2018), few studies have explored how these transformations will alter hospitality and tourism from the perspectives of parties involved in production, consumption, and adoption. Furthermore, as AI takes a more prominent place in hospitality and tourism, the risk of fragmented research rises. Studies may employ specific methodologies to respond to pertinent questions. This narrow view could keep scholars and practitioners from agreeing on the meaning of AI, associated devices, and appropriate usage (Huang & Rust, 2022; Ivanov et al., 2019; Tuomi et al., 2021). It is thus imperative to explore how AI will change hospitality and tourism. Our paper differs from previous reviews and/or bibliometric analyses on AI in hospitality and tourism (e.g., Gaur et al., 2021; Knani et al., 2022; Lv et al., 2022; Tuomi et al., 2021; Tussyadiah, 2020) by integrating multiple data sources (i.e., practitioner literature, research literature, and expert opinions). Data were examined via natural language processing to explore AI development and applications. Our empirical results reveal fruitful directions for academics and practitioners. In brief, this study aims to address three main research questions (RQs):

RQ1: What are the past and current applications and trends of AI in hospitality and tourism?

RQ2: What are the emerging opportunities and challenges facing AI applications in hospitality and tourism?

RQ3: What are future research directions and predictions of AI in hospitality and tourism?

We used a two-phase natural language processing approach to examine academic and industry knowledge regarding AI. Phase 1 entailed a large-scale analysis of global AI trends in hospitality and tourism to identify meaningful patterns of AI development from material on world news websites. Based on a dataset of 1,407 news pieces published between 2016 and 2023, we used natural language processing to extract summaries and keywords from each piece. Our findings revealed three global trends in AI implementation: AI applications in different business sectors, primary AI functions, and emerging AI topics. We then moved to Phase 2 to forecast how AI may change hospitality and tourism. Multiple types of data collection and analysis are better suited to predicting AI's future than traditional literature reviews (e.g., Doborjeh et al., 2021; Gaur et al., 2021; Goel et al., 2022; Knani et al., 2022; Lv et al., 2022). In this phase, 22 academic papers were chosen as primary sources regarding future directions in AI. We employed the advanced natural language processing software Leximancer. After we assembled a final list of 51 major concepts, three themes emerged upon consolidating related topics: AI adoption and acceptance, AI operations management, and AI marketing.

To uncover insight beyond the selected themes, two international panel reviews were administered to gather academic and industry insights. A total of 10 scholars with expertise in AI research and 10 industry practitioners agreed to participate and provide feedback. Drawing from assessments of the proposed future directions, we predicted the future of AI in hospitality and tourism based on four aspects: customer–AI interaction, AI and organizational decision making, organizational implications, and managerial issues.

Our work enriches the understanding of AI in relation to its definition, associated devices, and applications in hospitality and tourism based on the term's definition; that is, "AI"

refers to computational agents endowed with humanlike cognitive, perceptual, and conversational abilities that can flexibly deal with and learn from external data to fulfill service-oriented tasks (Huang & Rust, 2018). We also point to current and upcoming opportunities and challenges in AI based on multiple data sources. We then recommend that hospitality and tourism researchers explore less-studied domains (e.g., cruises, theme parks, resorts, and art galleries), each of which includes a range of AI functionalities such as mechanical AI, cognitive AI, and emotional AI. We further propose that scholars shift their attention to emerging AI trends (e.g., the rise of startups and corporate consolidation through financial activities like mergers and acquisitions). Furthermore, we urge authors to address overarching issues that could have far-reaching societal impacts. Our conclusions carry implications for stakeholders, including individual (e.g., customers, employees), organizational/business, and public policy/government. Stakeholders can then mitigate potential risks associated with AI. For instance, ethical concerns around transparency, equity, fairness, and privacy must be handled with care. Practitioners, scholars, and policy makers need to collaborate with interested actors, including businesses and organizations, to tackle these critical matters. This cooperation will promote solutions and initial guidelines for the ethical use of AI in hospitality and tourism. The identified issues are intended to inspire creativity among industry professionals.

LITERATURE REVIEW

AI has developed over decades and is now present in various industries. In the early 1950s, John Von Neumann and Alan Turing transferred machines to binary logic, which built the scientific

and technical foundation of AI (Turing, 2009). John McCarthy coined the term "artificial intelligence" at an academic conference in 1956 (McCorduck, 2004). AI was initially defined as the automation of intelligent behavior with a focus on math and logic problems (McCarthy, 2007). In the 1980s, the focus of AI moved to knowledge and rule-based expert systems; it was essentially considered a form of "advanced computing" (Ma & Sun, 2020). Early AI paradigms centered on high-level cognitive processes, such as the potential to engage in multi-step reasoning, comprehend the semantics of natural language, and formulate novel strategies to accomplish objectives (Collins et al., 2021). At the beginning of the 1990s, the AI paradigm shifted to machine learning (ML), namely how computer programs learn from experience and task performance (Goodfellow et al., 2016). AI development underwent a boom in 2010 with open access to massive volumes of data and accelerated learning algorithms (Duan et al., 2019). The development of digital technologies made it possible to collect and share massive datasets, enabling AI systems to learn from extensive real-world examples. The combination of abundant data and advanced learning algorithms marked a pivotal moment in AI history, propelling the field to new heights of application. These circumstances led to an innovation with multiple levels of representation: deep learning (DL), which combines big data and computer hardware, has extended AI applications in industries such as healthcare, marketing, and education (Huang & Rust, 2018). AI has more recently transformed various sectors and permeated daily life. In healthcare, AI is revolutionizing diagnostics, drug discovery, and patient care, thereby enhancing the accuracy and speed of medical decisions (Meenigea et al., 2023). AI has also made strong inroads in education, allowing for personalized learning and supporting educators in assessment and content development (Limna et al., 2022). The entertainment and gaming industry benefits from AI-driven content recommendations, immersive virtual reality experiences, and AI-

generated art and music (Dwivedi et al., 2021). At a personal level, AI has become an integral part of consumers' lives, from voice assistants and chatbots to AI-driven content curation on social media (Collins et al., 2021). The effects of AI are pervasive, and its ongoing evolution promises to bring about further enhancements in numerous industries and everyday experiences.

Definitions of AI

It has been argued that AI lacks a consistent definition despite having existed for decades (Collins et al., 2021; Dwivedi et al., 2021). It comprises sciences, theories, and techniques such as mathematical logic, statistics, computational neurobiology, and models to mimic human cognition (Huang & Rust, 2022). The term itself calls to mind humans: "artificial" refers to a human-created object, while "intelligence" captures an agent's ability to think on its own (Huang & Rust, 2018). Two types of definitions have therefore emerged. The first is human-centered; it focuses on experimental validation and empirical science (Borges et al., 2021). This human-centered approach states that a technical system needs intelligence to think, act, learn, and perform tasks as a person would (Daugherty et al., 2019; Li et al., 2019; Ruel & Njoku, 2021; Wilson & Daugherty, 2018). From this view, AI can be a computer, a computer-controlled robot, or even a type of software that obtains and analyzes real-time data and mimics human effort. By studying or simulating the brain's cognitive processes (Huang & Rust, 2022), AI (instead of people) can execute tasks through software and algorithms. Such algorithms can be used to predict or detect events. For example, tourism websites have adopted AI algorithms to forecast tourist arrivals (Sun et al., 2019).

The second definition takes a rationalist approach, marrying engineering and mathematics (Borges et al., 2021). AI is believed to think independently, recognize its

environment, and conduct autonomous tasks (Li et al., 2019). Previous studies (e.g., Goodfellow et al., 2016; McCarthy, 2007) suggested that AI has three distinct capabilities: understanding, reasoning, and learning. Understanding refers to how AI uses natural language processing to interpret environmental information (Volkmar et al., 2022). Reasoning describes AI's provision of informed recommendations to optimize human actions, whereas learning indicates that AI obtains information and adapts to the environment (Huang & Rust, 2018). Essentially, AI mimics human intelligence through computer systems via knowledge or experience and performs tasks (e.g., speaking and problem solving) similarly to humans (Li et al., 2019).

Based on the preceding discussion, we defined AI as computational agents endowed with humanlike cognitive, perceptual, and conversational abilities. Agents acquire these skills by flexibly dealing with and learning from external data. AI systems aim to simulate human cognitive abilities such as learning, reasoning, problem solving, perception, and decision making. These systems can analyze large amounts of data, recognize patterns, adapt to changing circumstances, and make autonomous decisions or provide recommendations based on available information.

Advanced techniques in AI

The notion of AI usually accompanies concepts such as ML, robotization, DL, and big data. Although the terms "artificial intelligence" and "machine learning" are often used interchangeably (Volkmar et al., 2022), they are different. AI is a broader concept which includes ML and DL. Specifically, ML is a computational method or a computer program, which

is typically embedded in AI technology and used to improve task performance via knowledge or experience (Volkmar et al., 2022). ML is a subset of AI that involves machines' ability to independently learn from data. In simpler terms, ML refers to machines that can acquire knowledge via algorithms and learn from the experience gained through data (Huang & Rust, 2022). ML and traditional computer programming are distinguished by ML's capability to learn from data and make predictions without explicit programming instructions. ML can autonomously derive knowledge from provided information and generate corresponding predictions. It has been widely applied in hospitality and tourism via robotics, voice recognition and control, facial recognition, and self-driving vehicles (Go et al., 2020). ML has also been used to forecast visitor arrivals and to conduct sentiment analysis (Huang & Rust, 2022).

Another advanced AI technique is DL, which can extract features with minimal knowledge through layer-wise training (Goel et al., 2022; Knani et al., 2022). DL is a category within ML and uses artificial neural networks with multiple layers to train data. This approach has demonstrated remarkable accuracy improvements in tasks such as image recognition/segmentation, recommender systems, and natural language processing (Essien & Chukwukelu, 2022). DL is a subfield of ML, leveraging associated techniques to address real-world challenges by utilizing neural networks that mirror human decision making. DL enables computers to learn from complicated concepts and can manage abstract information and computational models (Goodfellow et al., 2016). As such, the major difference between DL and ML is that DL enables the creation of computational models that include layered and hierarchical structures. These models are designed to learn data representations by progressively capturing multiple levels of abstraction.

AI can automate and improve the power of big data analytics and complicated prediction (Duan et al., 2019). Big data comprises complex datasets featuring volume, variety, and velocity (O'Leary, 2013). Volume reflects the amount of data drawn from multiple sources, variety refers to different data types, and velocity describes the need for frequent decision making regarding structured and unstructured data (O'Leary, 2013). As a computer technique, AI can boost these three aspects of data. It can also perform complicated pattern recognition and learning processes. Big data stands to revolutionize the travel industry by instantly connecting tourists to a vast amount of information. It can also provide them with customized, responsive support as they plan and manage travel experiences (Mnyakin, 2023).

Applications of AI in hospitality and tourism

In addition to the aforementioned approaches, AI applications are common in hospitality and tourism. AI continues to evolve alongside technology, offering opportunities for greater efficiency, enhanced customer experiences, and informed decision making. Salient innovations cover augmented reality (AR), blockchain, cryptocurrencies, mixed reality, quantum computing, robotics, and virtual reality (VR). AI robots are one type of AI technology and are generally equipped with computer science and other applied mechanisms. These devices can complete various tasks in the hospitality and tourism sector (Shin & Jeong, 2020; Tuomi et al., 2021). Robots' motion control and data patterns are determined by AI and ML strategies, which help robots operate efficiently (Ivanov et al., 2019; Li et al., 2019). Go et al. (2020) outlined AI robots in hotel departments across the front and back of the house: AI agents can assist with communication, delivery, cooking, housekeeping, and audio tours. These robots mimic human thought patterns to recognize consumers' demands and offer expected services.

VR and AR are increasingly popular (Loureiro et al., 2020). VR stimulates a virtual environment in a three-dimensional space (Loureiro et al., 2020). Consumers using a VR headset can interact with an imaginary digital environment. Different from VR, AR uses knowledge learning to connect abstract ideas to the environment and then with three-dimensional graphics. These technologies have presented customers with new ways to search for information and make decisions. They have also altered how businesses produce, develop, and deliver personalized hospitality and tourism experiences. Table 1 describes AI applications in hospitality and tourism.

Table 1. AI Applications in Hospitality and Tourism

Usage Context (specific firms or AI applications)	Description
AI-based chatbots/virtual agents (e.g., Starbucks barista, Subway order bot, ChatGPT on the Expedia app)	AI-based chatbots, available 24/7/365, can answer customers' questions or submit service requests.
AI-based robotics (e.g., Hilton's concierge robot "Connie")	AI-based robotics enable interaction with consumers in hotels, restaurants, and airports.
VR/AR (e.g., ETIPS AR travel app, VR travel booking service)	VR/AR offer consumers a digital environment that makes their experiences more enjoyable.
Search/booking engines (e.g., Allora's hotel search/booking engine)	Based on AI and ML, search/booking engines are common in hospitality and tourism.
Autonomous vehicles (e.g., Domino's autonomous pizza delivery)	Autonomous vehicles are widely used for service delivery.
Kiosks/self-service (e.g., facial recognition check-in kiosks)	Kiosks/self-service technologies use facial recognition software and biometric data to offer convenient hospitality and tourism services.

The growing demand for communication between travelers and service providers, coupled with the cost-saving benefits of integrating AI in customer service, has led to a notable rise in the adoption of AI and related technologies. Researchers in hospitality and tourism

management have adopted several theories (e.g., diffusion of innovation theory, theory of reasoned action, technology adoption model, and uncanny valley theory) to investigate AI, VR/AR, and other AI-based services (Chi et al., 2020; Kim et al., 2021). Authors have also examined how AI affects the tourist experience (Kong et al., 2023). These studies have bolstered scholars' and practitioners' understanding of AI. Recent work has centered on AI's effectiveness in areas such as data analysis, forecasting, marketing, management, service quality, and tourists' preferences (Lv et al., 2022; Mariani et al., 2022). Yet, as AI permeates hospitality and tourism, a holistic review of its roles in this sector—and how it may change the industry—remains necessary. AI has revolutionized hospitality and tourism operations in terms of service delivery, service recovery, and customer satisfaction. A thorough discussion of AI's benefits and risks for the industry is urgently needed.

METHODOLOGY

We utilized a two-phase natural language processing approach to investigate academic industry insights related to AI. Phase 1 entailed a large-scale analysis of global AI trends in hospitality and tourism to identify meaningful patterns of AI development from material on world news websites. To gather articles on AI in hospitality and tourism, we referred to the top five sources in this field. Outlets were chosen based on criteria such as website traffic, social media followers, and domain authority (Feedspot, 2022). Following the methodology of previous studies (e.g., Cheng & Edwards, 2019; Yildiz et al., 2022), we collected news articles whose titles included the term "artificial intelligence"; this parameter yielded a dataset of 1,407 news pieces published between 2016 and 2023. Natural language processing was used to extract summaries and keywords from each piece to identify AI-related practices and industry discussions. Our findings

revealed three global trends in AI implementation: AI applications in different business sectors, primary AI functions, and emerging AI topics.

Phase 2 focused on review publications, most notably future directions in AI. Multiple forms of data collection and analysis are thought to be more feasible for predicting AI's future than traditional literature reviews (e.g., Doborjeh et al., 2021; Gaur et al., 2021; Goel et al., 2022; Knani et al., 2022; Lv et al., 2022). Again, in line with earlier work (e.g., De Ruyter et al., 2022; Stocchi et al., 2021), we conducted a systematic search of journal databases including Web of Science, Google Scholar, and SCOPUS. Search terms included "AI," "artificial intelligence," "review," "future trends," "meta-analysis," "conceptual model," and "future directions." This search resulted in 31 papers published from 2015 to 2022. After thoroughly examining each article, twenty-two articles (totaling 131 pages of results) were chosen as primary sources on future directions in AI. In this phase, we employed the advanced natural language processing software Leximancer, which is popular in social science disciplines such as hospitality and tourism (e.g., Çakar & Aykol, 2021; Tseng et al., 2015). Leximancer quantifies text to contribute to a clear understanding of empirical reality (Cheng et al., 2018). The program initially identified 80 concepts in our dataset based on word occurrence and co-occurrence frequency. To refine the concept list, we conducted a rigorous fine-tuning process based on co-occurrence frequency and concepts' meanings, as has been done elsewhere (Çakar & Aykol, 2021). We eventually assembled a final list of 51 major concepts. Three key themes emerged upon consolidating related topics: AI adoption and acceptance, AI operations management, and AI marketing. To uncover insight beyond these themes, two expert panel reviews were performed to gather academic and industry input. These panels enabled a more in-depth exploration of upcoming

research directions around AI in hospitality and tourism. Figure 1 summarizes our research design.

PHASE 1

To examine emerging opportunities and challenges facing AI applications in hospitality and tourism, we analyzed news articles in Phase 1. We also discerned patterns over time.

Research design

We collected AI-related articles from five global hospitality and tourism news websites: Skift, Phocuswire, Travel Weekly, Travel Daily News, and Business Travel News. These websites are the top five sources of hospitality and tourism industry information based on traffic, the number of social media followers, and domain authority (Feedspot, 2022). In accordance with earlier work (Cheng & Edwards, 2019; Yildiz et al., 2022), we scraped all news pieces with "artificial intelligence" in the title and subsequently selected those that focused on AI as defined in this study (i.e., artificial agents with humanlike cognitive, perceptual, and conversational

Phase 1

- Entailed a large-scale analysis of global AI trends in hospitality and tourism
- Analyzed 1,407 news articles published between 2016 and 2023
- Used natural language processing to extract summaries and keywords
- Revealed three global trends in AI implementation: *AI applications in different business sectors, primary AI functions, and emerging AI topics.*

RQ1: What are the past and current applications and trends of AI in hospitality and tourism?

Future Research Directions and Predictions

- Suggested the significant future research directions of AI: *Customer–AI interaction, AI and organizational decision making, Organizational implications, and Other managerial issues.*

- Validated the research questions through two international panel reviews

- Predicted the future of AI in hospitality and tourism

RQ3: What are future research directions and predictions of AI in hospitality and tourism?

Phase 2

- Analyzed AI-related review publications
- Chose twenty-two articles as primary sources
- Employed the advanced natural language processing software Leximancer
- Suggested three key themes: *AI adoption and acceptance, AI operations management, and AI marketing.*

RQ2: What are the emerging opportunities and challenges facing AI applications in hospitality and tourism?

Figure 1. Research Design and Summary

abilities). Of the resultant 1,677 articles, those based on interviews (113 articles), with video only (89 articles), or introducing new companies (40 articles) were removed. Interviews can reflect AI trends; however, most scraped interview pieces introduced new company executives and did not offer substantial insights on AI. We therefore opted to remove these interviews from our dataset, resulting in the exclusion of 113 articles. We concentrated on pieces published between 2016 and 2022. AI became popular in the hospitality and tourism literature in the mid-2010s (Shin et al., 2022). The number of AI-related articles increased rapidly starting in 2016 as shown by our data. Thus, we chose 2016 as the starting year. In total, 1,407 articles were retained for analysis.

We extracted a summary and keywords for each article through natural language processing to identify which AI issues have been discussed in the practical domain. After pre-processing each summary (i.e., splitting text into words, lowercasing words, removing words without significant meanings, and converting words into base forms), we tagged parts of speech to all words and saved verbs and nouns because they are most likely to indicate a text's main topics (Cordier et al., 2013). We calculated the term frequency–inverse document frequency for each noun and verb. This frequency is a numerical value denoting a word's importance in corpora (news articles in this research), computed by multiplying a term's frequency (i.e., how many times it appears in a news article) and inverse document frequency (i.e., how many news articles include that word) (Aizawa, 2003). We subsequently assembled the top 30 AI-related words per year (Table 2). We explored keywords using perspectives employed to describe AI trends in other domains, such as medical science (Ailia et al., 2022), education (Yang & Kyun, 2022), and fashion (Shi et al., 2021). This step required us to 1) identify business sectors actively adopting AI; 2) highlight prominent AI functions; and 3) track keywords increasingly associated

with AI. We discerned three global AI trends within hospitality and tourism: AI applications across various business sectors, primary AI functions, and emerging AI topics.

Results

   Trend one. AI applications in different business sectors. Each sector demonstrated distinct trends based on keywords. Figure 2 shows that two major sectors (i.e., accommodation and aviation) have widely adopted AI technologies.
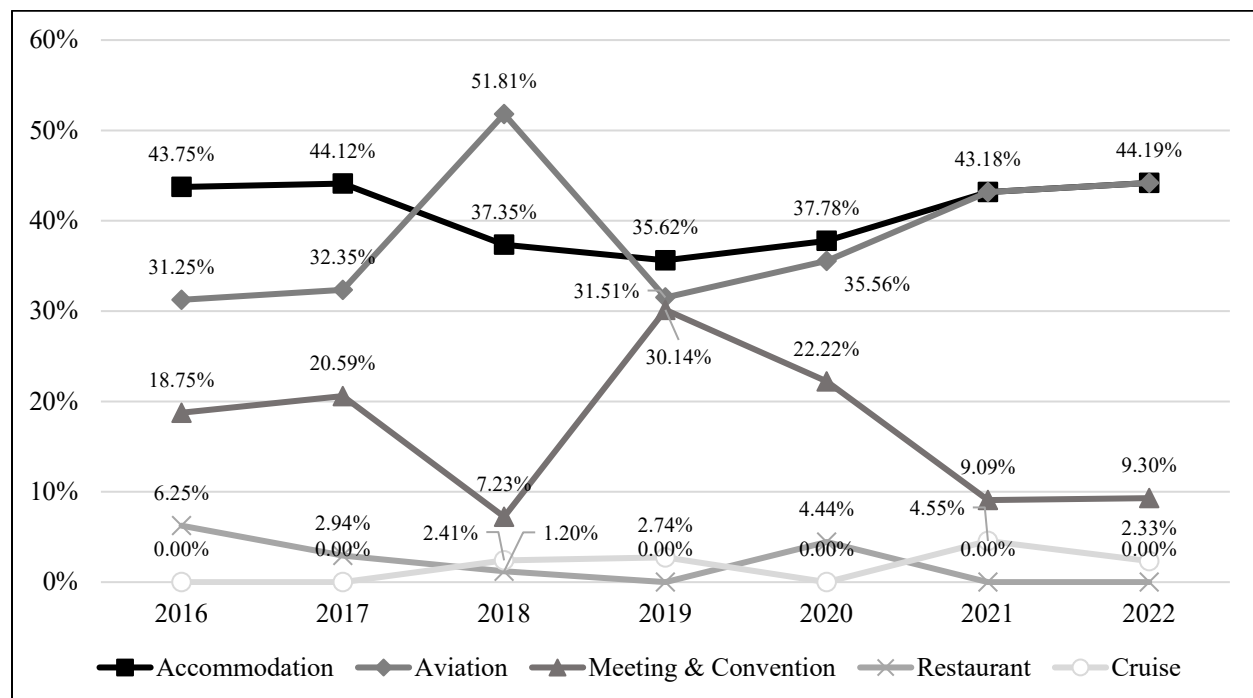
Note. "Other" includes cruises, theme parks, resorts, and art galleries.
Figure 2. Frequently Mentioned Business Sectors in News Articles from 2016 to 2022 (Calculations based on results presented in Table 2)

   Several accommodation-related keywords (e.g., "AI concierge," "AI-written messages," "chatbot," "contactless communication," "meta-search advertising," and "voice-controlled booking") were found. Keywords for aviation (e.g., "AI application in a lounge," "autonomous

plane," "baggage check/tracking," "climate tracking," "digital identity," and "passenger flow management") were also common. Those for restaurants included "booking," "dining recommendation," and "restaurant reviews." Keywords such as "event registration," "virtual meeting," and "meeting management" were tied to meeting and convention settings. Although AI has been applied in different sectors of hospitality and tourism, it appeared more prevalent in certain contexts (e.g., hotels, airlines) while lagging in other settings (e.g., meetings and conventions, restaurants, cruises). This discrepancy may be due to variations in sector-specific tasks. Researchers have contended that AI is more feasible for some business sectors (e.g., financial services, automotive) than others (Kumari et al., 2021). The same could be said for hospitality and tourism.

Trend two. Primary AI functions. To trace the temporal evolution of AI functions, we split our 7-year study horizon into four sub-periods: 2016–2017 (mechanical functions), 2018–2019 (thinking functions), 2020 (AI integration), and 2021–2022 (AI suitability) as done in prior literature (e.g., Huang & Rust, 2022; Ivanov et al., 2019; Tuomi et al., 2021). Mechanical AI functions were frequently mentioned from 2016 to 2017. These capacities involve automating routine tasks (e.g., answering common customer questions or providing information on a specific topic) (Huang & Rust, 2018). Airlines started to adopt AI to improve speed and accuracy when responding to customer queries (O'neil, 2016a). AI has also reduced meeting firms' repetitive booking and contracting workload (West, 2017). A travel content company that offers visual storytelling solutions for destination marketing organizations has employed AI to identify travel-related photos on Instagram within a few seconds (May, 2016a).

The thinking functions of AI were described in 2018–2019. AI devices can process data to inform decisions, such as giving customers personalized guidance, tailoring advice to companies, and predicting market trends (Huang & Rust, 2018). One hotel used AI to find the optimal combination of travel demand and room supply (Karantzavelou, 2018). A flight search platform deployed AI to predict flight delays more accurately than airlines (Sorrells, 2018). Online travel agencies (OTAs) have integrated AI to profile millions of users' booking behavior (e.g., preferred booking platforms, conversion rates, cancellations) and forecast digital booking trends (Karantzavelou, 2019).

"Integration" was a popular function-related keyword in 2020. Airlines, OTAs, and travel management companies have all started to work with chatbot systems (Perrotta, 2020). Meanwhile, a business travel management company has incorporated text-based and voiced-enabled message functions into its AI chatbot (Fox, 2020).

AI functions related to security and sustainability have gained attention since 2021. An international airport in Toronto, Canada, became the first in the world to test an AI-based security system to detect metallic materials or concealed weapons (Karantzavelou, 2022). Airlines have also developed AI-based flight planning systems to decrease fuel consumption (Karantzavelou, 2021).

Trend three. Emerging AI topics. Several emerging trends in AI have received increasing media coverage. Articles in our sample often mentioned "acquire" and "partner(ship)"; these keywords typically ranked around 25th from 2017 to 2019 but around 10th from 2021 to 2022 (Table 2). The percentage of news articles containing these two terms has increased accordingly over time: 3.1% in 2016, 4.5% in 2017, 4.6% in 2018, 6.6% in 2019, 6.6% in 2020, 14.9% in

2021 and 14.04 in 2022. Most relevant articles concerned partnerships between technology companies and hotels, airlines, or OTAs. The number of hospitality and tourism businesses adopting AI by working with an AI company (vs. on their own) seems to be growing, most evidently in the accommodation, aviation, and OTA sectors.

A similar trend applied to another keyword, "startup." This keyword ranked about 10th from 2016 to 2019 and around 5th from 2019 to 2022 (Table 2). The percentage of news articles whose titles included this keyword also increased consistently: 3.07% in 2016, 3.69% in 2017, 4.57% in 2018, 5.56% in 2019, 8.19% in 2021, and 15.36% in 2022. Hospitality and tourism firms' connections with startups focused on AI technologies have garnered particular publicity. In the accommodation sector, startups specializing in chatbots (West, 2017), hotel recommendations (O'neil, 2016b), and contactless communication (Sorrells, 2020) were commonly discussed in our sample. Those specializing in geometric intelligence (May, 2016b) and flight disruption detection (Restanis, 2017) were mentioned in the transportation sector. As for OTAs, startups centered around personalized searches appeared often (Menze, 2018). Different business sectors in the hospitality and tourism industry are therefore recognizing the importance of technology startups.

Table 2. Keywords Mentioned in News Articles Regarding AI in the Hospitality and Tourism Industry

2016	2017	2018	2019	2020	2021	2022
1 Travel	1 Travel	1 Travel	1 Travel	1 Travel	1 Travel	1 Travel
2 Book	2 Technology	2 Airline	2 Startup	2 SABRE*	2 Startup	2 Technology
3 HIPMUNK*	3 Business	3 Airport	3 Technology	3 Technology	3 Technology	3 Startup
4 Data	4 Digital	4 Technology	4 Hotel	4 Startup	4 Hotel	4 Hotel
5 Formula	5 Airline	5 Hotel	5 Airline	5 Hotel	5 Airline	5 Airline
6 Technology	6 Launch	6 Launch	6 Book	6 Airport	6 Acquisition	6 Market
7 Plan	7 Startup	7 Speaking	7 Business	7 Business	7 Platform	7 Term
8 Agent	8 App	8 Trend	8 Airport	8 Airline	8 Data	8 Raise
9 Hotel	9 Book	9 Startup	9 TMC*	9 Sector	9 Digital	9 Expense
10 Launch	10 Personalization	10 Program	10 Digital	10 Platform	10 Partner	10 Data
11 App	11 Expense	11 Book	11 Power	11 Launch	11 HOTELPLANNER*	11 Future
12 Trip	12 Hotel	12 Growth	12 Future	12 Vacation	12 Space	12 Partnership
13 Startup	13 Prediction	13 Service	13 Conference	13 Fund	13 CEO	13 Crisis
14 Market	14 Service	14 Expense	14 Aviation	14 AMEX GBT*	14 Cruise	14 Hospitality
15 Assistance	15 Future	15 Data	15 Flight	15 Tourism	15 Recovery	15 Personalization
16 Future	16 Hotelier	16 Corporate	16 Hospitality	16 Offering	16 Suspension	16 Book
17 FACEBOOK*	17 Trend	17 Platform	17 Tourism	17 Service	17 Raise	17 Acquisition
18 Messenger	18 Data	18 Market	18 Launch	18 Digital	18 SABRE	18 Transportation
19 Airport	19 Power	19 Acquisition	19 Report	19 Conference	19 Business	19 Price
20 Tool	20 Maintenance	20 Plan	20 Data	20 Coronavirus	20 Biometric	20 SABRE*
21 VIRTUOSO*	21 Corporate	21 Conversation	21 Destination	21 Contact	21 Book	21 Sustainability
22 CEO	22 Conference	22 Digital	22 Bringing	22 Recovery	22 Service	22 Tourism
23 Expectation	23 Partner	23 Model	23 Service	23 Book	23 Hospitality	23 App
24 EXPEDIA*	24 Person	24 HOPPER*	24 Partner	24 Trend	24 HOPPER	24 Car
25 KAYAK*	25 CEO	25 Company	25 Trip	25 Data	25 Plan	25 Cloud
26 PRICELINE*	26 Convention	26 Prediction	26 Trend	26 Raise	26 LYFT*	26 Valuation
27 Addition	27 Raise	27 World	27 FLIGHTCENTRE*	27 Impact	27 SOFTBANK*	27 Flight
28 Airline	28 Building	28 Report	28 TRIPACTIONS*	28 Integration	28 Boost	28 Meeting
29 America	29 Learning	29 Partner	29 Expansion	29 Opportunity	29 Event	29 Integration
30 Division	30 Meeting	30 Assistance	30 Price	30 Transformation	30 BIZZABO*	30 Software

*Company names are written in capitals.

PHASE 2

To predict how current/emerging opportunities and challenges related to AI applications could change the hospitality and tourism industry, in Phase 2, we reviewed a list of previously suggested research directions that could benefit from more focused attention. Areas of interest spanned hospitality, tourism, marketing, business, and service.

Research design

In line with prior work (e.g., De Ruyter et al., 2022; Moher et al., 2009; Stocchi et al., 2021), as well as the procedure suggested by Paul et al. (2021), we conducted a systematic search using the terms "AI," "artificial intelligence," "review," "future trends," "meta-analysis," "conceptual model," and "future directions" across multiple journal databases (i.e., Web of Science, Google Scholar, and SCOPUS). We next refined our results by limiting the search parameters to hospitality, tourism, marketing, business, and service, yielding 31 articles published between 2015 and 2022. After thoroughly reviewing each paper to assess whether it qualified as a review article, we chose 22 as primary sources to compile a list of future directions in AI. Our content analysis focused on research directions proposed in each article; the results totaled 131 pages.

We employed Leximancer in this phase. This high-level natural language processing software has been adopted in various social science fields, including hospitality and tourism (e.g., Çakar & Aykol, 2021; Tseng et al., 2015), to quantify text and provide a thorough understanding of empirical reality (Cheng et al., 2018). The program uses an unsupervised ML approach and two stages of algorithms to convert lexical co-occurrence information from natural language into semantic patterns (Pearce & Wu, 2018). Outcomes can enable researchers to

summarize text and interpret underlying processes while suggesting sociocultural explanations (Çakar & Aykol, 2021; Tseng et al., 2015).

Before analyzing the data, preliminary work was carried out to enhance the validity of conceptual maps as recommended in other studies (e.g., Cheng et al., 2018; Pearce & Wu, 2018). We corrected misspelled words and grammatical errors in reviews, which may have been misleading. Minor adjustments were also made to align the terms, and identical expressions were merged. Several technical operations were necessary to obtain interpretable results: 1) identifying and removing meaningless words, such as "I'm," "the," "of," "on," and others, during text processing; 2) setting up a custom configuration and editing concept seeds and a thesaurus for semantic information; 3) repeatedly examining the results, exploring and modifying settings, and further discovering main topics within the text; and 4) grouping relevant concepts into themes and highlighting their relationships.

The Leximancer program identified 80 concepts in the preliminary stage based on word occurrence and co-occurrence frequency. However, in general, not all concepts drawn from reviews are included in subsequent results (Pearce & Wu, 2018); researchers must refine the major concept list to account for fillers or nonessential words in natural speech and written text (Cheng et al., 2018). We conducted a systematic fine-tuning process in which we considered co-occurrence frequency and concepts' meanings (Çakar & Aykol, 2021). Our final list contained 51 major concepts. Upon combining related topics, we detected three key themes: AI adoption and acceptance, AI operations management, and AI marketing. Figure 3 depicts our holistic conceptual model of AI.
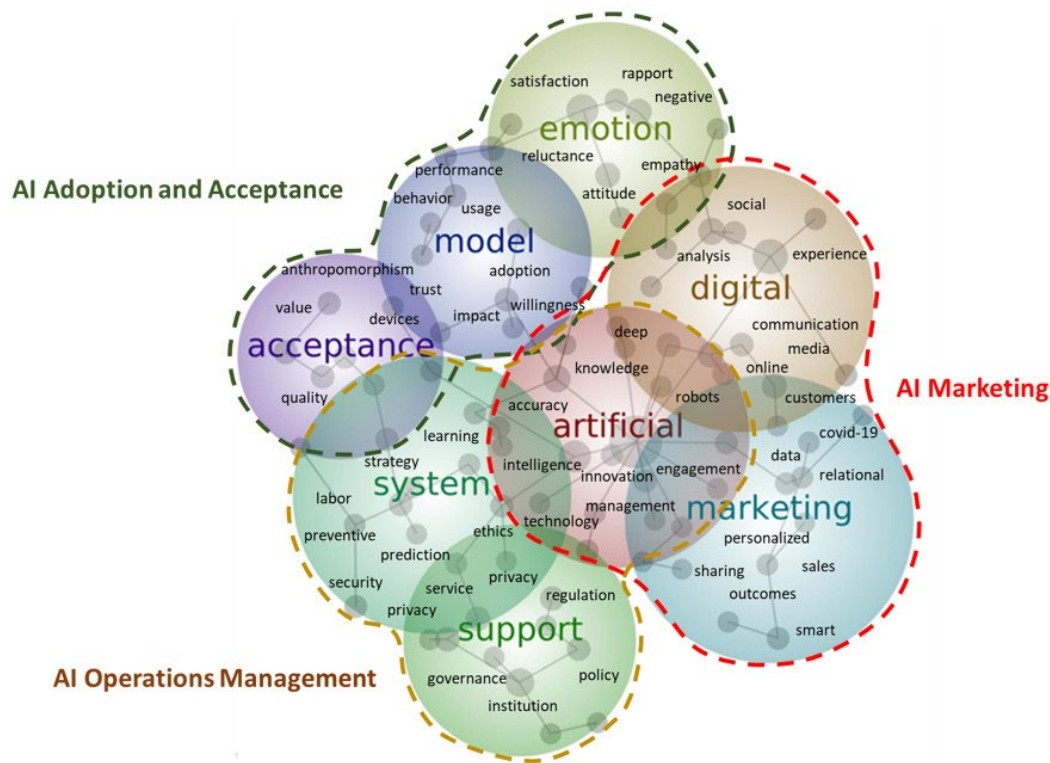
Figure 3. Conceptual Map of AI

Results

Theme one. AI adoption and acceptance. The first theme explained the mechanisms of AI acceptance (Huang & Rust, 2022). Several scholars have predicted that AI will ultimately replace human jobs because AI-based innovations can deliver more reliable and timely service with superior quality compared to people (Knani et al., 2022). Other studies (e.g., Knani et al., 2022) have suggested that ambient computing, fueled by AI, will improve the reliability of hospitality and tourism electronics by enabling remote servicing. Yet not all researchers are convinced: although AI agents possess advantages over humans in terms of speed and accuracy, they lack qualities such as emotion, intuition, and cultural sensitivity (e.g., Mustak et al., 2021). Some authors (e.g., De Bruyn et al., 2021) have hence recommended using AI as a supplement to, rather than a substitute for, human judgment (e.g., to automate administration).

In light of user reluctance regarding AI (Chi et al., 2020), certain information technology models (e.g., the technology acceptance model; Davis, 1989) are thought to be less appropriate for analyzing AI acceptance among consumers. AI devices' unique properties (e.g., humanlike appearance, social norms) differ from those of conventional technologies (Chi et al., 2020). Users may anticipate better service quality and performance thanks to cutting-edge innovations but may feel uneasy due to agents' humanlike nature (Murphy et al., 2019). Longoni et al. (2019) discovered that people may hesitate to use healthcare services from AI providers; patients may worry that AI providers will overlook their personal characteristics, circumstances, and symptoms. Scholars have further claimed that empathy is crucial to AI agents' understanding of social dynamics (e.g., Chi et al., 2020; Vlačić et al., 2021).

Theme two. AI operations management. The intersection of AI and operations management has brought an array of benefits. Some researchers (e.g., De Bruyn et al., 2021) have contended that a quality leadership advantage should be pursued through more analytical AI for service tasks that rely on learning from data (e.g., identifying new markets or services, personalization). However, for tasks that rely on experiential learning (e.g., customer engagement), more intuitive AI may present a relational advantage (Huang & Rust, 2021). Multiple forms of AI are expected to enhance service performance depending on offerings, strategies, and processes (Huang & Rust, 2018).

Ethical issues (e.g., transparency, justice, fairness, and privacy), data protection, and employment opportunities remain major drawbacks of AI (Vlačić et al., 2021). Privacy is of utmost importance while using these technologies. From the pre-trip to the post-trip stage, tourists respond to numerous requests for personal information (e.g., from airline companies,

travel agencies, hotels, and location-based services along with the extensive use of smart technologies; Tussyadiah, 2020). These inquiries contribute to the acquisition, handling, and sharing of sensitive details (e.g., sociodemographic, geographic, behavioral, and biometric data), thus raising privacy concerns (Verma et al., 2021).

Theme three. AI marketing. AI has come a long way in marketing. Advances have been leveraged to reform outdated strategies, including scrutinizing individuals' purchase habits and monitoring data to identify customers' requirements (Huang & Rust, 2021). AI-based marketing tactics are geared towards fine-grained, data-driven personalization of products, services, and marketing mix variables. Addressing these elements throughout the customer journey engages people and optimizes experiential value (Gaur et al., 2021). AI-based systems can be used to investigate vast volumes of online data. For instance, this information can inform data-based marketing (Tussyadiah, 2020). Organizations could also harness AI systems to assess customers' data and offer customized recommendations regarding subsequent purchases, optimal prices, and so on (Vlačić et al., 2021). Furthermore, AI innovations such as emotion recognition and intelligent robots help marketers better serve consumers, leading to stronger customer retention (Vlačić et al., 2021).

The continuous integration of technology and AI will accelerate the physical establishment of smart tourism and smart destinations (Johnson & Samakovlis, 2019). Smart tourism, which includes AI, features three characteristics: instrumented infrastructure, interconnected systems, and intelligent technology (Xiang et al., 2021). A destination is not smart simply because it has new technology. Instead, AI extends companies' abilities to provide real-time knowledge. Collecting and exchanging information instantaneously can align tourists'

needs with products/services via several channels: smart location-based apps; smart tourism cloud infrastructure; smart VR/AR tours (e.g., virtual tours from tourists' smartphones and LED animation); sensors (e.g., checking entries and exits at beaches and museums); smart wearable technology (e.g., watches); and smart mapping (e.g., listing access points for people with mobility needs; street previews). These options can lead to value creation, enhanced tourist engagement, and more satisfying experiences.

The COVID-19 pandemic increased the demand for marketing-channel improvements while customers were confined to their homes and less able to visit physical stores. This reality altered consumers' preferences for digesting information (i.e., without interacting with sales assistants). AI solutions have since been acknowledged as complementary or alternative marketing avenues. Devices' use of semantic recognition creates databases from which marketers can extract information and learn about customers. This approach offers resourceful insights into the business landscape triggered by the pandemic, as demonstrated by unusual customer behavior and business actions.

FUTURE RESEARCH DIRECTIONS AND PREDICTIONS

We identified four directions pertinent to future AI-related research in hospitality and tourism based on our data-driven approach, with implications for stakeholders at three levels: individual (e.g., customers, employees); organizational/business; and public policy/government.

Two expert panel reviews were completed to gather academic and industry insights for validation purposes. While the number of experts (i.e., 10 scholars with expertise in AI research and 10 industry practitioners) that agreed provide feedback was not comparable to sample sizes for traditional surveys, these sample sizes were considered suitable given that the expert

responses were meant to verify our findings (Gallarza et al., 2017). Every participating scholar and industry practitioner received a panel review link that included information about our research and accompanying instructions. After agreeing to take part, each expert was directed to our full list of research questions. Participants rated each question on a 5-point scale (1 = *not important at all*, 5 = *very important*). They were prompted to suggest additional topics and research questions at the end of the panel review task. Scholars deemed the research question focusing on the incorporation of AI and related technologies into a smart, sustainable ecosystem within hospitality and tourism to be the most important. By contrast, practitioners' top-ranked research question concerned businesses in the hospitality and tourism industry safeguarding customers' data in a socially responsible manner during AI implementation. Table 3 summarizes the ranked results.

Expanding upon the evaluations of questions in Table 3, we predicted the future of AI in hospitality and tourism by focusing on four crucial aspects: customer–AI interaction, AI and organizational decision making, organizational implications, and managerial issues.

Direction one. Customer–AI interaction: Customer–AI interaction is gaining increasing attention from academics and practitioners as AI systems assume tasks traditionally performed by humans (e.g., culinary roles in restaurants, concierge services in hotels, and security functions at airports). Although AI is considered a breakthrough in many ways, our results indicated that the research questions on consumers' adoption and acceptance of AI could offer valuable insight (see Table 3). For example, how do customers interpret the personal information that AI devices use to provide tailored service and generate positive impressions of associated technologies? How do human relationship-oriented factors, such as trust and rapport, influence customers'

acceptance of AI technologies? In addition, AI applications are advancing to elevate human engagement via natural language processing and machine learning, ultimately enhancing customer companionship. For example, cognitive computing, epitomized by IBM's Watson, emulates human thought processes and self-learning; it can potentially facilitate natural conversations between AI systems and humans with support from generative AI like ChatGPT. Thus, scholars are encouraged to examine the optimal integration of such advancements in hospitality and tourism service operations. AI agents can display emotions that are inauthentic despite being pleasant. Obstacles to effective interaction may lead to confusion, frustration, and safety concerns. Accordingly, future research could explore how these prospective challenges can be minimized or eliminated.

Our results also highlighted that inquiries into AI's positive and negative consequences continue to be emphasized within hospitality and tourism (see Table 3). Considering this industry's labor-intensive nature, some fundamental questions include the following: What aspects inform customers' decisions to interact with AI or human staff? Why do customers trust or distrust AI technologies? In addition, building relationships with AI agents depends on factors like human likeness, advanced AI features, roles, interaction styles, and functionality. Developing AI with empathy and interactive capabilities is a significant obstacle. Researchers could therefore investigate human–AI interaction and/or interfaces to better understand the linkages between the design, characteristics, and capabilities of AI and people's perceptions. Notably, despite AI's ability to make precise decisions, people often override them due to algorithm aversion stemming from a lack of trust in machines (Dietvorst et al., 2015). Consumer skepticism toward algorithm-based recommendations is common but can be reduced by

emphasizing algorithms' learning capacity (Reich et al., 2023); doing so can promote trust and acceptance.

It is similarly critical to assess the roles of demographics and cultural differences. Customers' acceptance of AI varies demographically, with some people expressing doubts about their capacity to interact effectively with AI devices. Findings will clarify the dynamics of customer–AI interaction (see Table 3). For example, to what extent do variations in bias awareness (e.g., among digital natives and digital immigrants) affect customers' likelihood of feeling misunderstood by AI? How do customers' demographics (e.g., gender, ethnicity, age) affect their probability of accepting or embracing AI? How do cultural variations within and between countries inform customers' perceptions of AI?

Human–AI interaction is immature, bringing a plethora of unexplored opportunities in hospitality and tourism. As technology advances, the potential for more meaningful interactions between people and AI will continue to rise. We expect the era of AI to usher in an exciting chapter in human–AI interaction, with the prospect of ever-broader possibilities as technology evolves.

Direction two. AI and organizational decision making: Automation, powered by AI and technological progress, is generating opportunities across industries. Our comprehensive analyses of data from multiple sources suggest that several questions remain unanswered regarding implementation (see Table 3). For instance, is there an ideal balance between AI-automated activities and those performed by humans that can achieve superior results? As the capabilities of AI expand and its task range increases, how will the normative boundaries between human- and algorithm-provided tasks change? The hospitality and tourism sector is swiftly embracing automation, offering an intriguing area for investigating how customers

perceive and engage with these changes. AI adoption differs, although information, professional services, management, and finance sectors are taking the lead. Younger companies appear more likely to adopt AI regardless of their size, reflecting the costs of implementation. The full impact of automation will not be immediately apparent but will instead unfold gradually over several years. The speed and extent of automation will also vary by tasks, roles, and skills. Factors such as technological progress, costs, competition with human labor, performance benefits, and societal acceptance will influence the pace and scope of automation. Approximately 50% of current work activities could be automated by 2055, though this timeline may shift by up to two decades depending on specific factors and economic conditions (OECD, 2023).

Our data also revealed aspects concerning the design and development of products and services (see Table 3). For example, how can AI and associated technologies (e.g., Internet of Things, metaverse, blockchain, ChatGPT) be incorporated into a smart, sustainable ecosystem within hospitality and tourism? Current industry trends reflect a growing reliance on AI-driven operations within hospitality and tourism. Moreover, financial transactions are shifting towards decentralized blockchain frameworks. For instance, the booking processes for flights, hotels, and other travel arrangements increasingly depend on AI-driven customer data analysis. This move towards AI technologies is expected to enhance value creation while protecting customers' privacy and security. As these technologies evolve, the hospitality and tourism industry is moving towards fully personalized experiences inspired by user-provided data. Nevertheless, effectively incorporating spatiotemporal data into systematic models remains a persistent challenge in tourism research; available methods often handle spatial and temporal dimensions separately. Enhanced integration, with the assistance of AI, offers the promise of deeper insights

into tourists' behavior. Results should allow for more accurate data interpolation and much-improved capabilities when forecasting tourism demand.

Another set of questions surrounding AI and organizational decision making involves resource optimization (see Table 3). For instance, how can AI-based price negotiation be effectively managed? How can AI integrate various types of data on communication (e.g., voice data), customer behavior, and other information (e.g., similar customer actions) to predict repurchases? AI profoundly affects resource allocation across industries: this technology can rapidly process data, enhance efficiency, and identify anomalies. It also plays a crucial role in resource management, especially in areas such as inventory tracking, data administration, analytics, and reporting within hospitality and tourism. AI's key advantage lies in its ability to execute multiple queries concurrently, ensuring efficient resource allocation across various tasks without interference. This transformative technology in turn leads to cost savings, heightened efficiency, and better decisions. Predictive analytics and intelligent automation can facilitate the anticipation of resource requirements and streamline tasks. Furthermore, AI appears invaluable in areas such as workforce planning, talent acquisition, and project management; it enhances resource allocation practices across a spectrum of industries. Thus, AI has the potential to revolutionize resource allocation via predictive analytics, intelligent automation, and data-informed decisions. Organizations that embrace AI are well-positioned to thrive in competitive, resource-constrained environments, ultimately achieving more effective and sustainable development outcomes.

Direction three. Organizational implications: Despite the promise of AI applications in hospitality and tourism, the drivers of and barriers to organizational AI adoption have yet to be

fully understood (see Table 3). For example, how should organizations determine when and how to replace human decision making with automated decision-making systems? What aspects propel or hinder the corporate adoption of AI technologies in hospitality and tourism? AI adoption in hospitality and tourism is spurred by factors such as its relevance to businesses' operations; barriers include issues of inapplicability and high costs. A sizable proportion of AI adopters use this technology to upgrade product or service quality, refine existing processes, and automate tasks. AI hence plays a pivotal role in automation, which could have substantial implications for labor productivity and employment in hospitality and tourism. AI has the transformative potential to reshape staff training and development by offering customized training programs with real-time feedback. Employee retention and skills acquisition should improve in kind.

In addition, research on the organizational impacts of AI is scarce (see Table 3). For instance, how do AI technologies affect job roles and task redesign? How does AI affect the industry's workforce, and what changes does it bring to the labor market and skill requirements? Concerns exist regarding the potential displacement of jobs as AI automates repetitive tasks in hospitality and tourism. Simultaneously, AI is expected to generate job opportunities, particularly in customer service. The societal and political dimensions of AI's effects on employment and workplaces are of utmost importance. Safety nets are urgently needed to protect workers from the structural job-market shifts that AI could bring to hospitality and tourism. Although AI may automate certain tasks and produce novel job roles, predicting the nature of these positions is complex. Public discourse and policymaking around the equitable distribution of AI's economic benefits, and the development of measures to ensure social security, are therefore essential to consider.

In summary, AI is reshaping workplaces by improving task performance, modifying job structures, and raising questions about potential employee displacement. Our results further show that research questions related to AI's impacts on employees are of particular interest (see Table 3). Scholars have discussed AI–human collaboration (Huang & Rust, 2022). In this vein, how can customers and service providers (or firms) collaborate with AI for increased efficiency? It is imperative to mull over the societal, political, and ethical implications of AI's influences on employment and work dynamics. Additionally, AI's role in creating "digital twins" could revolutionize how organizations model real-world dynamics and conduct training and scenario testing in digital environments.

Direction four. Other managerial issues: Ethical concerns such as privacy, bias, and compliance deserve attention (see Table 3). Such issues often arise from unsupervised AI applications (Bock et al., 2020). Many questions thus warrant contemplation. For example, what unique moral challenges are present (e.g., in data capture, data analysis, data reliability, and data privacy)? Can discrepant ethical norms affect AI implementation in marketing to establish a win-win scenario for all stakeholders (i.e., individuals, companies, and others)? An unwavering commitment to responsible AI is vital to successful AI implementation. Emphases on assurance and control in hospitality and tourism are required. This dedication involves addressing AI initiatives' societal and ethical implications, building stakeholder trust, ensuring transparent AI systems that the general public understands, and assembling AI systems that are both unbiased and transparent. Transparency is essential for mitigating biases within AI, improving people's grasp of AI capabilities, and enabling devices' practical use. The transformative potential of AI is well recognized. Even so, its adoption in various sectors—especially in tourism and

hospitality—raises privacy concerns that necessitate clear ethical standards and data management guidelines.

Other managerial issues, particularly those related to preventive action, have also been identified at the macro level (see Table 3). For example, how can AI improve relationships between institutions and customers? AI and automation have already been evaluated in hospitality and tourism (Tussyadiah, 2020). Building on the extant literature, can AI create a more sustainable future for this industry—or even a better world? If so, how can the benefits of AI be leveraged across industry areas? Policymakers are intensifying their calls for empirical research to gain a more profound sense of the evolving landscape of AI adoption, especially within hospitality and tourism. Public policies should be formulated to enable society to embrace AI applications, extend their benefits, tackle issues related to privacy and ethics, and ensure a fair distribution of AI-derived advantages. AI offers societal opportunities and challenges given concerns such as privacy violations, the rise of anti-competitive conditions, and behavioral manipulation stemming from AI's influence over information.

Concerns also exist about AI automation displacing workers, contributing to discrimination and democratic issues. Comprehensive government monitoring and regulation are therefore needed. For instance, is crucial to rectify biases in AI datasets in order to combat gender and racial bias in facial recognition and predictive policing. Ethical consideration and public awareness are paramount in this regard. In addition, federated learning can offer a solution for collaborative training without centralized data exchange (Bammens & Hünermund, 2023). This type of learning can improve patient care, expedite clinical trials, and enable precise predictions within hospitality and tourism. Its adoption may require public support and

regulatory measures, including addressing cybersecurity concerns while enhancing

policymakers' knowledge of its benefits for hospitality and tourism.

Table 3. Future Research Directions by Mean Importance

Theme	Future research	Mean importance		
		Academics (a)	**Practitioners (b)**	**Mean difference (a) - (b)**
Customer–AI interaction	**1. Adoption and acceptance of AI**			
	How do customers interpret the personal information that AI devices use to provide tailored service and generate positive impressions of associated technologies?	4.6	3.9	0.7
	How do human relationship-oriented factors, such as trust and rapport, influence customers' acceptance of AI technologies?	4.4	4.0	0.4
	How could AI facilitate customer–service provider interaction?	4.3	4.0	0.3
	How do AI technologies' design attributes (e.g., appearance, functionality, and mobility) shape customers' acceptance?	4.2	3.1	1.1
	What generic and context-specific factors contribute to customers' acceptance of AI?	4.1	4.4	-0.3
	How might human readiness affect customers' adoption of different AI applications?	4.1	3.5	0.6
	In what ways could human-based emotional factors, such as enjoyment and curiosity, affect the acceptance of AI applications in hospitality and tourism?	3.4	4.0	-0.6
	2. Understanding of the negative and positive outcomes of AI			
	What aspects inform customers' decisions to interact with AI or human staff?	4.1	4.4	-0.3
	Why do customers trust or distrust AI technologies?	4.0	4.0	0.0
	To what extent might the AI-based automation of hospitality and tourism services minimize human interaction during the customer journey?	3.9	4.1	-0.2
	How do customers perceive this lack of interpersonal contact arising from AI automation?	3.8	3.9	-0.1
	What interactive AI experiences or factors influence customers' likelihood of feeling misunderstood?	3.7	4.0	-0.3
	What are the determinants of customers' assessments of perceived autonomy in hospitality and tourism settings with AI mediation, and to what extent do customers value this autonomy?	3.9	3.5	0.4

	3. Differential demographics and cultural differences			
	To what extent do variations in bias awareness (e.g., among digital natives and digital immigrants) affect customers' likelihood of feeling misunderstood by AI?	4.1	4.0	0.1
	How do cultural variations within and between countries inform customers' perceptions of AI?	4.1	3.5	0.6
	How do users' cognitive attributes, such as levels of attention, influence the link between their intentions to use AI technology and actual use?	3.7	4.1	-0.4
	How do customers' demographics (e.g., gender, ethnicity, age) affect their probability of accepting or embracing AI?	3.6	4.5	-0.9
AI and organizational decision making	**1. Implementation level**			
	Is there an ideal balance between AI-automated activities and those performed by humans that can achieve superior results?	4.3	4.3	0.0
	As the capabilities of AI expand and its task range increases, how will the normative boundaries between human- and algorithm-provided tasks change?	4.3	4.0	0.3
	In what ways might AI technologies be integrated at different stages of the hospitality and tourism journey?	4.2	4.0	0.2
	When, how, and to what degree should AI deliver hospitality and tourism service offerings?	4.1	4.0	0.1
	What is the optimal level of AI implementation (ranging from manual to full automation) given the hospitality and tourism industry's distinctiveness?	4.0	3.9	0.1
	2. Design and development of products and services			
	How can AI and associated technologies (e.g., Internet of Intelligent Things, the metaverse, blockchain, ChatGPT) be incorporated into a smart, sustainable ecosystem within hospitality and tourism?	4.8	4.0	0.8
	How can AI be integrated to improve activity performance in this industry?	4.3	4.4	-0.1
	How might the algorithms and models required for thinking and feeling AI be applied?	4.1	3.9	0.2
	Can AI deliver sales representatives immediate feedback to enhance sales pitches by analyzing customers' facial and vocal reactions?	3.9	3.6	0.3

	How can AI be best used to create products that meet customers' requirements?	3.8	4.5	-0.7
	3. Resource optimization			
	How can AI-based price negotiation be effectively managed?	4.3	3.5	0.8
	How can AI integrate various types of data on communication (e.g., voice data), customer behavior, and other information (e.g., similar customer actions) to predict repurchases?	4.2	4.0	0.2
	How can AI be optimized to predict suitable prices and determine the appropriateness of price promotions in hospitality and tourism?	4.1	4.0	0.1
	Can firms in this industry potentially reduce their advertising expenditure as they forecast customers' preferences using AI?	3.4	3.9	-0.5
Organizational implications	**1. Drivers and barriers of organizational utilization of AI**			
	How should organizations determine when and how to replace human decision making with automated decision-making systems?	4.2	3.8	0.4
	What aspects propel or hinder the corporate adoption of AI technologies in hospitality and tourism?	3.9	4.3	-0.4
	How do organizational capabilities influence decision making about AI adoption in marketing within this industry?	3.9	4.0	-0.1
	How do businesses decide whether to implement AI systems in their marketing practices?	3.9	4.0	-0.1
	How do businesses choose which AI-centered companies to partner with for technology adoption?	3.9	3.6	0.3
	2. Impacts on organizations			
	How do AI technologies affect job roles and task redesign?	4.6	4.3	0.3
	How does AI affect the industry's workforce, and what changes does it bring to the labor market and skill requirements?	4.4	4.0	0.4
	How can AI technologies effects' on organizational performance be managed well?	4.2	4.3	-0.1
	What is the relative importance of different AI elements in transforming hospitality and tourism (e.g., mechanical, thinking, and emotional AI)?	4.2	3.9	0.3
	To what extent does AI-based automation help hospitality and tourism businesses lower human costs?	4.1	3.6	0.5

	What are the major downsides of introducing AI into the hospitality and tourism industry?	4.0	4.0	0.0
	How does AI influence the transfer of soft and hard skills across organizational levels (i.e., horizontally and vertically)?	4.0	3.4	0.6
	3. Impacts on employees			
	How can customers and service providers (or firms) collaborate with AI for increased efficiency?	4.6	4.5	0.1
	To what extent do AI technologies contribute to workers' satisfaction?	4.6	4.0	0.6
	How do AI and automation affect workers' reskilling and retraining?	4.4	4.0	0.4
	How does AI influence job insecurity and employee turnover in hospitality and tourism?	4.4	3.8	0.6
	How do employees perceive AI-based automation?	4.4	3.6	0.8
	How does AI affect employees' mental health and well-being in the workplace?	4.3	3.6	0.7
	How can AI–worker interactions be made more natural?	4.3	3.6	0.7
	To what extent can AI replace human interaction (e.g., by employees) in hospitality and tourism settings?	4.2	4.4	-0.2
	How do AI technologies affect employees' tasks and performance?	4.2	4.1	0.1
	How can levels of AI be feasibly incorporated into hospitality and tourism contexts (e.g., lodging, restaurants, theme parks, events)?	4.1	4.1	0.0
Other managerial issues	**1. Privacy, bias, and ethical issues**			
	What unique moral challenges are present (e.g., in data capture, data analysis, data reliability, and data privacy)?	4.4	4.1	0.3
	Can discrepant ethical norms affect AI implementation in marketing to establish a win-win scenario for all stakeholders (i.e., individuals, companies, and others)?	4.4	4.0	0.4
	How can businesses in this industry safeguard their customers' data in a socially responsible manner while implementing AI systems?	4.2	4.6	-0.4
	How can experts address ethical concerns surrounding AI technologies in digital marketing?	4.2	4.0	0.2
	How can AI enhance ethical practices in hospitality and tourism?	4.2	3.6	0.6
	Can AI make ethical decisions?	4.1	3.4	0.7

2. Preventive actions

Can AI create a more sustainable future for this industry—or even a better world? If so, how can the benefits of AI be leveraged across industry areas?	4.4	3.9	0.5
How can organizations ensure regulatory compliance to protect stakeholders from the potential consequences of AI?	4.2	4.0	0.2
How can AI improve relationships between institutions and customers?	4.1	4.4	-0.3
Will legal restrictions affect AI acceptance, adoption, and expansion in hospitality and tourism?	4.1	4.3	-0.2
To what extent do public policies affect the acceptance and adoption of AI technologies?	3.9	4.0	-0.1
How do national and international institutional initiatives contribute to the successful implementation of AI?	3.7	4.0	-0.3
How do policy support, such as infrastructure, financial assistance, and education or training, contribute to AI acceptance and adoption?	3.6	4.0	-0.4

Note. Dark denotes positive mean differences; grey denotes negative mean differences; white denotes neutral mean differences.

<h1 style="text-align: center;">IMPLICATIONS</h1>

Theoretical implications

This research makes several theoretical contributions. First, our study has enhanced the understanding of AI regarding this term's meaning, associated devices, and appropriate usage. Although AI has been in development since the 1950s, no uniform definition exists. Knowledge from multiple disciplines was integrated here to define AI as computational agents endowed with humanlike cognitive, perceptual, and conversational abilities that can flexibly deal with and learn from external data to fulfill service-oriented tasks. In addition, we summarized AI applications (e.g., AI-based chatbots/virtual agents, AI-based robotics, VR/AR, search/booking engines, autonomous vehicles, and kiosks/self-service). Our description and applications help concretize the boundaries of AI research in hospitality and tourism.

We explored AI's past and present in Phase 1 before forecasting its future in Phase 2 by using a natural language processing approach with multiple data sources. We recommend that researchers continue investigating understudied contexts, including cruises, theme parks, resorts, and art galleries, featuring various AI functions (e.g., mechanical AI, thinking AI, and feeling AI). We also suggest that scholars focus on emerging AI topics (see Phase 1), including startups and the consolidation of companies (or their assets) through financial transactions such as mergers and acquisitions. AI is becoming increasingly popular in hospitality and tourism in this regard. Furthermore, we encourage authors to tackle overarching problems that could bring societal impacts; doing so will reduce the potential harms of AI. For instance, ethical issues (e.g., transparency, justice, fairness, and privacy) must be handled carefully. Scholars should collaborate with stakeholders (e.g., firms, organizations) to address important matters. These

parties can then jointly implement solutions and provide clear guidance on AI use within hospitality and tourism.

Our findings enlarge the literature on AI as well as hospitality and tourism by systematically uncovering potential areas for future research. Four specified directions (i.e., customer–AI interaction, AI and organizational decision making, organizational implications, and other managerial issues) cover parties pertinent to hospitality and tourism: individuals, including customers and employees; organizations and businesses; and public policymakers and governments. Addressing these players will extend the knowledge base around AI in hospitality and tourism from both academic and practical points of view.

Practical implications

The widespread adoption of AI in hospitality and tourism is not a fad: customers' demands are growing for reliability, empathy, and personalized service before, during, and after their experiences (Chi et al., 2020). In particular, given its capacity to process emotional data, emotional AI is well suited to this field because customers are likely to engage in conversation and express their feelings. AI innovations such as emotion recognition and intelligent robots can help marketers better serve consumers, leading to stronger customer retention. Our findings and proposed research directions offer industry stakeholders novel opportunities.

We hope that the identified issues will spark creativity among hospitality and tourism professionals. We have shown that AI has shifted the operational paradigm from a rule-based, expert systems approach to a data-driven one. The new AI-based systems are geared towards fine-grained, data-driven personalization of products, services, and marketing mix variables. Organizations can explore fresh ways to use AI productively—to enhance employees' and

customers' well-being, address pressing customer concerns, initiate more sustainable resource management, and empower customers to take charge of their own well-being. Firms could harness AI systems to assess customers' data and offer customized recommendations regarding subsequent purchases, optimal prices, and so on (Vlačić et al., 2021). Collaborating with experts in relevant fields could expedite the development of solutions to these challenges.

This research area requires innovative thinking and detail-oriented approaches, including in policy formulation and implementation. Government policies are crucial in shaping public attitudes toward ethical and moral issues and influencing the growth of AI applications. External factors such as laws and regulations can also affect companies' operations and interactions with the environment. In addition to government directives, each industry has unique characteristics that affect AI adoption. Scholars and practitioners need to engage with policymakers by taking part in relevant discussions and helping to drive transformative change.

CONCLUSION AND LIMITATIONS

This study has presented a thorough review of AI's history, status quo, and possible future in hospitality and tourism. However, several limitations remain. First, our analysis of news and academic articles relied on specific keywords to answer the research questions; other relevant items may have been overlooked during screening. Second, despite our team reaching a consensus prior to making decisions, manual article screening could introduce personal bias and subjectivity. Follow-up research can feature alternative approaches, such as focus groups or in-depth interviews, to supplement publication datasets.

As a concluding observation, AI is becoming a well-established sub-field within hospitality and tourism. The potential for research, based on prevalent knowledge gaps, indicates that AI studies will remain important. We encourage researchers to ponder the aforementioned questions. A review of the AI ecosystem and its possible roles for customers and industry operations demonstrates that this area is still in flux. The future of AI in hospitality and tourism is thus exciting but uncertain. If nothing else, it is vital to understand AI because this technology is culturally relevant. We hope that the ideas discussed here will inspire novel studies tied to AI innovations.

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