

THE RISE OF AI IN TOURISM - A SYSTEMATIC LITERATURE REVIEW

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Abstract: Tourism ranks among the world's largest industries, and its sustained expansion has paralleled swift advancements in technology. Artificial Intelligence (AI) is increasingly recognized as a transformative force in tourism, offering human-like capabilities that enhance decision-making and service automation. Its application across the sector improves operational efficiency and personalizes customer experiences, thereby fostering innovation and competitiveness. However, the rapid integration of AI also presents conceptual, theoretical, and societal challenges that require critical examination. The research aims to synthesize the conceptual and theoretical research on AI in tourism from 2019 onwards. It examines key themes, theoretical perspectives, methodological rigor, and research gaps in the existing literature. Further goal is to identify thematic areas with a specific focus on AI applications. The study followed the PRISMA guidelines to conduct a systematic literature review (SLR). Academic databases, including Scopus and Web of Science, were searched to identify scientific-relevant peer-reviewed articles. From an initial pool of over 400 studies, we identified 45 significant journal articles and selected them for an in-depth analysis, that collectively illuminate how AI is reshaping tourism research and practice. Studies have drawn on innovation diffusion theory to explain adoption patterns, technology acceptance models to gauge user and employee attitudes, and service quality and co-creation theories to understand how AI can add value to the customer experience. It also highlighted the evolution of AI research in tourism, from conceptual discussions to empirical investigations. Gaps and challenges in the research were identified, including a limited focus on human-AI interaction, ethical concerns, and methodological rigor. The review concludes that AI has the potential to transform tourism by enhancing efficiency, personalization, and sustainability. The findings reveal that AI has been envisioned as a catalyst for transformation in the tourism industry, with applications ranging from intelligent forecasting and revenue management to service automation via robots and hyper-personalized travel experiences. AI-driven analytics can improve decision support for revenue management, capacity planning, and marketing strategy. However, realizing this potential requires addressing the improvement of technological competence of human resources, ethical issues, and implementation strategies.

Keywords: artificial intelligence, tourism, hospitality, systematic literature review, automation, personalization, smart tourism, sustainability, human-ai interaction

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INTRODUCTION

Tourism is one of the largest global industries, and its continued growth has been accompanied by rapid technological development. Artificial Intelligence (AI) has emerged as a transformative technology in tourism, offering tools with human-like capabilities (e.g. sensing, learning, reasoning, and acting) that can augment decision-making and automate services. By applying AI across various tourism domains, businesses can increase efficiency through better resource use and deliver more personalized customer experiences. In recent years, the integration of AI in tourism has accelerated, enabling innovations from AI-powered chatbots and recommender systems to service robots and smart destination management. These developments underscore AI's significance for enhancing competitiveness and innovation in hospitality and tourism services. However, the rapid proliferation of AI also raises complex questions regarding its conceptual role, the theoretical frameworks guiding its adoption, and broader impacts on consumers, businesses, and society.

Given the burgeoning but fragmented body of literature, a systematic review is needed to synthesize how AI has been studied in tourism from a conceptual and theoretical standpoint. Existing studies range from comprehensive literature reviews to perspective articles and frameworks that attempt to assess AI's transformative impact on tourism. There is a need to consolidate these insights to understand prevailing themes, theoretical lenses, and research gaps. This review addresses that need by conducting a Systematic Literature Review (SLR) of peer-reviewed research on AI in tourism since 2019, following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. The objectives of this review are to: (1) examine the key conceptual themes in the literature on AI's role in tourism; (2) identify

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the theoretical perspectives and frameworks applied; (3) evaluate methodological rigor in these studies; and (4) highlight research trends and gaps to inform future investigations. By focusing on conceptual, theoretical, and methodological discussions (and excluding narrow case-specific implementations), this SLR provides a rigorous synthesis of how AI is understood and studied in tourism globally. The following sections present the literature review of key themes, the methodology and PRISMA-based process, discussion of findings and gaps, and conclusions with future research directions.

METHODOLOGY

This systematic literature review was conducted in accordance with the PRISMA 2009/2020 guidelines for transparent and comprehensive reporting. The review followed the four-phase PRISMA flow: **Identification**, **Screening**, **Eligibility**, and **Inclusion**. The process is outlined below. **Identification:** We defined a search strategy to capture relevant literature from 2019 onward, focusing on peer-reviewed journal articles that discuss AI in a tourism context at a conceptual or theoretical level (rather than purely applied case studies) focusing on Business, Management and Accounting category. We searched multiple academic databases – primarily **Scopus** and **Web of Science (WoS)** – given their broad coverage of high-quality journals. Additional searches were run on **ScienceDirect**, **SpringerLink**, and **Google Scholar** to ensure comprehensive coverage, especially for recent publications and any journals not indexed in Scopus/WoS. Search strings combined keywords related to artificial intelligence with tourism/hospitality/travel, for example: '*artificial intelligence*' **AND** (*tourism OR hospitality OR travel*). The initial search (conducted in 01/2025) yielded a total of $N_1 = 627$ records (after removing clearly irrelevant results such as those outside tourism or AI domains).

Screening: All identified records were exported into reference management software, where **duplicate removal** was performed. After de-duplication, $N_2 = 421$ unique records remained. We then screened titles and abstracts against inclusion criteria. The inclusion criteria were: (a) written in English; (b) published in a peer-reviewed journal (to ensure quality and consistency); (c) published 2019 or later; (d) explicitly focused on AI (or closely related concepts like machine learning, intelligent systems, robotics, etc.) *in a tourism, hospitality, or travel context*; and (e) discussing AI from a conceptual, theoretical, or broad methodological perspective (as opposed to reporting a single-case empirical application or technical algorithm details unrelated to tourism theory). We **excluded** papers that were: conference proceedings, theses, or other non-peer-reviewed sources; not in English; or clearly off-topic (e.g. AI applied in unrelated fields with a passing mention of 'tourism'). We also excluded papers that were primarily **case studies or empirical implementations of a specific AI system in one company**, as per the review's focus on generalizable concepts and frameworks. For example, an empirical study on AI-driven guest satisfaction in one hotel chain (Al-Hyari et al., 2023, on luxury hotels) was excluded during screening because it centered on a specific case context rather than deriving broader conceptual insights. After the title/abstract screening, $N_3 = 141$ articles were deemed potentially eligible and moved to full-text assessment.

Eligibility: In the eligibility phase, we retrieved and read the full texts of these 141 articles to confirm their relevance and quality. Each article was assessed on: relevance to AI in tourism (Does the full text indeed discuss AI's role in tourism?); conceptual depth (Does it provide theoretical discussion or a literature synthesis rather than just a technical implementation?); and methodological rigor (For reviews, did they follow a clear method?; For conceptual papers, is the argumentation well-supported?). At this stage, we further excluded studies that, upon full reading, did not substantially engage with AI in a tourism context (for instance, a few papers turned out to be only tangentially related, using 'tourism' examples but focusing on AI algorithm performance, etc.), or that lacked any clear methodological or theoretical grounding. We also scrutinized review papers to ensure they had a systematic approach (where applicable). By the end of this eligibility check, $N_4 = 45$ studies met all criteria. **Inclusion:** The final set of included studies for analysis numbered 45. These comprised a mix of article types: approximately one-third were **systematic or structured literature reviews** of AI in tourism (or subtopics thereof), another one-third were **conceptual/theoretical papers or viewpoints** proposing frameworks or discussing trends, and the remainder were **broad empirical studies or meta-analyses** whose findings had conceptual implications (e.g. bibliometric studies, meta-studies of multiple papers). Notably, the included literature spanned a **global range** of research, with studies originating from Europe, Asia, North America, and beyond, reflecting the international scope of AI in tourism research. All included papers were published in English-language journals. Figure 1 illustrates the PRISMA flow of study selection (from 627 initial records to 45 included articles), detailing the numbers removed at each stage for reasons such as duplication, irrelevance, or not meeting inclusion criteria.

During data extraction, we catalogued each included study's bibliographic details, research objectives, methodology, and key conclusions. To facilitate analysis, we coded the studies by theme (as identified in the Literature Review section) and noted any theoretical frameworks used. We also recorded publication venues and dates to observe temporal and journal distribution of the research. The final sample was drawn from over 30 different journals, indicating a diverse set of outlets. A significant portion of the literature appeared in high-impact tourism and hospitality journals. For instance, we found multiple relevant articles in *International Journal of Contemporary Hospitality Management*, *International Journal of Hospitality Management*, *GeoJournal of Tourism and Geosites*, *Journal of Hospitality & Tourism Technology*, *Tourism Review*, and others, which together accounted for a large share of the included studies (over 50%). This distribution aligns with a recent analysis by Henriques et al. (2024), who noted that the top outlets for AI-tourism research include leading hospitality management journals. The diversity of sources enhances the robustness of our review, and we ensured via multiple independent searches that key contributions were not missed. To ensure methodological rigor, the review protocol (search strategy, inclusion criteria, etc.) was defined a priori and, where applicable, this report follows PRISMA reporting standards (e.g. describing information sources, selection process, data synthesis). By strictly adhering to these procedures, we aim to provide a transparent and replicable account of how the literature was gathered and analyzed.

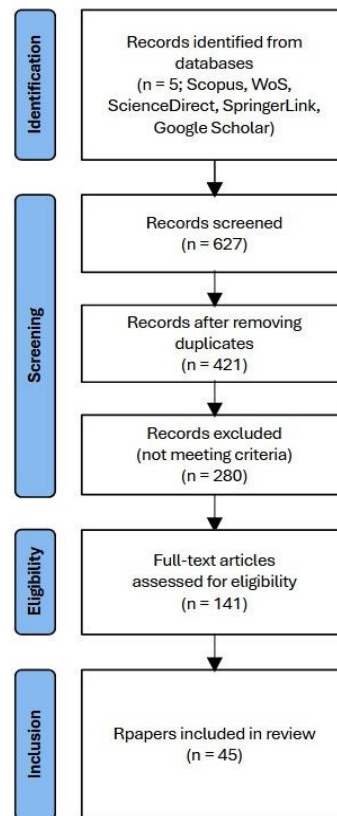


Figure 1. PRISMA 4-phase flow diagram of the literature selection process (Source: own construction)

RESULTS OF THE SYSTEMATIC LITERATURE REVIEW

Research on AI in tourism has grown markedly in the past decade, yielding several recurring themes and conceptual perspectives. The reviewed studies (2019–2024) predominantly discuss AI’s applications in **demand forecasting and analytics**, **service automation and robotics**, **customer experience personalization**, **marketing and consumer engagement**, and **smart tourism and sustainability**. Across these themes, scholars have also considered issues of technology adoption, user trust, and ethical implications. Below, we summarize each theme and the theoretical insights from representative studies (also Table 1 for an overview of thematic categories).

AI for Forecasting and Analytics

One fundamental application of AI in tourism is improving forecasting accuracy for demand and market trends. Early uses of AI in the sector were in predicting tourism demand and hotel occupancy. Traditional statistical methods for tourism forecasting are increasingly augmented or replaced by machine learning models that can handle large, complex datasets. For instance, Song et al. (2019) review decades of tourism demand forecasting research and note the **emergence and success of AI-based models** in improving forecast accuracy. Similarly, Liu et al. (2019) conduct a scientometric analysis and find a surge in the use of AI (e.g. neural networks, support vector machines) for tourism forecasting since around 2009. A recurring insight is that AI models can detect nonlinear patterns and leverage big data (such as online search queries or social media metrics) to enhance predictions. However, these studies also caution about challenges like the ‘black box’ nature of some AI algorithms and the need for large datasets for training. Jiao & Chen (2019) specifically review methodological developments in tourism forecasting over the 2008–2017 period and highlight how AI techniques (e.g. ensemble learning, hybrid models) have expanded forecasting capabilities, albeit with issues in interpretability and computational demand. Recent advancements continue to refine forecasting methodologies by integrating sophisticated AI-driven hybrid models. Hu et al. (2024) developed a **two-stage combination model** for tourism demand forecasting, blending **data decomposition techniques** with machine learning algorithms such as **support vector regression** and **extreme learning machines**. Their approach enhances prediction accuracy by capturing both **seasonal** and **nonlinear dynamics**, outperforming traditional single-model methods in empirical testing.

However, while the model shows strong robustness across different forecasting horizons, a critical limitation is its **high computational complexity**, which may hinder adoption among smaller tourism enterprises with limited technological infrastructure. Moreover, the study’s evaluation relies heavily on **benchmark datasets**, and real-world operational validation under diverse market conditions remains an area for future research.

In a complementary approach, Liao et al. (2024) propose the **SARIMAX-helpful model**, which integrates **sentiment analysis** and the **helpfulness ratings** of user-generated online reviews to enhance short-term tourism demand forecasts. Their findings demonstrate that incorporating the **perceived usefulness** of reviews significantly boosts model performance, especially in volatile demand environments. Nevertheless, the approach is sensitive to **regional disparities** in digital

engagement and **platform-specific biases**, potentially affecting its generalizability. Additionally, the study primarily focuses on a single data source (Meituan reviews in China), which may limit the applicability of findings to broader, multilingual, and multi-platform tourism markets, suggesting the need for cross-platform validations in future studies.

Overall, the literature establishes **forecasting** as a key conceptual domain for AI in tourism, demonstrating that AI-driven analytics can improve decision support for revenue management, capacity planning, and marketing strategy. This theme often intersects with the next one, as forecasting improvements contribute to operational efficiency in tourism services.

AI-Driven Service Automation and Robotics

Another dominant theme is the use of AI to automate tourism and hospitality operations, often via robotics and intelligent systems. The concept of service automation in tourism gained traction with the advent of **social robots, chatbots, and autonomous service kiosks** in hotels, airports, and tourist attractions.

Ivanov et al. (2019) provide a comprehensive review of progress in hospitality robotics, documenting deployments of robots as hotel receptionists, restaurant servers, concierges, and tour guides. Their review (and similar work by Cain et al., 2019) illustrates that what was once ‘science fiction’ is becoming ‘sci-fact’, as AI-powered robots increasingly handle customer-facing tasks in the industry. These studies discuss potential efficiency gains – robots can work 24/7, reduce human error, and perform repetitive tasks – as well as consistency in service delivery.

Conceptually, the literature frames robotics and automation as part of the broader digital transformation of tourism. Tussyadiah (2020) in an editorial overview notes that automation in tourism spans not just physical robots but also algorithmic processes that automate information provision and transactions. For example, AI-driven **self-service kiosks** and **automated check-in systems** use computer vision and natural language processing to replace traditional human staff at airports and hotels, streamlining operations. Several theoretical perspectives emerge in this theme: one is **technology acceptance**, as researchers note that the success of service automation depends on customer readiness and comfort with AI. Cain et al. (2019) emphasize that understanding customers’ willingness to accept and engage with robotic services is *vital* for their effective adoption. This aligns with technology acceptance models (TAM, UTAUT) which are often invoked to assess how perceived usefulness and ease of use of service robots influence guest acceptance (Ivanov & Webster, 2019b). Another perspective is the **diffusion of innovations**: Huang et al. (2022) bridge Rogers’ diffusion theory with AI adoption by proposing a framework to evaluate various AI innovations (from chatbots to robots) on attributes such as relative advantage, compatibility, complexity, and trialability. Their theory-driven assessment helps explain why certain AI applications (e.g. mobile concierge apps or chatbots) see faster uptake than others in hospitality settings.

In general, service automation literature acknowledges substantial operational benefits of AI – such as cost savings, speed, and scalability of services – but also discusses management implications. Studies caution that automating services is not just a technical issue but a managerial one: firms must address employee retraining, job redesign, and integration of AI into service workflows. Some papers even highlight emerging issues of **labor displacement and ethics**. For example, Yeh et al. (2020) conduct a systematic review on AI’s impact on employment and warn that increasing automation could displace certain jobs in tourism, requiring proactive strategies for workforce development and policy guidance. Such concerns foreshadow discussion in later sections on research gaps around the human side of AI integration. The issues emphasized herein suggest future dialogues on research deficiencies regarding the human element in AI assimilation.

Building on these foundational insights into service automation, recent research has introduced more nuanced perspectives by focusing on the typologies of AI robots and the organizational factors influencing their adoption in hospitality settings. Saputra et al. (2024) propose a novel **anthropomorphism-based typology** of **AI robots** in hospitality and tourism, classifying them into four categories: **chatbots, mechanoids, humanoids, and android robots**. The study emphasizes that anthropomorphic features (both physical and behavioral) significantly influence **customer perceptions, service evaluations, and adoption willingness**. Importantly, the authors highlight that the level of **human-likeness** should match the **service function**: for instance, simple functions are better served by mechanoids, while emotional interactions may benefit from humanoids. However, the research warns about the “**uncanny valley**” phenomenon; overly human-like robots can trigger discomfort among guests, ultimately harming service satisfaction. This suggests that while anthropomorphism can enhance **human–robot interaction (HRI)**, excessive realism may backfire without careful design. Nevertheless, a limitation of this study is that the proposed typology has yet to be empirically validated across diverse real-world hospitality settings, which could affect its practical generalizability.

Complementarily, Irani (2024) examines the readiness of the **North Cyprus hospitality industry** to integrate **robot-assisted services** through a qualitative study. The findings reveal several barriers to adoption: **insufficient awareness** among hotel managers, inadequate training for operating robots, **limited budgets** for technological investment, **adherence to traditional management practices**, and a **lack of supportive incentives from tourism authorities**. While the potential of robotics to enhance **operational efficiency** is acknowledged, **cultural resistance** and **structural limitations** present significant hurdles. Irani’s study critically points out that successful adoption of robotics in hospitality is not only a **technological issue** but also requires deep **organizational and policy-level transformations** to foster **innovation acceptance** and **sustainability**. However, the study’s findings are limited by the geographic and managerial focus on North Cyprus, which may restrict the applicability of results to broader international hospitality contexts.

Customer Experience Personalization and Engagement

Enhancing customer experience is a central promise of AI in tourism. Many conceptual studies focus on how AI can enable *personalized and interactive services* that improve traveler satisfaction and engagement. A frequently cited

application is **AI-powered chatbots and virtual assistants** for customer service. These AI agents, deployed on hotel websites, mobile apps, or messaging platforms, can handle common inquiries, provide travel recommendations, and even make reservations in natural language. Chi et al., (2020) present a systematic review of AI devices in service delivery, finding that chatbots and voice assistants are becoming integral in hospitality for instant, 24-hour customer support. They report that AI-driven personal assistants (for example, cruise line concierge apps or smart speaker devices in hotel rooms) markedly improve service convenience and personalization, such as by addressing guests' questions in multiple languages on demand. Closely related are **recommender systems** and personalized marketing tools powered by AI. Several studies note that machine learning algorithms enable highly tailored travel recommendations. For instance, Samara et al., (2020) review AI and big data in tourism and conclude that AI facilitates *trust-based recommendations*, meaning systems that learn user preferences and behavior to suggest destinations or services that users are likely to value. This personalization builds customer trust and loyalty as travelers feel that suggestions are relevant and helpful. Another study by Doborjeh et al. (2022) systematically reviews AI methods in hospitality/tourism, highlighting that **customer relationship management (CRM)** has been revolutionized by big data analytics: AI can aggregate and analyze customer data (search history, past purchases, social media posts) to know travelers 'better than any staff' and offer individualized travel services. AI-driven CRM and sentiment analysis tools can even gauge customer emotions and satisfaction from online reviews, enabling businesses to respond proactively.

Virtual and augmented reality (VR/AR) are another facet of AI-related innovation to enhance experiences. While VR/AR are distinct technologies, they often incorporate AI for content personalization. Li et al. (2021) discuss how AI-integrated media (such as VR tours that adapt to user input) can **amplify tourist experiences**, leading to higher satisfaction and likelihood of positive recommendations. Likewise, Das et al. (2021) argue that AI can even offer *substitute experiences* via AR – for example, allowing virtual visits to cultural heritage sites – which not only enhance engagement but can mitigate over-tourism at sensitive sites. From a theoretical angle, **customer experience management and service quality** frameworks are enriched by AI considerations. Several authors integrate concepts like co-creation and personalization into service-dominant logic for tourism. Leung (2020), in a perspective article, forecasts that **traveler co-creation** will play a considerable role in the future of tourism services, as AI tools enable tourists to actively customize and co-produce their experiences. This view aligns with emerging service theory that sees customers as partners in creating value, with AI acting as a facilitator of this interaction.

Additionally, trust and **human-computer interaction** theories are relevant: as AI becomes the 'face' of customer service, issues of trust, satisfaction, and even the 'uncanny valley' effect (in the case of humanoid robots) must be managed. Some studies note that poorly implemented AI interactions can lead to frustration; thus, the design of AI interfaces should account for user psychology and expectations (a point drawing from human-computer interaction theory). Importantly, Osei et al. (2020) observe that *customer reluctance to use new technologies* can pose a serious challenge for tourism firms adopting AI. If customers are uncomfortable with, say, a robot butler or an AI tour guide, the intended experience enhancements may backfire. This highlights the need to manage the **technology acceptance and change management** aspects of AI-enabled customer experience programs.

Building on these earlier insights into AI-driven personalization, recent empirical studies have expanded the understanding of how artificial intelligence, immersive technologies, and data-driven strategies are reshaping customer experience personalization in tourism and hospitality sectors. Talukder & Hoque (2024) investigate the transformative impact of technological improvements on traditional travel agencies. Their study highlights how travel firms are adjusting to the changing demands and preferences of travelers in the digital era through the integration of **artificial intelligence (AI)**, **virtual reality (VR)**, **augmented reality (AR)**, and **data-driven personalization**. The study also discusses the challenges and opportunities faced by agencies, analyzing the effects of digital transformation on traditional business models and emphasizing the need for travel agencies to embrace digital innovation to remain competitive. However, a critical challenge identified is the **organizational inertia and resistance to technological adoption** often observed among traditional agencies, which may limit the effectiveness of digital transformation initiatives.

Yang et al. (2024) examine **Personalized Tourism Recommendations (PTR)** in the context of **e-tourism user experience**, integrating constructs from PTR, big data, artificial intelligence, and the technology acceptance model, using the **Stimulus-Organism-Response (S-O-R)** theory. Based on an online survey of 496 users from the Ctrip platform and analyzed through **PLS-SEM**, the study identifies **perceived personalization**, **visual appearance**, and **information quality** as key factors stimulating consumers' perceptions of PTR. While the findings contribute to understanding how these factors influence users' trust and attitudes toward personalized services, the study also implicitly suggests that **overemphasis on personalization without considering user privacy concerns** could undermine consumer trust, representing a potential limitation in practical applications.

Moreover, as the sample is based solely on users of a single Chinese platform (Ctrip), the generalizability of the findings to global tourism contexts remains limited. Gonçalves et al. (2024) bridge the fields of **extended reality (XR)** and **luxury hospitality**, investigating how **immersive AI technologies** impact customer perceptions of luxury value and consumer differentiation. Across three experimental studies, the authors find that immersive AI applications, compared to traditional hospitality, **reduce customers' behavioral intentions** and **lower perceived luxury value**, particularly when customers seek differentiation. The research highlights the potential detrimental effects of immersive AI on luxury service perceptions if customer needs for human touch and exclusivity are not carefully managed.

However, the study is experimental in nature, and its scenarios might not fully capture the complex real-world interactions that occur in actual luxury service environments, limiting external validity.

Lv et al. (2024) study how **AI-powered personalized luxury recommendations** influence **customers' life satisfaction** in luxury tourism marketing. Drawing upon **self-perception theory**, and based on three experimental studies across different tourism contexts (hotel, restaurant, and airport shopping), they demonstrate that personalized luxury recommendations enhance customers' **perceived future self-growth**, thereby improving their **life satisfaction**. However, this positive effect is found to weaken when recommendations are presented using **user-based framing** rather than emphasizing the exclusivity of the offer, suggesting that personalization strategies must carefully manage the balance between personalization and perceived exclusivity. The study's limitations include reliance on scenario-based experiments and the use of self-reported measures of life satisfaction, which may not fully reflect real-world behaviors or emotions.

AI in Marketing and Managerial Decision-Making

AI's role in tourism marketing and management emerges as a theme overlapping with customer experience but extending to **strategic and analytical functions**. AI techniques like machine learning, and natural language processing (NLP) are increasingly used to glean market intelligence and inform marketing strategy in tourism. Giotis & Papadionysiou (2022) provide a review of technological innovations in tourism and note that AI tools have become essential in analyzing consumer data and automating marketing campaigns. One key contribution of AI is the ability to segment and target customers with tailored marketing messages at scale. For example, AI algorithms can analyze past traveler behavior to identify those most likely to be interested in a specific tour package, and then automatically deliver customized advertisements to those individuals. This degree of precision targeting was previously unattainable with conventional analytics. Artificial intelligence's capacity to segment and precisely target customers with personalized marketing messages at a large scale is a significant benefit. AI algorithms can examine previous travel patterns and pinpoint people who are most likely to be interested in a particular tour package, then automatically provide them with customized advertisements. This level of targeted marketing was not possible with traditional analytics.

Moreover, AI helps monitor and manage **online reputations** and social media marketing. By deploying sentiment analysis on travel reviews or social media posts, tourism businesses can gauge public perception in real time and adjust their marketing or service recovery efforts accordingly. Several studies highlight how **user-generated content analysis** using AI can provide valuable insights: for instance, big data from TripAdvisor reviews or Twitter feeds can be mined to identify drivers of customer satisfaction or pain points in the visitor experience. This information feeds back into managerial decision-making, supporting evidence-based improvements in service offerings and marketing communications.

In terms of managerial decision support, AI-driven **business intelligence systems** are being adopted in the tourism sector. Chen et al., (2022) conduct a bibliographic study on big data analytics and predictive techniques for business intelligence, noting that tourism and hospitality firms are turning to AI for revenue management, pricing optimization, and demand forecasting as discussed earlier. These AI systems can analyze historical booking patterns, competitor pricing, and even weather or event data to recommend optimal pricing and inventory allocation strategies (a practice often termed **yield management** in airlines and hotels). The conceptual literature suggests that such data-driven decision-making is part of the **digital transformation** of tourism organizations, promising greater agility and responsiveness to market changes.

A theoretical perspective common in this theme is **decision theory and analytics**. Researchers often frame AI as a decision-support tool that enhances the bounded rationality of human managers. By quickly processing vast information, AI can reduce uncertainty and support more rational decision outcomes in areas like marketing mix optimization and service design. Another relevant concept is **dynamic capabilities** – the idea that firms need to continuously integrate new technologies to sense and respond to the environment. AI is viewed as a capability that can help firms better sense consumer trends (through analytics) and seize opportunities (through targeted marketing and personalization), thereby renewing their competitive advantage in fast-changing tourism markets.

Recent research continues to emphasize AI's strategic role in enhancing tourism marketing and managerial decision-making. Li et al., (2024) apply **predictive processing theory** to examine how **AI-driven robotic performances** influence tourist emotions and **electronic word-of-mouth (eWOM)** behaviors. Their empirical study finds that interactive and novel AI-enhanced performances significantly encourage **positive eWOM**, mediated through heightened emotional engagement. However, melodic aspects of performances were found to have no significant effect on consumer sharing behaviors. A limitation of this study is its cultural focus, as the sample is primarily **U.S.-based**, which may restrict generalizability across different tourist populations and service settings.

In the area of immersive technology adoption, Sujood & Pancy (2024) integrate the **Theory of Planned Behavior (TPB)**, the **Technology Acceptance Model (TAM)**, and the **Stimulus-Organism-Response (S-O-R) framework** to explore how tourists form intentions to experience immersive technologies at destinations. Their findings highlight that virtual interactivity, social interaction, perceived usefulness, trust, and perceived behavioral control are strong predictors of adoption intention, while perceived ease of use and motivation showed no significant impact. These insights have important implications for marketing managers aiming to promote immersive experiences. A noted limitation is the exclusive focus on **Indian tourists**, suggesting that future research should test the model across different cultural and destination contexts to validate broader applicability.

Complementing these developments, Blanco-Moreno et al. (2024) investigate how tourists express **happiness** during their travel experiences using **artificial intelligence** techniques to analyze **Instagram posts**. Their mixed-methods study shows that positive emotions are predominantly reflected through **socialization** and **self-representation** behaviors (e.g., selfies) rather than solely textual expressions. Importantly, the presence of **social companions** and the **gender composition** of travel groups significantly enhanced tourists' emotional engagement with the destination. A critical

limitation of this study is its narrow focus on a **single cultural and gastronomic tourism destination** in Spain, which may limit the generalizability of the findings across broader tourism markets and experiences.

Smart Tourism and Sustainability

An emerging theme in the literature is the intersection of AI with **smart tourism** initiatives and sustainability goals. Smart tourism refers to the integration of information and communication technologies (ICT), including IoT (Internet of Things), big data, and AI, to create intelligent systems to manage destinations and enhancing tourist experiences. AI is a backbone of smart tourism ecosystems, enabling real-time data processing and automated decision-making. Several studies within the review period explore how AI contributes to more **sustainable and smart destination management**. For instance, Gaur et al. (2021) review the role of AI and robotics in fostering '*touchless*' travel during the COVID-19 pandemic, an aspect of smart tourism focused on health safety and seamlessness. They suggest that AI-powered contactless services (such as robotic cleaners, voice-activated controls, and facial recognition check-ins) became especially important in the pandemic context to reduce physical contact while maintaining service quality. This not only has public health benefits but also improves efficiency and can be part of a sustainable operations strategy in the long run.

AI also aids sustainability by optimizing resource usage and supporting environmental management. Several conceptual papers note that AI systems can help **optimize energy consumption, waste reduction, and resource allocation** in tourism operations (for example, smart hotel thermostats and lighting systems that learn guest preferences to save energy). Lv et al., (2022) review big data and AI literature in hospitality and find that these technologies are being used to monitor environmental performance – for example, analyzing data on water/electricity usage and guest behavior to improve conservation without compromising guest comfort. In the context of destinations, Rahmadian et al. (2022) provide a systematic review on big data for sustainable tourism and illustrate how AI can analyze visitor movement patterns (via GPS, mobile data) to manage crowding in parks and protect natural resources. Such insights enable destination managers to implement smart strategies like dynamic visitor routing or capacity limits that enhance sustainability.

The notion of **smart tourism** heavily emphasizes system integration. Tussyadiah (2020) and others argue that the **convergence of AI, IoT, and big data** forms the core of smart tourism ecosystems, which can not only improve visitor experiences but also promote sustainable practices through intelligent management. For example, IoT sensors might detect overcrowding at a heritage site and trigger AI-driven redistribution of visitors via real-time notifications or incentives to visit alternative sites, thus preventing environmental degradation. In cultural heritage tourism, AI and VR have been proposed as tools to provide virtual experiences that reduce physical tourist pressure on fragile sites. Loureiro et al. (2022), using a text-mining review approach, note that advanced technologies like AI-driven virtual tours can help **preserve heritage** by allowing immersive digital experiences, potentially substituting some physical visits and thereby mitigating wear and tear on cultural assets. This theme also touches on the broader concept of **sustainable tourism development**. The literature conceptually links AI to the triple-bottom-line of sustainability: economically, AI can improve efficiency and profitability; environmentally, it can aid conservation and resource management; and socially, it can enhance tourist satisfaction and safety. However, a careful balance is needed – reliance on AI should not create new issues such as exacerbating digital divides or reducing local employment opportunities. These concerns bridge into the discussion of challenges and research gaps. Table 1 provides a summary of the key thematic areas identified in the review, along with examples of AI applications and illustrative references. The integration of advanced artificial intelligence (AI) technologies into destination ecosystems continues to drive innovation in smart tourism and sustainability research. Schuhbert et al., (2024) examine how the integration of **deep learning (DL)** with traditional **organizational learning (OL)** processes can catalyze innovation at tourism destinations, using Berlin as a case study.

Their scenario analysis emphasizes that **AI-supported learning systems**, when combined with human organizational learning, can significantly enhance **knowledge creation, resource optimization, and adaptive management** which are key drivers for smart and sustainable destinations. However, they critically note that fragmented knowledge networks, insufficient data interoperability, and cultural resistance among tourism stakeholders present serious barriers. A methodological limitation of their study is **the reliance on a single destination (Berlin)** and the **use of scenario-based forecasting**, which may limit the broader applicability of the findings across different tourism environments.

Complementarily, Palomo et al., (2024) conduct a comprehensive **bibliometric review** on the evolution of **Smart Tourism Destinations (STD)** research from 2000 to 2023. Their findings reveal that AI, big data analytics, and robotics have become increasingly pivotal in shaping STD strategies aimed at improving sustainability, personalization, and visitor management. Yet, they caution that while technological integration is accelerating, challenges such as stakeholder adoption lags, fragmented conceptual frameworks, and ethical concerns about data governance persist. A critical limitation of their study lies in the **exclusive use of the Web of Science (WoS) database**, potentially omitting relevant literature indexed elsewhere. Additionally, they suggest that future research should adopt more interdisciplinary methods to better align **AI-driven smart tourism initiatives** with broader **sustainability and inclusivity goals**.

Human resources management

With the widespread adoption of AI technology following the launch of ChatGPT's pioneering chatbot service in late 2022, research has increasingly focused on the development of human resource technology competencies and the potential for AI-driven technology responses to the industry's labour shortages. Beyond operational efficiency, recent research highlights the transformative role of **AI and automation** in addressing critical **human resources management (HRM)** challenges within tourism and hospitality. Birdir & Sahilli Birdir (2024) synthesize findings from a special issue exploring technology-driven

responses to the sector's labor shortages. They emphasize that **AI, robotics, 3D printing, and unmanned smart hotels** offer viable solutions to workforce gaps by automating repetitive tasks and enabling leaner operations. However, they also critically acknowledge that while these technologies can alleviate shortages, barriers such as **high implementation costs, maintenance demands, and scale-up challenges** persist. Moreover, a limitation of their editorial synthesis is that it aggregates multiple papers thematically without offering empirical validation of the proposed solutions' long-term workforce impacts.

Adding a conceptual layer, Ercik & Kardaş (2024) conduct a comprehensive review on the impact of **digital transformation** on HR practices in tourism. Their findings show that **AI-driven recruitment, performance management systems, and digital training platforms** have redefined skill demands, necessitating continuous upskilling and technological literacy among employees. They also highlight ethical risks around **data privacy, employee surveillance, and work-life balance erosion** due to hyper-connectivity. Nevertheless, a methodological limitation of their study is its reliance solely on secondary sources without empirical validation; thus, the findings may overlook practical nuances experienced by frontline staff and managers in actual implementation contexts.

From an employee-centric viewpoint, Kang et al., (2024) explore how **AI adoption increases job insecurity and turnover intentions** among hotel employees. Using structural equation modeling on a sample of South Korean hotel workers, they find that **AI awareness elevates job stress**, which in turn fosters **turnover intentions**, especially towards sectors outside hospitality. The study offers valuable empirical evidence, but it has certain limitations: it focuses only on a specific national context (South Korea), and the cross-sectional design limits the ability to infer long-term causal relationships between AI deployment and workforce attrition. Focusing on generational dynamics, Fu et al. (2024) perform a systematic literature review on **Generation Z's engagement with RAISA technologies** (Robots, Artificial Intelligence, and Service Automation) in hospitality. Their findings reveal that while Gen Z consumers and employees are more digitally inclined and receptive to automation, there are still concerns over **loss of human touch, privacy risks, and ethical deployment** of AI tools. A critical limitation they highlight is the **over-reliance on quantitative studies** in the existing literature and **geographic biases** favoring Asian markets, suggesting the need for more mixed-methods and cross-cultural research to generalize findings globally.

Table 1. Key themes in the literature of AI and tourism, with examples of applications and sources (Source: own construction)

Thematic Area	Focus of AI Applications	Representative Studies
Demand Forecasting & Analytics	Predicting tourism demand, visitor flows, and market trends using AI (machine learning models, big data analytics, hybrid models, online review sentiment analysis).	Song et al. (2019); Jiao & Chen (2019); Liu et al. (2019); Hu et al. (2023); Liao et al. (2023)
Service Automation & Robotics	Using robots and automated systems in service delivery (hotels, restaurants, attractions) to improve efficiency, consistency, and guest experience.	Ivanov et al. (2019); Cain et al. (2019); Tussyadiah (2020); Saputra et al. (2024); Irani (2024)
Customer Experience Personalization	Personalizing services, experiences, and emotional engagement through AI (chatbots, virtual assistants, recommender systems, immersive AI, VR/AR experiences, and luxury personalization).	Chi et al. (2020); Doborjeh et al. (2022); Samara et al. (2020); Talukder & Hoque (2024); Yang et al. (2023); Gonçalves et al. (2024); Lv et al. (2024)
Marketing & Consumer Engagement	AI-driven market segmentation, targeted advertising, sentiment analysis of reviews, eWom stimulation, immersive experience marketing, and social media emotional analysis for marketing decisions.	Giotis & Papadionysiou (2022); Leung (2020); Chen et al. (2022b); Li et al. (2024); Sujood & Pancy (2024); Blanco-Moreno et al. (2024)
Smart Tourism & Sustainability	Integrating AI in smart destination management, resource optimization, organizational learning for innovation, bibliometric mapping of smart destination evolution, and sustainable tourism planning (smart ecosystems, contactless services, environmental monitoring).	Gaur et al. (2021); Rahmadian et al. (2022); Loureiro et al. (2022); Schuhbert et al. (2024); Palomo Santiago & Parra López (2024)
Human resources management	Developing the technological competence of human resources, AI-driven recruitment and training, managing job insecurity and turnover, and addressing ethical challenges of AI adoption in labor management.	Birdir & Sahilli Birdir (2024); Ercik & Kardaş (2024); Kang et al. (2024); Fu et al. (2024)

DISCUSSION

Through this systematic review, we identified major themes in how AI is conceptualized and studied in tourism, as well as notable gaps and future directions. The findings reveal that AI in tourism is a multifaceted topic, touching on technical, managerial, and social dimensions. Here we discuss the implications of the results, critically analyze the state of knowledge, and pinpoint areas for further research. **Research Trends and Evolution:** The volume of research on AI in tourism has grown exponentially since the mid-2010s. Early discussions around 2014–2016 often framed AI within the emerging paradigm of *smart tourism*, focusing on potential applications (e.g. smart destinations, recommendation systems) and drawing heavily from the Information Systems literature. As indicated by a recent bibliometric analysis, the core research clusters revolve around ‘artificial intelligence’, ‘hospitality’, and ‘tourism’, confirming that scholars have coalesced around applying AI to service contexts. Notably, since 2018 there has been a shift from purely conceptual or descriptive studies to more empirical investigations assessing AI implementations and their outcomes. Mandić et al. (2024) observed that the research emphasis moved from promoting automated systems in principle to

addressing practical challenges in the workplace and customer service as AI adoption became reality. This suggests a maturation of the field – initial optimism and exploration gave way to more nuanced analysis of the effects of AI.

Contributions and Strengths: The extant literature collectively provides a broad understanding of the roles AI can play in tourism. One clear contribution is to outline the **benefits and opportunities** of AI deployment. Studies consistently highlight efficiency gains (e.g. faster data-driven decisions, reduced labor costs, 24/7 service availability) and enhancements to customer experience (personalization, reduced waiting times, new forms of engagement like virtual tours). Another strength is the development of **conceptual frameworks** that guide understanding of AI in tourism. For instance, several works propose frameworks categorizing AI applications, such as Huang et al.'s (2022) seven-dimension framework for AI adoption susceptibility, or frameworks distinguishing front-of-house vs. back-of-house AI systems. These frameworks are valuable for scholars and practitioners to systematically evaluate where and how AI can be leveraged in tourism operations and what factors influence its success. Additionally, the literature has begun to incorporate **theoretical foundations** from innovation diffusion, technology acceptance, and service management to explain AI phenomena. By doing so, it grounds the discussion of AI not just in technical terms but in terms of human behavior and organizational strategy, which is crucial for tourism – an industry ultimately about human experiences.

Interdisciplinary Integration: We find that tourism scholars have engaged with knowledge from computer science (e.g. understanding AI techniques), but more importantly, have contextualized AI within tourism theories. This interdisciplinary approach is evident in works that merge data science with consumer behavior theory, or robotics with hospitality management models. For example, integrating Rogers' diffusion of innovations theory helped identify which AI tools are more likely to be adopted in hospitality (those offering clear relative advantage and ease of use, like chatbots, are adopted faster). Such insights enrich both tourism management theory and provide feedback to technology developers about user requirements in a service context.

Despite these strengths, the review also uncovered **gaps and challenges** in the literature:

- **Limited Research on Human-AI Interaction in Tourism:** While many studies tout the benefits of AI, fewer delve into the **nuanced interaction between AI systems, employees, and customers**. There is a need for deeper investigation into how customers perceive and trust AI in different service scenarios. For instance, the novelty of robot staff could intrigue some visitors but alienate others. Only a handful of studies (Ivanov et al., 2019; Tussyadiah, 2020) explicitly address negative attitudes or discomfort toward AI. Future research should empirically examine factors affecting guest acceptance of AI, drawing on psychology and marketing insights. Similarly, employees' perspectives are under-researched – how do tourism workers adapt to AI tools or robotic colleagues? Initial work suggests technology anxiety and job insecurity can be issues, impacting employee well-being. More qualitative studies or organizational research in this vein would be valuable.

- **Insufficient Focus on Ethical and Privacy Concerns:** The conceptual discourse on **ethics, data privacy, and security** in AI-tourism is relatively sparse. Given AI systems often rely on personal data (travel history, biometrics for facial recognition, etc.), questions of privacy and consent loom large. Only a few papers (often outside mainstream tourism journals) tackle issues like data governance or algorithmic bias in a tourism context. For instance, a systematic review by Mandić et al. (2024) noted a gap in research addressing **data privacy and human-robot interaction ethics**. This represents a significant research gap – future studies should examine how to ensure ethical AI deployment in tourism, perhaps borrowing frameworks from computer ethics or developing industry-specific guidelines (e.g. for use of facial recognition at attractions, or AI surveillance in hotels). There is also a need to study the impact of AI on accessibility and inclusivity in tourism: Can AI tools be designed to better serve travelers with disabilities or from different cultural backgrounds? Such questions of equity have seen little coverage so far.

- **Fragmentation and Terminology Issues:** Our review noted that 'AI in tourism' means different things in different studies – some include robotics, some focus on algorithms, others on data analytics. This lack of standard definitions sometimes makes it hard to compare studies. For example, one paper might consider 'AI' as synonymous with robots and ignore non-embodied AI like machine learning software, whereas another does the opposite. While the broad scope of AI means it indeed encompasses many technologies, the literature could benefit from clearer categorization or terminology consensus.

- **Methodological Rigor and Coverage:** Methodologically, many of the included literature reviews (including this one) use systematic approaches, which is commendable. However, there are still areas under-explored. For example, **meta-analyses** quantifying the effect of AI on outcomes (like satisfaction or efficiency) are scarce. A meta-analysis could statistically synthesize findings from various experimental studies (e.g. on chatbot vs human agent satisfaction levels) to provide higher-level evidence. Also, regional imbalances exist: much conceptual work comes from developed regions (Europe, North America, East Asia). Regions like Africa or South America have less representation in the conceptual AI tourism literature, potentially overlooking context-specific challenges or uses (although Soliman et al. (2023) used bibliometrics to highlight some global trends amidst COVID-19). Future research collaborations or comparative studies could address this imbalance, examining how AI adoption in tourism might differ in, say, developing countries or under different cultural values.

- **Emerging Technologies and Future Scenarios:** The tourism AI literature has begun to address up-and-coming technologies (like the use of **neuro-tourism** techniques or **large language models**), but this is still nascent. Al-Nafjan et al. (2023) explore 'neuro-tourism' – applying AI to analyze brain data for understanding tourist experiences – which opens a novel line of inquiry merging neuroscience with tourism marketing. Similarly, the explosion of **generative AI** (e.g. GPT-4, large language model chatbots) in 2023 begs the question of how these could transform travel planning and content

creation. As of the cut-off for this review, few academic studies covered such generative AI in tourism, representing an important future direction. Researchers should look at scenarios like AI-generated travel itineraries, deepfake tour guides, or automated content creation for destination marketing, assessing their feasibility and impact. These emerging issues are both opportunities (for innovation) and challenges (for ensuring authenticity and managing potential misinformation), and thus rich areas for theoretical exploration. In summary, the current body of literature provides a solid foundation affirming that AI holds significant promise for tourism in enhancing efficiency, personalization, and strategic decision-making. Yet, it also highlights that *technology alone is not a panacea* – human factors, ethical considerations, and implementation strategies critically determine AI's ultimate success in the sector. There is a noticeable shift in recent research towards addressing these broader implications rather than just showcasing technology capabilities. Going forward, bridging gaps such as those in user acceptance, ethics, and global inclusivity will be key to advancing both the theory and practice of AI in tourism.

CONCLUSION

This systematic literature review examined the conceptual and theoretical discourse on artificial intelligence in tourism from 2019 onwards, following a rigorous PRISMA-guided methodology. From an initial pool of over 400 studies, we identified 45 relevant peer-reviewed journal articles that collectively illuminate how AI is reshaping tourism research and practice. The review finds that AI is envisioned as a catalyst for transformation in the tourism industry, with applications ranging from intelligent forecasting and revenue management to service automation via robots and hyper-personalized travel experiences. Researchers have documented numerous potential benefits of AI: improved predictive accuracy for tourism demand, cost and time efficiencies through automation, enhanced customer satisfaction through personalized recommendations and 24/7 chatbot assistance, and even contributions to sustainable tourism goals through smart resource management. These advantages underscore the importance of AI as a driver of innovation and competitiveness in tourism.

Crucially, this review also synthesized the *theoretical perspectives* underlying AI research in tourism. Studies have drawn on innovation diffusion theory to explain adoption patterns, technology acceptance models to gauge user and employee attitudes, and service quality and co-creation theories to understand how AI can add value to the customer experience. The integration of such theories marks a maturation of the field – moving beyond technological novelty to situate AI within established bodies of knowledge in tourism management and consumer behavior. For instance, viewing AI through the lens of service-dominant logic highlights that value is co-created by AI systems in partnership with human actors (customers and employees) rather than by technology alone. This theoretical foundation is essential for developing a holistic understanding of the role of AI and for guiding practical implementation strategies.

Despite the progress, the review identified several gaps and challenges that warrant attention. Ethically, questions around data privacy, algorithmic bias, and the socio-economic impacts of automation in tourism remain insufficiently addressed. Additionally, the *human element* in AI-enabled tourism needs deeper exploration. There is also room for more cross-cultural research, considering that acceptance of technologies like social robots can vary widely across cultures.

In terms of future research directions, several promising avenues emerge. Scholars should examine the implications of **next-generation AI technologies** in tourism. The rise of generative AI and advanced language models opens new possibilities for automated content creation – for example, AI could personalize travel narratives or simulate interactive dialogues as part of a virtual tour experience. Investigating how these tools can enhance (or potentially disrupt) areas like tour guiding, marketing content, and trip planning is timely. Furthermore, building on the current focus of smart tourism, researchers could develop models for **AI-enhanced destination management**, exploring how real-time data and AI optimization can help manage tourist flows, improve accessibility, or respond to crises (like pandemics or natural disasters) in a destination. Moreover a systematic evaluation of AI's **return on investment and performance outcomes** in tourism businesses would be highly valuable as well.

From a practical point of view, the insights in this review suggest that tourism stakeholders should approach AI adoption strategically. It is advisable for organizations to start with AI applications that have proven value (such as chatbots for customer service or recommendation engines on booking platforms) and ensure that they are implemented in a user-friendly manner. Training employees to work effectively with AI, and preparing change management plans, will help mitigate resistance and maximize the augmentation effects of AI on human labor. At the industry level, collaboration will be key – sharing best practices through industry associations or partnerships between tech firms and tourism operators can accelerate learning and avoid pitfalls. Policymakers and educators also have a role: policies might be needed to govern data use and protect workers, while hospitality education should incorporate AI literacy to prepare the workforce of the future.

In conclusion, AI stands as a powerful tool that is increasingly interwoven with the fabric of tourism systems. The literature from the past decade paints AI not as a distant futuristic concept, but as a present reality gradually permeating all facets of travel and hospitality – from how destinations are marketed and managed, to how services are delivered and experienced. The **conceptual consensus** is that AI, when thoughtfully integrated, can significantly improve both operational efficiency and the tourist experience, potentially leading to smarter and more sustainable tourism development. However, realizing this potential requires careful navigation of the associated challenges and a commitment to keeping the 'human touch' in an AI-rich tourism future. We hope that this systematic review serves as a foundation for both scholars and practitioners to understand current knowledge, identify what remains unknown, and collaborate in steering the evolution of AI in tourism in a positive, human-centric direction.

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