**Journal of Computer Science and Information Technology**
ISSN: 3080-3586
DOI: https://doi.org/10.61424/jcsit.v3i1.711
Journal Homepage: https://bluemarkpublishers.com/index.php/JCSIT

JCSIT
BLUEMARK PUBLISHERS

**| RESEARCH ARTICLE**

# Smart Tourism Technologies in the Industry 4.0 Era: A PRISMA-Based Systematic Review of Adoption, Implications, Outcome and Future Direction

**Md. Nafij Mondol[1], Mahfuzul Islam Takee[2], Abdul Ahad[3], Md. Sujan Ali Joardar[4] and Md. Sohan Hossain[5]**✉
[1]*Lecturer, Department of Tourism and Hospitality Management, Rangamati Science and Technology University*
[2]*Officer, Sales & Business Development, Intertek Bangladesh*
[3]*Seraton Dhaka, Sales Executive*
[4]*Department of Tourism and Hospitality Management, University of Rajshahi*
[5]*Department of Tourism and Hospitality Management, Islamic University*
**Corresponding Author:** Md. Sohan Hossain, **E-mail**: mdsohanurrahman36@gmail.com

**| ABSTRACT**
The rapid nature of Industry 4.0 advancements has facilitated the adoption of smart tourism technologies in tourism and hospitality industry, which has fundamentally changed the ways that services are offered, operations and customer experiences. The paper is a systematic and comprehensive review of smart tourism technologies, that is, artificial intelligence (AI), big data analytics, the Internet of Things (IoT), chatbots, service robots, and immersive technologies, including virtual reality and augmented reality. The research is conceptualized under the PRISMA framework, which implies the screening of 142 peer-reviewed journal publications published in 2011-2025. The study uses the narrative and thematic synthesis to discuss significant tendencies in the acceptance of technologies, methodology, theoretical frameworks, and outcome dimensions in the study of smart tourism. The findings indicate that academic interest has increased exponentially since 2020, and most of the articles employ quantitative and technology adoption theory, such as TAM, UTAUT, and the S-O-R model. The review demonstrates that customer satisfaction, customer engagement, customer loyalty, operational efficiency, service quality, and organizational sustainability are positively affected by smart tourism technologies. However, the concerns of confidentiality, ethical considerations, employee well-being, and geographical shortcomings of research remain eminent. Combining fragmented literature by offering an integrated approach, the research paper aids in gaining a better insight into how smart tourism technologies affect experiential, operational, and sustainability outputs. The findings can significantly contribute to the theoretical understanding of researchers and offer practical suggestions to tourism managers and policymakers who tend to adopt a responsible and human-centered digital transformation in Industry 4.0.

**| KEYWORDS**

Smart tourism technologies; Industry 4.0; Artificial intelligence; Hospitality and Tourism; PRISMA systematic review; Technology adoption; Employee experience; Sustainability

**| ARTICLE INFORMATION**

**ACCEPTED:** 09 January 2026 **PUBLISHED:** 27 February 2026 **DOI:** https://doi.org/10.61424/jcsit.v3i1.711

## 1. Introduction

Tourism is one of the fast developing industries in the world playing a huge role in driving growth of economies, creation of employment, and exchange of culture (Amin & Budilestari, 2025). The sphere of tourism is rapidly

changing in the past few years as the sphere of digital technologies evolves. A major role has been taken by the emergence of Industry 4.0 that includes the Internet of Things (IoT), artificial intelligence (AI), big data, cloud computing, blockchain, and smart devices in designing, delivering, and experiencing tourism services (Bratić et.al.,2025).

These digital innovations are usually referred to as Smart Tourism Technologies (STTs) in their implementation in tourism. Smart tourism depends on advanced technologies to gather, process, and share data in real time to improve decision-making, increase tourist experiences, work more efficiently, and contribute to sustainable development (Rosario and Dias, 2024; Zhang and Deng, 2024). The application of smart tourism technologies has become increasingly important to destinations, tourism organizations, hotels, and tourist. The traditional patterns of tourism are no longer sufficient due to the growing competition among destinations and the changing demands of tourists (Zhang et.al., 2022; Ionescu and Sârbu, 2024). The present-day tourist is more online, informed, and technologically-minded (Zhang et.al., 2022). They want convenient services, real-time services, security, and custom experiences (Sustacha et.al., 2023). These expectations by the tourism stakeholders can be met by the use of the technologies of Smart tourism, and improve the management of the destination; utilization of the resources and sustainability (Czyz & Javed, 2025; Zhang et.al., 2022).

Over the past decade, a lot of research has been dedicated to numerous aspects of smart tourism technologies, including models of adoption, uses of the technologies, their impact on tourists and destinations, hospitality organizations and their performance in general (Sustacha et.al., 2023; Zhang et.al., 2022; Gajic et.al., 2024) ). The existing literature is however decentralized and studies have focused on the individual technologies, regions or even the stakeholders perspective. It does not also include a comprehensive and systematic review which will be able to investigate the factors of adoption, trends, implications and outcomes of smart tourism technologies within the framework of Industry 4.0.

To address these gaps, a PRISMA-based systematic literature review of 142 peer-reviewed journal articles published as early as 2011 and as late as 2025 is conducted in this study. The review will generalize the existing studies in Industry 4.0-based smart tourism technologies so as to determine the research themes, adoption procedures, and experiences and operations of smart tourism. It also examines the effects of STT implementation that include customer experience, organizational performance, ethical issues, and sustainability effects. Based on this synthesis, the research becomes formulated into a general guiding framework that can be applied in the future to lead the research and practical use of smart tourism technologies in the tourism and hospitality sector.

The following research questions are, therefore, informed in this review:

1. What are the key research themes related to smart tourism technologies in the Industry 4.0 era?
2. How are Industry 4.0 smart tourism technologies being adopted and experienced in the tourism and hospitality industry?
3. Which are the experiential, operational, ethical, and sustainability issues of using smart tourism technology?
4. What can be a broad guiding framework that can be used to further research in the field?

## 2. Methodology

The paper is based on a systematic literature review (SLR) following the PRISMA (Preferred Reporting Items in Systematic Reviews and Meta-analyses) model. It is a method that is highly credible and robust within a range of academic disciplines (Phillips and Moutinho, 2014; Reina-Usuga et al., 2024). PRISMA offers an evidence-based and systematic research process that will enable a comprehensive and impartial analysis of the literature regarding the issue of industry 4.0 technologies in the tourism and hospitality sectors.

### *2.1 PRISMA Protocol*

Jayasinghe et al. (2024) have described PRISMA procedure as having to follow few key steps. First, the research questions should be initially stated in order to define the objectives and scope of the review. Second, empirical

strategies of search were developed with the aim of searching relevant research systematically. In the third step, predetermined inclusion and exclusion criteria were used to filter and select the discovered studies. These were then analyzed and interpreted by extracting and synthesizing the data, as discussed below.

### *2.2 Systematic literature review method*

This study employed a systematic literature review (SLR) relying on the PRISMA framework to ensure methodological rigor and transparency. In the identification phase, 1,363 records were found in major academic databases, including Web of Science (383), Scopus (542) and Science Direct (124) and Google Scholar (314) with the help of a set of predetermined Boolean search queries involving smart tourism technologies and Industry 4.0. Out of 327 records dropped at the screening step, which included books, conference papers, editorials (213), 102 duplicate records and articles with inaccessible full texts (12), 1,036 records were screened. Title and abstract screening led to the removal of 590 irrelevant articles to the study and 446 articles could be subjected to full-text examination. In the process of evaluation, 239 articles were cut off as they were literature reviews (11), they were published in non-ranked journals (55), had poor methodologies (95) or were not clear in context (78). Thus, 207 articles were retained. A cross-check which was conducted by another author omitted 65 studies that are not directly related to smart tourism technologies. Finally, 142 peer-reviewed articles were included in the systematic review.

Table 1. Inclusion and Exclusion Criteria

| Criteria | Inclusion | Exclusion |
|---|---|---|
| **Time Frame** | Articles that were published in the past 15 years (2011–2025) | Articles published before 2011 |
| **Language** | Articles written in English | Articles in other languages besides English |
| **Document Type** | Peer-reviewed Journal articles | Editorials, opinion pieces, magazine articles, blogs, and non-peer-reviewed sources and book papers, conference papers |
| **Keywords** | ("smart tourism" OR "smart tourism technologies" OR "digital tourism" OR "intelligent tourism" OR "Industry 4.0 tourism") AND ("technology adoption" OR "technology acceptance" OR "implementation" OR "utilization") OR ("smart tourism" OR "smart technology" OR "IoT" OR "AI" OR "digital transformation") AND ("tourism" OR "hospitality" OR "travel" OR "destination management") OR ("artificial intelligence" OR "service robots" OR "virtual reality" OR "augmented reality" OR "big data") AND ("customer experience" OR "tourist experience" OR "employee experience" OR "service experience") OR ("ethical issues" OR "privacy" OR "data security" OR "job insecurity") AND ("smart tourism" OR "artificial intelligence") OR ("sustainability" OR "sustainable tourism" OR "operational efficiency") | Studies lacking relevant keywords |
| **Focus Area** | Studies concentrated on smart tourism technologies in cross-border situations | Research without focus on smart technologies |
| **Technologies Covered** | Studies discussing smart technologies (e.g., IoT, AI, Big Data, mobile apps) | Studies unrelated to smart technologies |
| **Scope** | Articles about adoption, challenges or opportunities of smart tourism technologies | Articles that lack discussion on adoption, challenges or opportunities |
| **Availability** | Articles that can be accessed as full-text | Articles that are not |

| | | |
|---|---|---|
| | | presented in full-text |
| **Database and Search Engines** | Science Direct, Scopus, Web of Science and Google Scholar | The other databases and sources, which could have resulted in an incomplete coverage of the literature on the subject |
| **Journal Quality** | Articles from Q1 and Q2 Journals | Articles below Q2 Ranked Journals |

### *2.3 Data extraction*

Data extraction through the use of a standardized form systematically collected key information in each study, including the name of the authors, the year of publication, the location of research, methodology, main results, and the thematic focus. Special attention was paid to the dynamics of the application of smart tourism technologies, the problems associated with it, the suggested remedies, and the prospects of future research studies.

### *2.4 Data synthesizing*

Narrative synthesis technique was used to analyze patterns in the research on smart tourism technologies. A meta-analysis was not suitable because the methods and fields of interest of the research were different. Narrative synthesis enabled the investigations to be organized into a few aspects, such as technology use, operational enhancement, staff and customer satisfaction, and ethical issues. It also facilitated the ease with which the applications of these technologies in different scenarios can be understood, as well as the results of different studies can be compared.

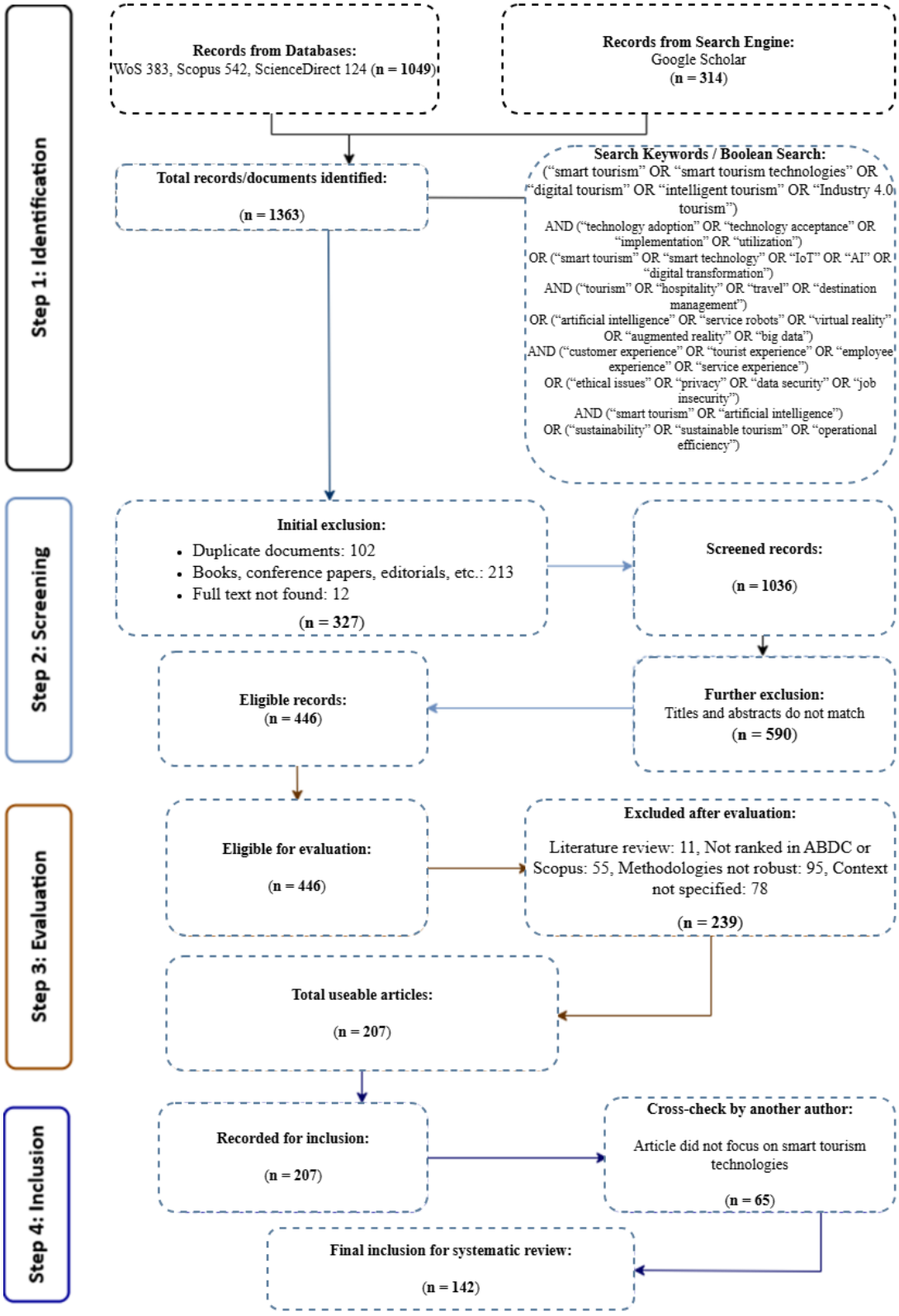


Figure 1.PRISMA diagram, outlining the stages for the systematic literature review.

### *2.5 Data analysis methods*

Thematic analysis was done on 142 articles selected to identify the significant themes in literature (Braun and Clarke (2022). This strategy helped to find common themes, such as technology adoption, operational improvement, employee and customer experience, environmental impacts, and ethical issues. The data were recoded through excel file and analyzation was done with the assistance of VOSviewer using Atlas.ti. The VOSviewer) was employed to analyze key word co-occurrence and Atlas.ti was applied for data mining and accumulating themes based research findings.

## 3. Findings

### *3.1. Publication Trend (2011 – 2025)*

The publication of research papers has a strong upward trend in the Smart Tourism Technology research. The amount of published papers from 2011 to 2015 was between 1 and 3 annually, which demonstrates an initial interest in research. Between 2016 and 2019, publications were increasing at a low pace with 4 papers in 2018. The greatest growth was noted in the period of 2020, 2021, 2022 with 28, 27 and 27 papers being published respectively. Although the amount of figures decreased a step, the research activity was still active in 2023 with 22 papers and in 2024 with 19 papers. Conversely, 2025 contains only 2 papers, and this value is likely due to the fact that the data has been collected up until March. Overall, this trend suggests the growth of the scientific interest towards smart tourism technologies and their role in the reconstruction of the tourism sector.

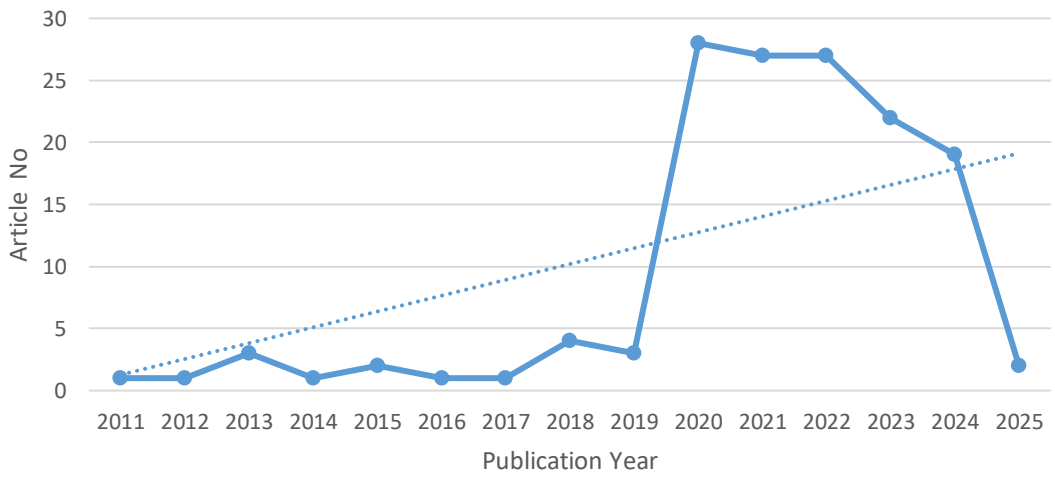


Figure 2. Overview of publication trend in Smart Tourism Technology

### *3.2 Methodological design used*

With an effort to understand how Smart Tourism Technology (STT) has taken shape within the global context, this paper has participated in a Systematic Literature Review of peer-reviewed articles. The reviewed studies adopted three general research methods that included quantitative, qualitative and mixed methods. Most of the researches (76 percent) engaged a quantitative design with much interest to numerical and statistical analysis. Surveys (85% quantitative studies) and experimental designs (10%), were the most common ones. A small number of studies utilized online reviews (2%), records of booking (1%), random data (1%), and the visual census methods (1%). Qualitative methods were used in 10% of the studies. Interviews (67%), case studies (20), focus groups (6%) and round table discussions (7%) were the most popular qualitative methods. The mixed-methods methods included 14 percent of the research, the combinations of surveys and interviews were the most common (45 percent). Overall, such diversity of methods can be explained by the complexity and multidisciplinary character of STT research.

Table 2. Analysis by Research Designs

| Type/Design | Frequency | Percentage (%) |
|---|---|---|
| Qualitative | 108 | 76% |
| Quantitative | 14 | 10% |
| Mixed-Methods | 20 | 14% |
| Total | 142 | 100% |

### *3.3 Journals and authors*

The analysis of the selected articles presents the most engaged journals and authors of the research concerning the sphere of Industry 4.0 technology application in the tourism industry. The most popular journal is sustainability with 23 articles and this demonstrates that the topic of digital innovation and sustainable tourism is of high interest to the journal. The International Journal of Contemporary Hospitality Management follows with 19 articles and is noteworthy in the smart tourism and hospitality studies. The remaining reputable ones such as the International Journal of Hospitality Management, Journal of Travel Research and Journal of Hospitality and Tourism Technology are not left behind. Among the authors, Yong Hee Kim is the most influential person, with six publications. Won-jun Lee and Pola Q. Wang contribute three articles each, which is a consistent engagement in this field of research.

Table 3. Top 10 journal and authors in the selected publications

| Top 10 Journals | Frequency | Top 10 Authors | Frequency |
|---|---|---|---|
| Sustainability | 23 | Yong Hee Kim | 6 |
| International Journal of Contemporary Hospitality Management | 19 | Won-jun Lee | 4 |
| International Journal of Hospitality Management | 10 | Pola Q Wang | 4 |
| Journal of Travel Research | 6 | Thi Bich Thuy Nguyen | 3 |
| Journal of Hospitality and Tourism Technology | 6 | Tamara Gajić | 3 |
| CURRENT ISSUES IN TOURISM | 5 | Yuwen Zhang | 2 |
| Journal of Hospitality and Tourism Management | 3 | Graeme McLean | 2 |
| Tourism Management | 3 | Chen-Kuo Pai | 2 |
| CONSUMER BEHAVIOR IN TOURISM AND HOSPITALITY | 2 | Daniel Belanch | 2 |
| International Journal of Tourism Research | 2 | Kwangsik Choi | 2 |

### *3.4 Study locations*

The study of the smart tourism technology is a worldwide uneven study as indicated by its geography. Asia has a dominant position because the majority of the literature is based in China, and subsequently South Korea, India, Indonesia and Vietnam because of rapid technological advancement in the area. The second one is Europe with the

great participation of the United Kingdom, Spain and Serbia. The US is the prime representative of North America. On the other hand, the number of studies is exceptionally low in Africa, South America and Oceania and therefore, there is a need to carry out more research within the regions.

**Table 4.** Continents and country-wise distribution of selected publications

| Continent | Explanation |
|---|---|
| **Asia** | China (29), South Korea (8), Korea (2), Vietnam (4), India(7), Japan(3), Bangladesh(1), Indonesia (6), UAE(1), Saudi Arabia(1), Malaysia(2), Pakistan(1), Thailand(1),Tehran(1), Jordan(1), Cyprus(2), North Cyprus (1), Israel(1), Singapore(3), Iran(1), Palestine (1) |
| **Europe** | Spain (5), UK (10), France(1), Germany(2), Netherlands(2), Portugal(2), Greece(1) Norway(1) , Malta(1), Romania(2), Serbia(4), Bulgaria(1), Switzerland(1), Finland (1) |
| **Africa** | South Africa(2), Morocco(1), Egypt(1) Tunisia(1), Mena(1) |
| **Global** | Batumi(1), Oman (3), Türkiye(2), Macau(2), Ireland(2), Gulf of Aqaba(1) |
| **North America** | USA (22), Canada(1), North America(2) |
| **South America** | Argentina(1), Brazil(2) |
| **Oceania** | New Zealand (1), Australia(5) |

### *3.5 Theories and frameworks applied*

There are a number of theories available in the smart tourism technologies literature that are used to explain the application and implication of the technologies. The most prevalent ones are the adoption of technology and theories about innovation. Popular models to explore the drivers of adoption, their long-term use, and organizational inclination to embrace AI, service robots, chatbots, and immersive technologies include the Technology Acceptance Model (TAM), Unified Theory of Acceptance and Use of Technology (UTAUT), Diffusion of Innovation Theory (DIT), and the Technology Organization Environment (TOE). The behavioural intention and decision-making are further explained in relation to The Theory of Planned Behavior (TPB), The Theory of Reasoned Action (TRA) and The Expectation-Confirmation Theory. The models of customer experience research include experience and perception based models. The theories that are often applied to the investigation of the impact of technological stimuli on the cognitive, emotional, and behavioural responses of tourists are Stimulus-Organism-Response (S-O-R) framework, Social Presence Theory, Flow Theory, and Experience Economy Theory theories. Furthermore, the Conservation of Resources (COR) Theory, Dynamic Capabilities Theory, Person-Environment Fit Theory, Social Exchange Theory, and Career Theory are several of the theories used to understand job stress, job insecurity, career resilience, learning behaviour, and sustainability outcome on an employee and organizational level.Responses toward service robots, AI failure, and anthropomorphic design are also elaborated with the assistance of the Attribution Theory, Role Congruity Theory, Cognitive Appraisal Theory, and Construal Level Theory. Ethical and privacy related issues are studied using Privacy Calculus Theory, Social Identity Theory, Rational Choice Theory and Signaling Theory. The integration of these frameworks provides a comprehensive theoretical perspective of the intricate impacts of smart tourism technologies.

Table 5. Summary of Key Theories and Their Application in STT Research

| Theory / Framework | Primary Application in Smart Tourism Research | Key Sources |
|---|---|---|
| **Technology Acceptance Model (TAM)** | Investigates the intention to adopt and use smart tourism technologies with respect to their perceived usefulness, ease of use, trust, anxiety, and anthropomorphism. | Pillai & Sivathanu (2020); Cai et al. (2022); Çallı et al. (2022) |
| **Unified Theory of Acceptance and Use of Technology (UTAUT)** | Examines the adoption of AI technologies amongst employees and consumers in terms of performance expectancy, effort expectancy, social influence, facilitating | Oncioiu & Priescu (2022); Gajić et al. (2024) |

| | | |
|---|---|---|
| | conditions, and habit. | |
| **Theory of Planned Behavior (TPB)** | Analyzes the behavioral intention of the tourists to smart tourism technologies based on attitude, subjective norms, and perceived behavioral control. | Torabi et al. (2022); Du et al. (2024); Van et al. (2020) |
| **Diffusion of Innovation Theory (DIT)** | Explains adaptation to new technologies on the basis of characteristics like innovation as compatibility, ease and relative advantage. | Phang et al. (2022); Kim et al. (2020) |
| **Stimulus–Organism–Response (S–O–R) Theory** | Investigates effects of technological stimuli like quality of system, interactivity, usability on cognitive and emotional attitudes of tourists and how it dictates satisfaction, trust and behavioural intention. | Rafiq et al. (2022); Nazir et al. (2022); Nguyen et al. (2023) |
| **Expectation–Confirmation Models (ECM / EDT)** | Explains continuance intention and satisfaction with AI systems based on the affirmation of expectations and perceived performance. | Dhiman & Jamwal (2023); Lim et al. (2024); Chiang & Trimi (2020) |
| **Attribution Theory** | Analyzes customer responsibility attribution and reaction to failure of robots and human employees. | Belanche et al. (2020); Um et al. (2020) |
| **Construal Level Theory (CLT)** | Explains customer attitude to service robots with reference to the level of human-likeness and the distance between humans and robots. | Akdim et al. (2021) |
| **Conservation of Resources (COR) Theory** | Examines how AI impacts employee stress, fatigue, emotional exhaustion, job crafting, withdrawal behavior and service performance. | Qiu et al. (2022; 2024); Teng et al. (2024) |
| **Privacy Calculus / Rational Choice Theories** | Explores the trade-offs in the benefits of personalization and the perceived privacy risks in tourist AI-based services. | Ioannou et al. (2020); Lehto et al. (2021); Boo & Chua (2022) |
| **Role Congruity & Social Identity Theories** | Evaluates customer comfort, perceived control and service evaluations of dealing with robots or humans. | Ho et al. (2020); Pitardi et al. (2022) |
| **Grounded Theory** | Inductively examines the stakeholder perceptions of smart tourism destinations, AI marketing, and value co-creation. | Corrêa & Gosling (2020); Gidumal et al. (2023) |
| **Dynamic Capabilities Theory** | Explains how AI has increased organizational adaptability, sustainability, capacity to learn, and career resilience. | Al-Romeedy & Alharethi (2024); Kong et al. (2024) |
| **Innovation Resistance Theory (IRT)** | Identifies usability and psychological predictive factors that determine the resistance of smart hotel technologies among tourists. | Zhang et al. (2024) |

### *3.6. Keyword co-occurrence over time*

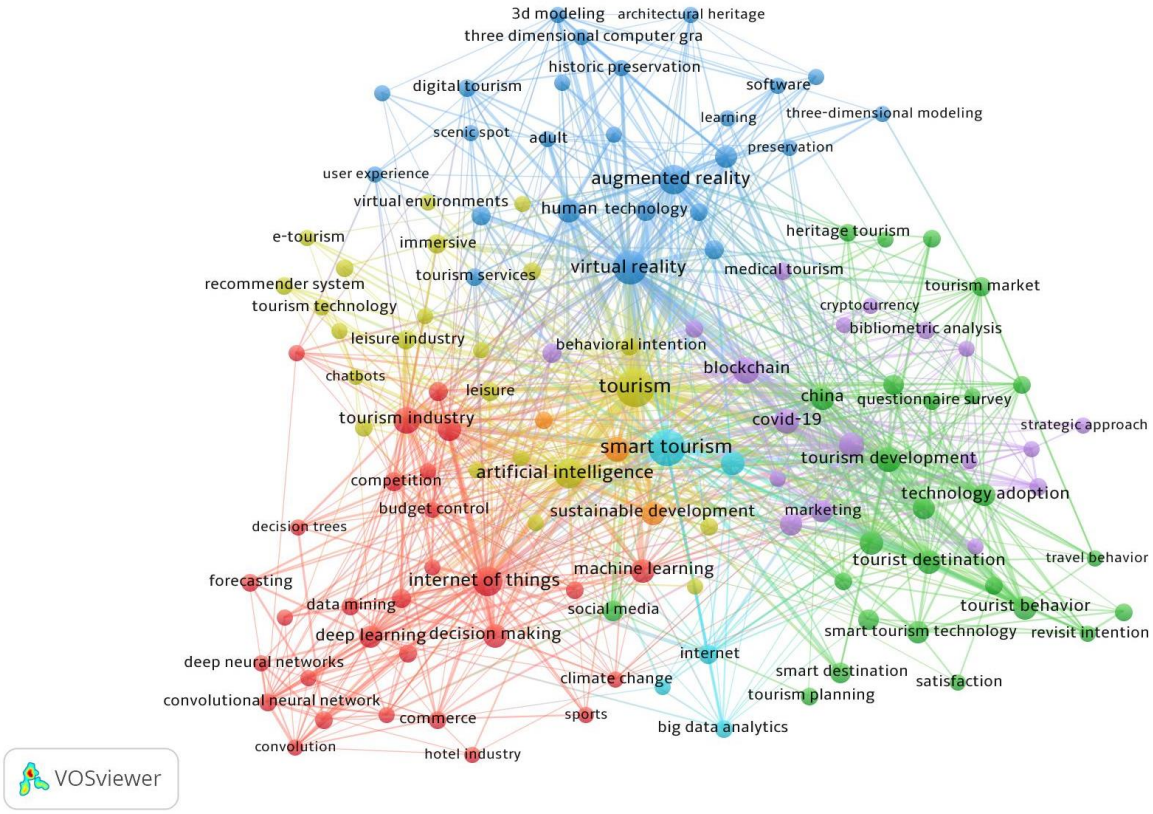


Figure 2. VOSviewer Analysis

The co-occurrence overlay analysis keyword in VOSviewer reveals the way in which the research topics of smart tourism have changed over time. Overall, there were 129 keywords that were categorized into seven groups, which implies that the field deals with multiple related issues (Figure 1). Much of the literature is dedicated to the data and AI, with concepts such as big data, data mining, forecasting, IoT, deep learning, and neural networks being used to make an improved decision in tourism and hotel industry. The other powerful theme is focused on smart destinations and adoption of technologies, where research frequently analyzes the reaction of tourists to new technologies; evaluating perception, satisfaction, revisit intention, co-creation, and survey-based research methods. Another evident stream is that of digital heritage and immersive experience, particularly using augmented reality and 3-D modelling in museums, scenic locations and heritage preservation with a focus on user experience and learning. Meanwhile, numerous works investigate AI-based services, such as chatbots, natural language processing, recommender systems, and mobile applications, and determine whether individuals believe they are helpful and may useful for them. More recent publications associate digital change with broader industry challenges, including innovation, competitiveness, sustainability, and more recent ones, including the effects of COVID-19, blockchain, and cryptocurrency. Lastly, the latest trend is observed in new keywords such as generative AI, as well as the topics of the supporting infrastructure, such as 5G and smart cities, indicating that the direction moves towards smarter, more interconnected, and more sustainable tourism systems.

### *3.7 Description of the Alluvial Diagram*

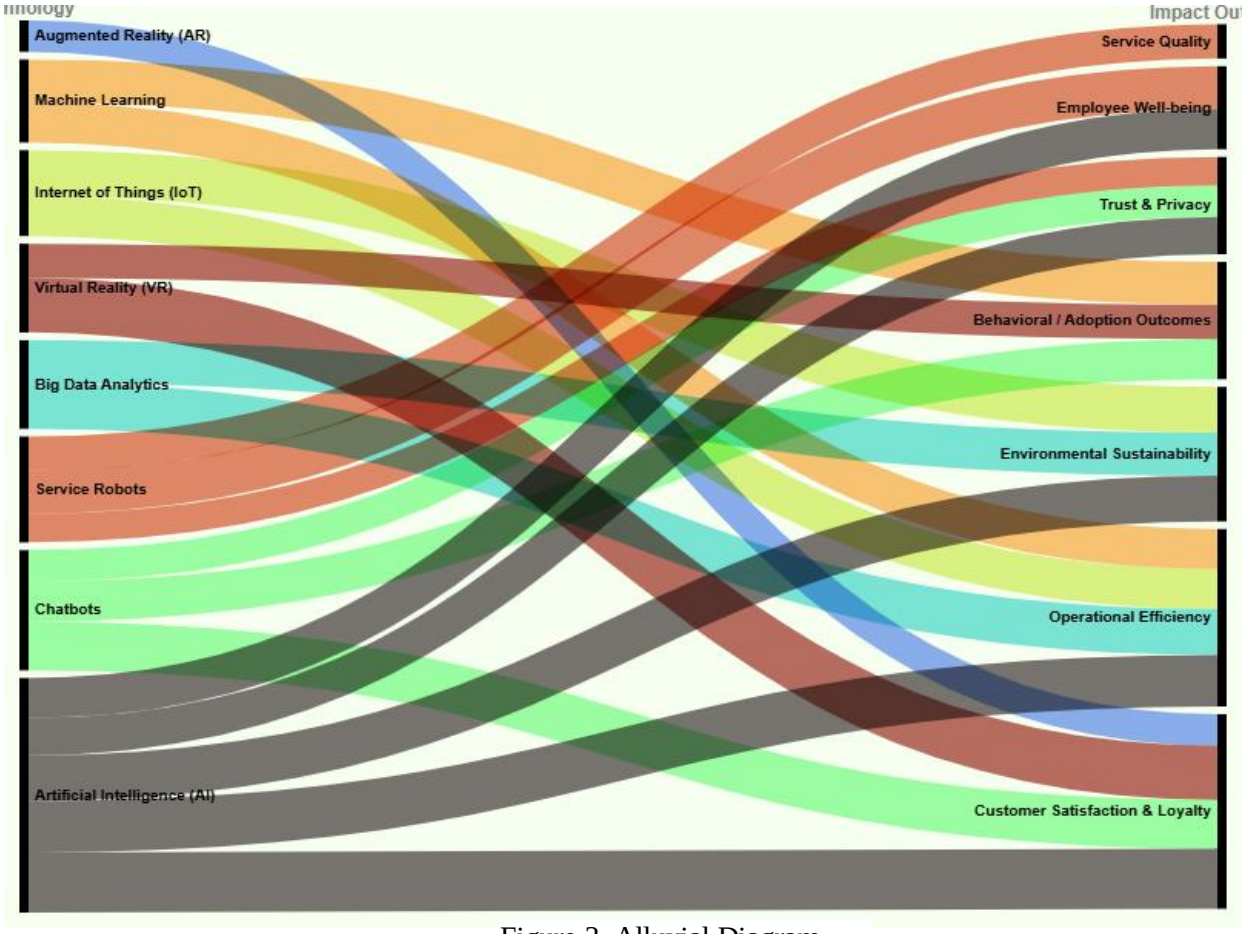


Figure 3. Alluvial Diagram

Figure 2 illustrates an alluvial diagram of the relationships between the smart tourism technologies and the impact outcomes that they yield, using 142 peer-reviewed publications used in this systematic literature review. The chart indicates the distribution and comparative dominance of the diverse Industry 4.0 technologies, i.e. artificial intelligence, chatbots, service robots, big data analytics, virtual reality, internet of things, machine learning, and augmented reality, and how they influence the critical outcome dimensions in the tourism and hospitality study. The thickness of the individual flows presents the rate of researches which have linked an individual technology and a specific effect on impact and therefore, they constitute the current research priorities in the literature. The diagram underlines the fact that the most significant effect of the artificial intelligence is the potent technology, and the main flows to the customer satisfaction and loyalty, the efficiency of operations, the quality of services and well-being of the workers, will underline the dominant role of this technology in the transformations of tourist activities and experiences. Mainly, the integration of chatbots and service robots is associated with such outcomes as behavioral and adoption outcomes, service quality, and employee well-being because these technologies may influence customer communication and working relationships on both levels. Customer satisfaction, customer loyalty, and customer experiential enrichment are mostly linked to immersive technologies such as virtual reality and augmented reality, and operational efficiency and environmental sustainability are much associated with big data analytics and IoT. Overall, the alluvial visualization of the fractured literature sums up the entire picture in a whole into a thorough image, which presents a clear image on how the adoption of technology in smart tourism could be translated into experiential, operational, ethical and sustainability-related gains.

### *3.8 Popular Research Themes in Smart Tourism Technologies*

#### *3.8.1 Technology Adoption and Operational Dynamics*

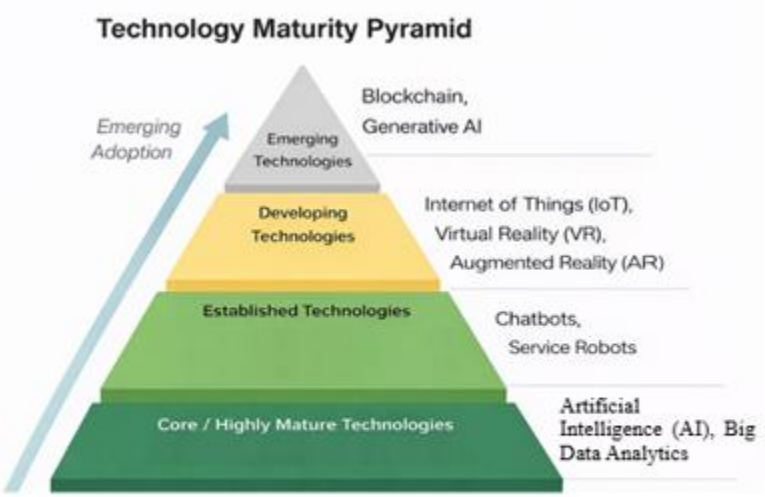


Figure 4. Technology Maturity Pyramid

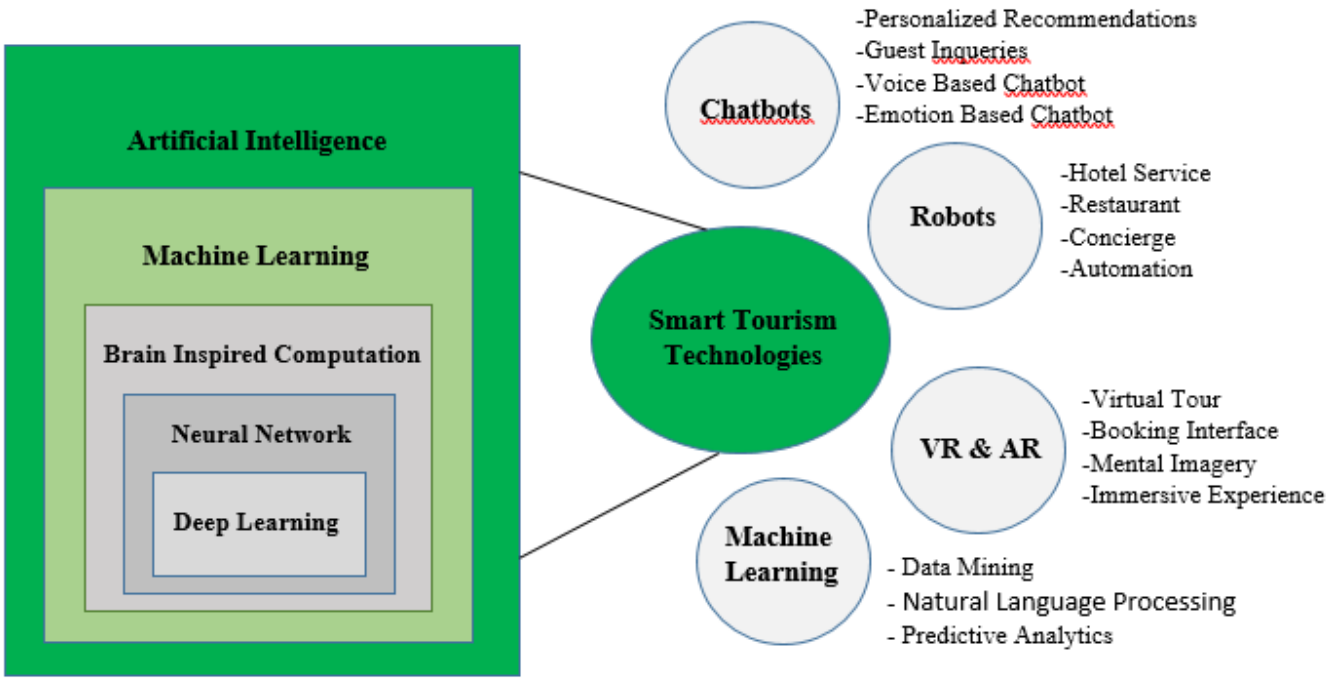


Figure 4. Model of AI Application in Hospitality

Applying smart technologies to the tourism and hospitality industry is a clear step towards data-intensive, automated, and personalized service delivery. The popularity of chatbots, service robots, voice assistants, virtual reality (VR), artificial intelligence (AI), augmented reality (AR), big data analytics, machine learning (ML), and other technologies are ensuring the efficiency of the operations, reducing costs, and enhancing the experience of the guests. VR and especially a 360-degree video help the targeted users to explore their destination beforehand, which enhances their sense of presence, cultural awareness, and want to visit it (Orús et al., 2021; Bogicevic et al., 2019; Zeng et al., 2022). Service robots and humanoid robots in particular contribute to the delivery of regular services, interaction with clients, and robots automation of processes so that the issue of labor could be addressed and the

hotels improve service recovery (Shin, 2023; Kim, 2023; Choi et al., 2021). The personalized suggestion that AI system provides due to the information about the guests will lead to enhanced satisfaction, interaction and loyalty (Morosan and Cengizci, 2023; Gidumal et al., 2023). The management of the energy, staff and automation of the administration also optimise resources of the management (Gajić et al., 2024). Chatbots are rapid and reliable communication tools that contribute to reducing the amount of work that employees have to perform and build trust with the guests (Nguyen et al., 2022; Jin and Youn, 2023). ML is also useful in making decisions as it predicts demand, determines prices in the most efficient way, and categorizes customers (Nilashi et al., 2019). However, the quality of the system, user trust, and organizational preparedness are the necessary preconditions of successful adoption, and perceived value, customer engagement, and social influence are the suggested mediators (Medina and Sanclemente, 2020; Zhang et al., 2024).

### *3.8.2 Impact of AI on Customer Experience*

Smart tourism technology initiated transformation of the customer experience in hospitality sector, which became one of the primary forces. As revealed in the literature reviewed, smart tourism technology has the ability to influence customer experience, which is embodied, has a human-oriented perception, emotional involvement, and perceived security (Pillai & Sivathanu, 2020; Cai et al. 2022; Belanche et al., 2020). The interaction, evaluation, and acceptance of AI-powered hospitality services are determined by a combination of these dimensions. Research shows that the efficiency of hotel preview in VR is more effective in attracting customers than images or video because they create rich, dynamic experiences that increase the intention to visit (McLean and Barhorst, 2022). The interactive VR will merely help customers to develop good mental images of their stay and this will have a positive influence on the decision making process. Similarly, the perceived ease of use, usefulness, trust, and anthropomorphism are the causes of using technologies like chatbots (Pillai and Sivathanu, 2020). The personal type of interaction will enhance the customer satisfaction and lead to repeat visits. Studies also testify to the statement that perceived innovativeness and usefulness of VR and AR make the engagement and satisfactions significantly greater (Lim et al., 2024). There is also the active engagement of social presence, interactivity, and image processing, which leads to the continuous interaction with the AI devices (Jin and Youn, 2023). However, overly realistic robots may be understood as awkward and this phenomenon is known as the uncanny valley effect and are deemed to be inappropriate in the context of a job that requires empathetic behavior (Akdim et al., 2021). The relational model focuses on the ease of use, experience value, trust of the origin of satisfaction and behavioral intention mediated by the perceived usefulness and the feeling of presence (Cai et al., 2022; Orús et al., 2021). In spite of the emergence of the technology, a number of customers are more inclined towards human interaction as opposed to using AI-based services. Shin and Jeong (2020) state that the customers think that the more human employees the more genuine and empathetic compared to robots. Even though humanoid robots can raise interest and affinity (Belanche et al., 2020), they cannot handle the cases of complex service recovery. Choi et al. (2021) established that customers expect human beings to be more demanding in the face of service failures as compared to AI. The preferences however have been transformed by external forces, such as COVID-19, as customers now are more inclined toward robots in those spheres where a physical presence is not necessarily (such as checkouts) (Kim et al., 2020). The feeling of presence and trust are mediators of the gap between AI and human interaction and define the satisfaction level and the level of intention to behave (Morosan and Cengizci, 2024; Zeng et al., 2022). Emotional engagement can be pointed out as other crucial features of customer experience based on AI. Categories of emotional characteristics include friendliness and service robot competence, which affect attitudes and customer loyalty to a great extent (Hlee et al., 2022). Even though humanoid robots can develop empathy, too realistic robots are likely to cause negative emotions (Akdim et al., 2021). It also relates to branding since AI-powered devices marked are considered more functional and affective (Cai et al., 2022). The relational model proves that the informativeness and authenticity correlate with cognitive effort and mental imagery to become tourist happy and word-of-the-mouth (Morosan and Cengizci, 2024; Orus et al., 2021). The application of virtual reality technologies proves to be successful in the context of emotional attachment. Finally, but not the least, the feeling of security is an excellent contributor to the acceptance of AI. The customers will also be willing to engage with AI systems in case they think that it is ethical, transparent, and secure (Morosan and Cengizci, 2024). The problem of privacy and technological anxiety can be an obstacle, however, it does not always prevent its use (Cai et al., 2022; Lim et al., 2024). The most important one is the aspect of trust and specifically, it is when AI aligns with customer values and

does not compromise on safety and privacy (Yang et al., 2021). The opposite is also true because human-like robots are more trusted than machine-like robots (Belanche et al., 2020). Overall, AI customer experience needs a strike between innovation and trust, emotional relationship, and human-centered service design.

### *3.8.3 Employee Experiential Dynamics*

Experiential dynamics of employees is a significant process dimension of tourism and hospitality industry to understand the role of smart tourism technology in internal organizational performance. In the literature analyzed, it is evident that the experiences of the employees of AI are multidimensional since they comprise collaboration and adaptability, job satisfaction and emotional well-being, technological preparedness and acceptance, and job security and performance perceptions. The willingness of employees to collaborate with and transform AI-enabled systems is one of the most important matters that define the experience of the latter. Empirical evidence indicates that frontline employees would be more willing to collaborate with the AI when its service skills are seen as supporting, rather than disruptive. Kim (2023) confirms that the ability of frontline service robots (FLSRs) to service directly enhances the willingness of employees to collaborate, particularly when using robots that are perceived to be trustworthy and competent. However, perceived risk with AI, such as ignorance of errors, accountability, and control - emerges as a significant barrier and suggests that the perception of AI potential is the major determinant that can help establish favorable collaboration among employees (Kim, 2023). Similarly, Qiu et al. (2022) reveal that anthropomorphic, functional, and informational properties of AI reduce mental fatigue among employees and increase flexibility and performance. These aspects decrease the amount of cognitive and emotional load, which enhances the role of AI as a facilitating tool in the service-intensive environment. Another factor that prompts the use of AI technologies by employees, according to Ivkov et al. (2020), is the perceived business output and performance benefits, which means that the collaboration rates are even higher when AI is viewed as the means of enhancing the efficiency of work. The process of task designing is also facilitating and enables the employee to work proactively with AI, which supports the adaptability and hospitality of service (Bhargava et al., 2021). Nevertheless, technical hiccups and the absence of physical connection to the employees are also an operational problem that may affect them negatively (Cheong and Law, 2023), and a perceived lack of service quality due to the perceived loss of human touch can also be a demerit (Bhargava et al., 2021). AI also influences job satisfaction and emotional health to a considerable extent. It has already been indicated that AI can be used to reduce burnout (both physical and mental) as it enables employees to work more efficiently and more accurately, which directly impacts job satisfaction (Qiu et al., 2024). Additionally, the anthropomorphic, functional, and informational AI features are related to the increase in the quality of the services and overall well-being of the employees (Qiu et al., 2024). The robots of repetitive and physically intensive jobs also allow individuals to get more value-added jobs, which contributes to more meaningful working experiences (Van et al., 2020). However, this positive result is offset by the doubts of being jobless and the emotional strain. Kong et al. (2021) state that the greater the level of AI awareness among workers is, the more likely it is to trigger job insecurity, stress, and emotional fatigue, which is detrimental to organizational commitment and career adaptation. In line with this, Teng et al. (2024) point out that negative work-related remuneration perception reinforces emotional depletion, which reduces job engagement and withdrawal intentions. These observations demonstrate the importance of the interventions in organizations to safeguard the psychological well-being of the workers. Technological preparedness and acceptance also affect the experiences of the employees with AI. The more employees have positive expectations, innovativeness, and value AI technologies as helpful, the more they are ready to utilize these technologies (Cimbaljevic et al., 2020). Organizational readiness, perceived organizational support, and informal learning environments strengthen this relationship because they cultivate confidence and engagement (Prentice et al., 2023; Jerez, 2025). Such aspects as self-efficacy, role clarity, and motivation also contribute to the willingness to use AI to ensure that the implementation process may be completed in a less challenging manner (Jerez, 2024). It is then very important to train and enable organizational climates to facilitate acceptance. Finally, the last problem is that of job security, which is a typical concern influencing the performance of employees in the artificial intelligence integrated workplace. The relationship between engagement and service performance and perceived job security is positive, as employees having a sense of job security will perceive that AI is more of a work-performance-increasing tool than a job destroyer (Prentice et al., 2023). On the other hand, employees who perceive fear of AI become burnt out and disengaged and this reflects in poor performance (Kong et al., 2021). Wang et al. (2022) also demonstrate that

workers with a higher locus of control take a more active part in the learning and job crafting process and have the chance to adapt to the changes introduced by AI positively. The combination of these findings aims to point to the fact that the dynamics of experience in employees are the ultimate to the benefits of AI in hospitality and that the balance in the design of technologies and the support of organizations, as well as human-centered management practices are required.

### *3.8.4 Ethical and Social Implications*

Implementation of smart tourism technology in the tourism and hospitality industry has elicited some of the most critical ethical and social concerns that touch on customer trust, the job security of the employees, and the socio-cultural acceptance. Studies indicate that the customers are highly sensitive towards the issue of gathering, storing, and sharing with their personal and biometric information. According to the results of the study by Lehto et al. (2021), the hotel clients are considerably concerned with the usage of the biometric data, of course, when it is possible that this data can be handed to a third-party without a clear consent of a customer. This kind of considerations negatively affects the welfare and desirability of the customers, which implies the importance of transparency and user control. Similarly, Ioannou et al. (2020) concluded that customers offer a greater level of protection of biometric data (facial recognition) as compared to behavioral data, which means that privacy strategies should differ depending on the type of data. Kang et al. (2024) also provided that accountability can be more complex in scenarios when the information is stolen or hacked through the use of AI systems because of the lack of transparency. The relational model proves the hypothesis that perceived control, privacy concern, and perceived security are the greatest predictors of behavioral and adoption intentions mediated by trust and moderated by privacy awareness and regulatory environments (Boo and Chua, 2022; Du et al., 2024). Du et al. (2024) also added that the fact that privacy risk is a reality of unmanned or AI-enhanced hotels contributes to the lack of trust in the form of psychological discomfort. As a reaction to this, Boo and Chua (2022) proposed the idea that the AI interface should be designed in a manner that would avoid the perception of excessive surveillance on clients that would be a means of balancing technology advantages and privacy. Fairness, transparency, and the loss of human authenticity is not the only ethical issue pertaining to the use of AI, other issues include privacy. The findings of Pitardi et al. (2022) show that the customers are likely to consider the services provided by AI as dehumanizing, especially in the case when the human employees are replaced by robots or chatbots. Castillo et al. (2021) also revealed that customers become deceived and uncomfortable when informed that AI-rendered services are offered without direct disclosure and that it mitigates the degree of trust and provokes the problem of manipulation. Cultural expectations and comfort related to the ethical concerns also exist due to the fact that human-robot gender congruity and psychological ownership influence behavioural intention and satisfaction (Pitardi et al., 2022). The deeper ethical issue is outlined in New Zealand by Wang (2024), that the use of AI in the hotels cannot be applied to the Maori culture, and the author underlines that the preservation of the cultural norms and human-centered hospitality against the backdrop of AI implementation use is noteworthy. The introduction of AI significantly affects the labor market and the workforce through the societal prism. Hussssain et al. (2023) note that the greater automation leads to the panic of losing a job, particularly to people with little technological skills. Li et.al. (2023) supported this reasoning by showing that the threat posed by AI increases turnover intention and reduces job engagement among the staff in the hotel. Another factor that Cheong and Law (2023) have found out is that job performance and commitment to the organisation could also be undermined with the introduction of AI, unless the issue of job security was considered. The relational model identifies the institutional trust and perceived security as vital in maintaining confidence among the workforce, and the perception about AI systems works as a moderator of negative perceptions. The last, yet not the least, is the social perception and inclusion into the culture, which is vital in the AI acceptance. Wang (2024) identified a big disparity on the generational principle, with younger guests being more open to AI, and older guests preferring communication with humans. The same findings were reached by Lehto et al. (2021) who confirmed that younger and technological customers are more accepting of biometric services, and older and better educated customers are more worried about privacy. Research by Cheong and Law (2023) investigated that the absence of a human touch could decrease the service experience despite the fact that customers value efficiency and innovation. Negative experiences are usually caused by perceived social and psychological risks, such as the lack of personalization and staff substitution by a human being, as shown by Tan et al. (2024). The notion that the human interaction is important in the satisfaction was supported

by Du et al. (2024). Overall, these findings can lead to the conclusion that a sensible, responsible strategy that will not deprive individuals of their trust, their jobs, and cultural values and nor eliminate the human element of hospitality is necessary.ence of hospitality.

### *3.8.5 Operational Optimization and Sustainability*

At the operational level, the Smart Tourism Technology found to be useful in the improvement of sustainability within the Tourism and Hospitality industry by ensuring the efficiency and resource management, as well as the environmentally friendly experience of a guest. The studies of Al-Romeedy and Alharethi (2024) and Gajic et al. (2024) indicate that AI technologies may be helpful in the work of the hotel by increasing its resource use, reducing its vulnerability, and reducing its environmental consequences. Hotels can also use Ai-based energy management systems to monitor and control heating, cooling, and lighting in real-time to reduce energy consumption and carbon emissions (Al-Romeedy and Alharethi, 2024). Similarly, in Gajic et al. (2024), AI algorithms are also applicable in optimization of energy consumption and waste minimization, thereby leading to the decrease of operating costs and improvement of the environmental performance. The other application of AI in hotels is to address the problem of labor shortages because manual operations are automatized, hence, requiring fewer human labor and its impacts on the environment (Jang and Lee, 2020). Additional benefits of AI and Human -Machine Interface (HMI) integration in the sustainability, time-saving, material waste, and efficient delivery of services are also mentioned (Van et al., 2020). These findings are substantiated in the relational model, which shows that AI-IoT integration, waste management practices, and sustainable tourism technologies are the key to the effectiveness of operation, and the environmental commitment supports their sustainability results (Azarmi et al., 2018; Van et al., 2020; Gajić et al., 2024). Sustainable waste reduction and waste management is also positively contributed by AI. Research has shown that AI-based systems can predict the waste generation rates at a high level of accuracy to the extent that the hotels make plans on how to manage the waste efficiently. Azarmi et al. (2018) explain that Artificial Neural Networks (ANN) can be applied to forecast the quantity of waste produced by hotels using the previous data, especially in the seasons of high demand. This will also see the hotels to plan in advance and save on wastages that are not essential. In addition, AI algorithms along with IoT sensors will enable hotels to monitor their water usage and decrease the amount of waste, which will lead to resource conservation (Gajić et al., 2024). The AI systems can also divide waste into the recyclable, food, and general waste and help the hotels to develop particular waste management strategies (Azarmi et al., 2018). According to the relational model, the realization of the long-term waste reduction goals is facilitated by the enabling conditions and sustainability-oriented organizational culture through which proper waste management practices should be adhered to (Gajić et al., 2024). Besides the internal processes, AI is employed to make the company more sustainable by creating more responsible and sustainable guest experiences. The guest services are customized with the help of chatbots and AI technology-based recommendation systems that promote the green practices. Al-Romeedy and Alharethi (2024) showed that AI can be used to assist guests make sustainable choices when purchasing to stay at a hotel to enhance their satisfaction, loyalty, and pro-environmental behaviors. The AI-based analytics tools used to determine the sustainability factors that the guest of the green hotels deems the highest priority are Latent Dirichlet Allocation (LDA) and Adaptive Neuro-Fuzzy Inference Systems (ANFIS) aimed at the adjustment of the services according to the expectations of the guest (Nilashi et al., 2019). The added value of the VR and AR technology that leads to sustainability is that it allows visitors to see a destination and its activities without going outside and damaging the environment (Duy et al., 2020). The technologies positively influence the sense of presence and imagination that impact the satisfaction and revisit intention, especially through the presence of the environmental commitment and cultural values (Bogicevic et al., 2019; Lee and Kim, 2021).

### *3.9 Antecedents–Process–Outcomes (APO) Framework of Smart Tourism Technology Research*

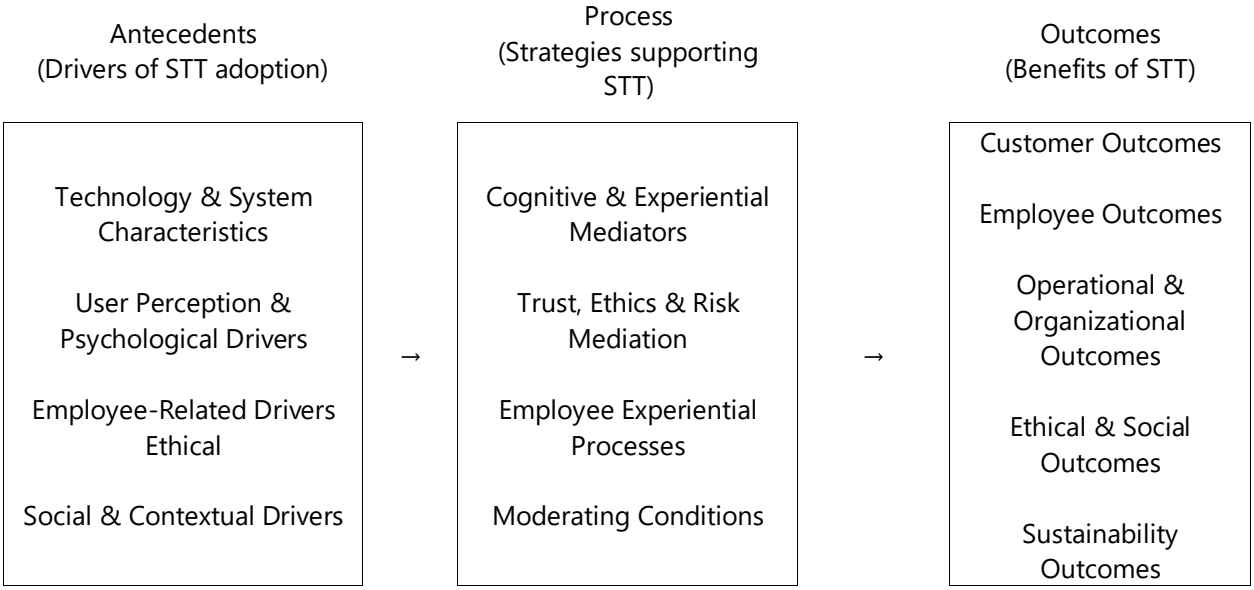


Figure 1. Conceptual APO framework

The current literature on Smart Tourism Technologies (STTs) synthesis within the framework of Industry 4.0 is discussed through the prism of the Antecedents Process Outcomes (APO) framework. This framework provides a methodological view in the presentation of how different technological, psychological, organizational and situational forces of the smart tourism technology are mediated and moderated to multidimensional impacts by some mediating and moderating processes.

#### *3.9.1 Antecedents*

Antecedents in this study are the main drivers that shape or define the adoption and utilisation of STTs. These drivers cut across different levels. System and technology characteristics, such as artificial intelligence (AI), Internet of Things (IoT), VR/AR, system robots, system quality, interactivity, personalization, security, and anthropomorphism are the enablers of smart tourism applications on a technological level. In the user level, the acceptance and engagement are greatly influenced by other factors like user perceptions and psychological motivations, including the perceived usefulness, ease of use, trust, innovativeness, hedonic motivation, and technology readiness. Employee antecedents that comprise AI awareness, readiness, perceived organizational support, and job security perceptions reflect the internal workforce conditions that an efficient technology integration necessitates. Also, ethical, social, and contextual motives like privacy issues, perceived risk, cultural values, regulatory settings, and perceptions of risk in relation to the pandemic are also underlying factors in determining the choice to adopt STT.

Table 6.Summary of Antecedents Supporting STT Adoption

| Category | Key Variables (from reviewed studies) | Representative Sources |
|---|---|---|
| Technology & System Characteristics | Artificial Intelligence (AI), IoT, VR/AR, Service Robots, Chatbots, Media Richness, Informativeness, Accessibility, Interactivity, Personalization, Security, System Quality, Anthropomorphism, Human-likeness, Robot Type | Orús et al. (2021); Bogicevic et al. (2019); Lei et al. (2021); Tosyali et al. (2023); Akdim et al. (2023) |
| User Perception & Psychological Drivers | Perceived Usefulness (PU), Perceived Ease of Use (PEOU), Perceived Intelligence, Trust, Anxiety, Technology Readiness, Innovativeness, Hedonic Motivation, Utilitarian Value, Social Influence, Performance Expectancy, Effort Expectancy | Pillai & Sivathanu (2020); Cai et al. (2022); Lim et al. (2024); Chi et al. (2022); Huang (2021) |
| Employee-Related Drivers | AI Awareness, Service Competence, Employee Readiness for AI, Optimism, Innovativeness, Perceived Organizational Support, Job Security Perception, Psychological Job Demand | Kim (2023); Qiu et al. (2022); Cimbaljevic et al. (2024); Prentice et al. (2023) |
| Ethical, Social & Contextual Drivers | Perceived control, Familiarity with AI systems, Privacy Concern, Perceived Risk (privacy, financial, social, psychological), Institutional Trust, Cultural Values, COVID-19 Risk Perception, Competitive Pressure, Regulatory Environment | Boo & Chua (2022); Du et al. (2024); Lehto et al. (2023); Kim et al. (2020) |

### *3.9.2 Process*

Process dimension entails the mechanisms by which these antecedent factors influence the outcome. The intermediaries of the causes of STTs on user experiences and attitudes are cognitive and experience-based and comprise mental imagery, immersion, flow, sense of presence, emotional engagement. The technology acceptance and further continued use are also mediated by trust-, ethics-, and risk-related factors, including the perceived ethics, privacy awareness, perceived control, and institutional trust. The impacts of STTs on the workforce outcomes can be attributed to experience reduction by the factors like physical and mental fatigue, job pressure, emotional burnout, informal learning and career resilience at the employee level. It also incorporates the critical moderating circumstances that cause these relationships to be stronger and more direct, like cultural orientation, technology anxiety, familiarity with AI, service context, and organizational readiness, which are integrated within the framework.

Table 7. Summary of Processes Supporting STT Adoption

| Category | Key Variables (from reviewed studies) | Representative Sources |
|---|---|---|
| Cognitive & Experiential Mediators | Mental Imagery, Quality of Mental Imagery, Ease of Imagination, Flow, Sense of Presence, Telepresence, Immersion, Psychological Presence, Cognitive Processing, Emotional Engagement, Attitude | Orús et al. (2021); McLean & Barhorst (2022); Alyahya & McLean (2022); Jin & Youn (2023) |
| Trust, Ethics & Risk Mediation | Perceived Ethics, Perceived Control, Privacy Awareness, Risk–Benefit Evaluation, Institutional Trust, Perceived Security | Morosan & Cengizci (2024); Pitardi et al. (2022); Ioannou et al. (2020) |
| Employee Experiential Processes | Reduced Physical Fatigue, Reduced Mental Fatigue, Positive Emotion, Job Stress, Emotional Exhaustion, Career Resilience, Informal Learning, Task Crafting | Qiu et al. (2022); Teng et al. (2024); Kong et al. (2024) |
| Moderating Conditions | Individual Collectivism, Cultural Values, Technology Anxiety, Job Insecurity, Familiarity with AI, Destination Type, Service Context, Organizational Readiness | Zeng et al. (2022); Lim et al. (2024); Prentice et al. (2023); Du et al. (2024) |

### *3.9.3 Outcomes*

Lastly, outcomes are used to capture the universal effects of STT adoption. They are customer outcomes like satisfaction, adoption and revisit intention, trust; Employee outcomes like engagement, performance, turnover intention; operational and organizational outcomes (e.g. efficiency, service quality, competitive advantage; ethical and social outcomes like; Ethical Acceptance of AI, Social Acceptance of Robots; and sustainability outcomes such as energy efficiency, waste reduction, sustainable tourism behavior. On balance, the APO model demonstrates that STTs create value by means of interrelated pathways of experiential, organizational, ethical, and sustainability.

Table 8. Summary of Outcomes Supporting STT Implementation

| Category | Key Variables (from reviewed studies) | Representative Sources |
|---|---|---|
| Customer Outcomes | Adoption Intention, Usage Intention, Continuance Intention, Visit Intention, Revisit Intention, Booking Intention, Satisfaction, Tourist Happiness, Subjective Well-being, Trust toward AI, Word-of-Mouth, Willingness to Pay | Cai et al. (2022); Shukla et al. (2024); Pai et al. (2020); Zhang et al. (2022) |
| Employee Outcomes | Willingness to Collaborate with AI, Job Engagement, Service Performance, Creativity, Career Resilience, Turnover Intention, Work Withdrawal | Kim (2023); Kang et al. (2024); Prentice et al. (2023); Teng et al. (2024) |
| Operational & Organizational Outcomes | Operational Efficiency, Service Quality, Memorable Tourism Experience, Competitive Advantage, Customer Loyalty, Marketing Performance | Gupta et al. (2022); Al-Shami et al. (2022); Azis et al. (2020) |
| Ethical & Social Outcomes | Acceptance of Technology Agency, Willingness to Share Biometric Data, Willingness to Share Behavioral Data, Ethical Acceptance of AI, Social Acceptance of Robots | Lehto et al. (2021); Boo & Chua (2022); Du et al. (2024) |
| Sustainability Outcomes | Waste Reduction, Energy Efficiency, Sustainable Hotel Operations, Organizational Sustainability, Green Work Engagement, Sustainable Tourism Behavior | Al-Romeedy & Alharethi (2024); Gajić et al. (2024); Azarmi et al. (2018) |

### *3.10 Limitations in Existence Literatures and Future Research Direction*

The research paper indicates some of the evident gaps in the existing literature regarding AI in the hotel industry and recommends specific directions on how the future research must be carried out. Majority of the studies have convenience sampling, small population size of demographics and gender biasness that reduces the generalization capacity. More differentiated, balanced, and globally representative samples should be included in the future studies (Orús et al., 2021; Zeng et al., 2022; Bhuiyan et al., 2024). The research on cross-cultural aspects in other countries is also considered an opportunity to learn more (Zeng et al., 2022; Nazir et al., 2022; Cai et al., 2022). The research works are hypothetical in many cases, and based on cross-sectional research that hinders application of knowledge. Longitudinal and field studies, that is, studies focused on the actual behavior over time, are recommended (Shin and Jeong, 2020; McLean and Barhorst, 2022; Fang et al., 2024). Current literature tends to deal with somewhat simple AI tools without paying attention to the use of advanced technologies, such as big data, intelligent robots, and neural networks (Dhiman and Jamwal, 2022; Kim et al., 2023; Zhang et al., 2024).The majority of studies are based on self-reported data and they do not take into account cultural and sensory aspects. In the future, the accuracy of data should be improved by adding the eye-tracking and sensory inputs tools to the research (McLean and Barhorst, 2022; Qiu et al., 2024). It is also important to study post-pandemic behavior as there is a lot of research conducted in the context of the COVID-19 (McLean and Barhorst, 2022; Phang et al., 2022). Finally, they need to discuss the human-AI interaction and ethical concerns, displacement of jobs, and equity within the hospitality setting more (Kim, 2023; Wang, 2023; Al-Romeedy and Alharethi, 2024).

**Table 9. Summarization of Limitations and Future Research Directions**

| Theme | Limitations | Future Research Directions | Authors |
|---|---|---|---|
| **Sample Characteristics** | Narrow demographics, convenience sampling, gender bias, and cultural lack of diversity. | Include diverse, balanced, and representative global samples. | Orús et al. (2021), Zeng et al. (2022), McLean & Barhorst (2022), Kim (2023), Bhuiyan et al. (2024) |
| **Study Design** | Hypothetical scenarios, cross-sectional studies, and limited real-world context. | Conduct longitudinal and field studies for trend analysis and practical insights. | Orús et al. (2021), Shin & Jeong (2020), Bhuiyan et al. (2024), Fang et al. (2024), McLean & Barhorst (2022) |
| **Technological Scope** | Essential AI tools ignored advanced and comparative analyses. | Investigate advanced technologies and comparative AI applications across domains. | Dhiman & Jamwal (2022), Fang et al. (2024), Kim et al. (2023), Zhang et al. (2024) |
| **Variables and Measurement** | Exclusion of cultural factors, over-reliance on self-reports, and limited sensory variables. | Use objective metrics (e.g., eye-tracking), include cultural variables, and explore sensory dimensions. | McLean & Barhorst (2022), Kim (2023), Bhuiyan et al. (2024), Qiu et al. (2024) |
| **Cultural Scope** | Confined to specific regions; lack of cross-cultural perspectives. | Conduct cross-cultural studies and include diverse regional perspectives. | Zeng et al. (2022), Kim (2023), Cai et al. (2022), Nazir et al. (2023) |
| **COVID-19 Context** | Pandemic-era data skew and unexplored post-pandemic impacts. | Examine post-pandemic changes in AI adoption and its long-term behavioral impacts. | McLean & Barhorst (2022), Phang et al. (2022), Bhuiyan et al. (2024) |
| **Industry Limitations** | Focus on specific sectors with minimal comparative analysis. | Extend research across industries and customer interaction stages. | Bogicevic et al. (2019), Cai et al. (2022), Dhiman & Jamwal (2022), Zhang et al. (2024) |
| **Sensory Design** | Neglected multisensory and interactive dimensions. | Explore multisensory elements and immersive designs for better engagement. | Orús et al. (2021), Lee & Kim (2021) |
| **AI-Human Interaction** | Limited understanding of workplace dynamics and psychological impacts. | Study AI's psychological impacts, workplace collaboration, and generational differences. | Kim (2023), Qiu et al. (2024), Bhuiyan et al. (2024) |
| **Ethics and Sustainability** | Overlooked privacy, ethical concerns, and sustainability implications. | Assess ethical issues and AI's role in sustainability, fairness, and inclusivity. | Al-Romeedy & Alharethi (2024), Gajić et al. (2024), |

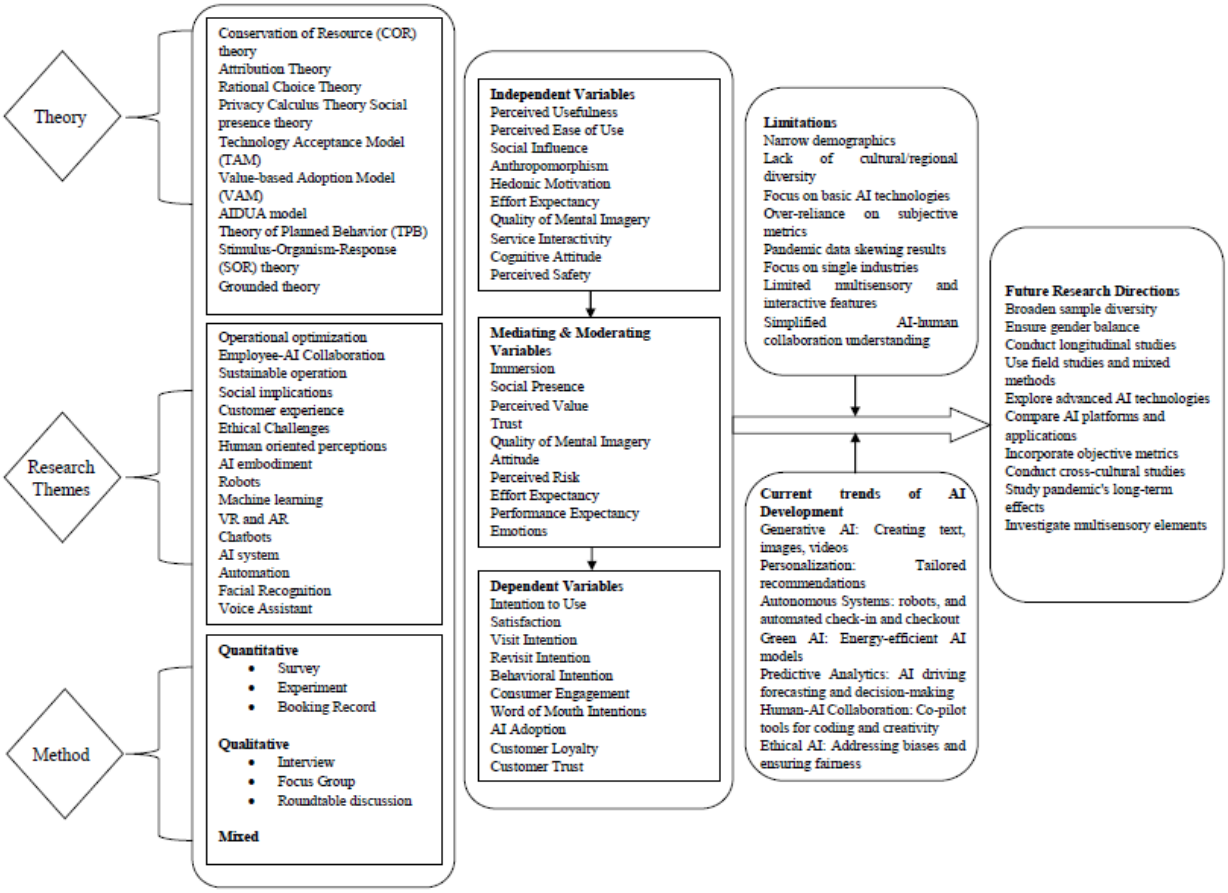


Figure 5. Conceptual Framework of AI Intersection in Hospitality

## 4. Conclusions, implications, and limitations

### *4.1. Conclusions*

The paper provides a straightforward and easily structured overview of how smart tourism technologies have developed and are used in the tourism and hospitality business under the Industry 4.0 era. The analysis of 142 peer-reviewed articles based on PRISMA has shown that the technologies, such as artificial intelligence, big data analysis, the Internet of Things, service robots, chatbots, and virtual and augmented reality have become the focus of the modern tourism processes. Through the review, it is evident that the application of smart tourism technologies is subject to different considerations. These include quality of technology, usability, perceived usefulness, trust and privacy problems. The willingness to take up technology, the employees job security, and organizational support are also significant factors that contribute to successful implementation. In the meantime, customer experiences can be affected by emotional engagement, immersion, presence, and trust in technology. The outcomes also indicate that the smart tourism technologies lead to the desirable outcomes at different levels. They increase customer satisfaction, involvement, loyalty and revisit intention to the customers. The workload can be reduced and performance respectively can be maximized, when appropriately controlled to the employees. On the organizational level, these are technologies that assist businesses in enhancing their operational efficiency, service quality, competitiveness and sustainability as a result of better management of resources and energy. However, there is still a significant concern about such ethical issues as privacy and data protection, as well as the declining human interaction. Broadly, the paper has discovered that smart tourism technologies have a significant potential to the tourism and hospitality industries, and it only depends on the responsible, accountable and ethical application that does not compromise innovation and social and sustainability factors.

### *4.2. Theoretical Implications*

The theoretical contributions to the field of smart tourism and Industry 4.0 studies are numerous in the proposed study. To begin with, it provides a synthesized, integrated knowledge regarding the role of smart tourism technologies to tourism results by adding up findings through the Antecedents Processes Outcomes (APO) framework. It is helpful in describing not only what is involved in the nature of technology adoption but also the cognitive, emotional and ethical processes that result in outcome. Secondly, the paper is based upon the earlier theories of technology adoption and line them through the experiences, employee and ethical and sustainability views. The review applies a synthesis of various theories to show the multi-level implication of smart tourism technologies. Finally, the study addresses apparent research gaps that are mainly on employee experience, ethical challenges, and sustainability as a robust theoretical framework of the future empirical research in smart tourism and hospitality.

### *4.3. Practical Implications*

The study can be important to the managers, the stakeholders and policymakers of the tourism and hotel industry. According to the findings, AI, chatbots, service robots, VR, and data analytics are smart tourism technologies, which can improve the quality of services, operational efficiency, and customer satisfaction in case of a cautious implementation. In an effort to win the confidence of the tourists and employees, managers are encouraged to focus on user-friendly systems, employee training and open data. In pursuit of warmth of service, the organizations must maintain the balance between the use of technology and human contact. Such pieces of knowledge may help policymakers to facilitate the development of digital infrastructure, develop ethical guidelines and encourage the use of sustainable technologies. Overall, sustainable and intelligent utilization of technologies can make the business competitive, improve customer satisfaction, the welfare of the staff, and sustainability.

### *4.4. Limitations*

Despite its contributions, this research project possesses a number of weaknesses. Firstly, the articles included in the review are those that have been published since 2011 to 2025, which can be considered out of date with the absence earlier foundational research regarding the foundations of digital transformation and the adoption of technology in tourism. Second, the peer-reviewed journal articles were used, and they were written in English. Although this enhances the sense of academic rigour; it might not capture the contributions of grey literature, industry issues and conference papers where novel technologies are mostly presented. Thirdly, the entire research is based on secondary information thereby constraining the researcher to obtain a real time industry practice and operational challenge experienced by tourism organizations. Fourth, the literature reviewed is geographically unbalanced, since more developed areas are presented and the developing and least developed areas have scarce evidence. This constrains effects of the happenings in the world. Lastly, both narrative and thematic synthesis were used, which was inappropriate in the scope of the study because of its diversity, is a weakness to the generalization by statistics. The investigations to be conducted in the future based on the expanded geographical coverage along with more empirical research and synthesis methods should address these gaps in the researches.

## Reference

[1] Akdim, K., Belanche, D., & Flavián, M. (2023). Attitudes toward service robots: analyses of explicit and implicit attitudes based on anthropomorphism and construal level theory. *International Journal of Contemporary Hospitality Management*, *35*(8), 2816-2837.

[2] Alma Çallı, B., Çallı, L., Sarı Çallı, D., & Çallı, F. (2023). The impact of different types of service robots usage in hotels on guests' intention to stay. Journal of Hospitality and Tourism Technology, 14(1), 53-68.

[3] Al-Romeedy, B. S., & Alharethi, T. (2024). Reimagining Sustainability: The power of AI and intellectual capital in shaping the future of tourism and hospitality organizations. Journal of Open Innovation: Technology, Market, and Complexity, 10(4), 100417. https://www.sciencedirect.com/science/article/pii/S2199853124002117

[4] Alyahya, M., & McLean, G. (2022). Examining tourism consumers' attitudes and the role of sensory information in virtual reality experiences of a tourist destination. *Journal of Travel Research*, *61*(7), 1666-1681. https://journals.sagepub.com/doi/full/10.1177/00472875211037745

[5] Amin, A., & Budilestari, W. (2025). Triple Impact of Tourism: Economic Growth, Cultural Dynamics, and Environmental Change. Journal Magister Ilmu Ekonomi Universtas Palangka Raya: GROWTH. https://doi.org/10.52300/grow.v11i1.21778.

[6] Azarmi, S. L., Oladipo, A. A., Vaziri, R., & Alipour, H. (2018). Comparative modeling and artificial neural network inspired prediction of hospitality industry waste generation rates: the case of North Cyprus. *Sustainability*, *10*(9), 2965 https://www.mdpi.com/2071-1050/10/9/2965

[7] Azis, N., Amin, M., Chan, S., & Aprilia, C. (2020). How smart tourism technologies affect tourist destination loyalty. Journal of hospitality and tourism technology, 11(4), 603-625.

[8] Belanche, D., Casaló, L. V., Flavián, C., & Schepers, J. (2020). Robots or frontline employees? Exploring customers' attributions of responsibility and stability after service failure or success. *Journal of Service Management*, *31*(2), 267-289. https://www.emerald.com/insight/content/doi/10.1108/josm-05-2019-0156/full/pdf

[9] Bhargava, A., Bester, M., & Bolton, L. (2021). Employees' perceptions of the implementation of robotics, artificial intelligence, and automation (RAIA) on job satisfaction, job security, and employability. *Journal of Technology in Behavioral Science*, *6*(1), 106-113. https://link.springer.com/article/10.1007/s41347-020-00153-8

[10] Bhuiyan, K. H., Ahmed, S., & Jahan, I. (2024). Consumer attitude toward using artificial intelligence (AI) devices in hospitality services. *Journal of Hospitality and Tourism Insights*, (ahead-of-print). https://www.researchgate.net/profile/Selim-Ahmed/publication/378284441

[11] Bogicevic, V., Seo, S., Kandampully, J. A., Liu, S. Q., & Rudd, N. A. (2019). Virtual reality presence as a preamble of tourism experience: The role of mental imagery. *Tourism Management*, *74*, 55-64. https://www.sciencedirect.com/science/article/abs/pii/S026151771930038X

[12] Bogicevic, V., Seo, S., Kandampully, J. A., Liu, S. Q., & Rudd, N. A. (2019). Virtual reality presence as a preamble of tourism experience: The role of mental imagery. *Tourism Management*, *74*, 55-64. https://www.sciencedirect.com/science/article/abs/pii/S026151771930038X

[13] Boo, H. C., & Chua, B. L. (2022). An integrative model of facial recognition check-in technology adoption intention: the perspective of hotel guests in Singapore. *International Journal of Contemporary Hospitality Management*, *34*(11), 4052-4079.

[14] Bratić, M., Stanković, A., Pavlović, D., Pivac, T., Kovačić, S., Surla, T., Čerović, S., & Zlatanov, S. (2025). New Era of Tourism: Innovative Transformation Through Industry 4.0 and Sustainability. Sustainability. https://doi.org/10.3390/su17093841.

[15] Braun, V., & Clarke, V. (2022). Conceptual and design thinking for thematic analysis. Qualitative psychology, 9(1), 3.

[16] Bulchand-Gidumal, J., William Secin, E., O'Connor, P., & Buhalis, D. (2024). Artificial intelligence's impact on hospitality and tourism marketing: exploring key themes and addressing challenges. *Current Issues in Tourism*, *27*(14), 2345-2362. https://www.tandfonline.com/doi/pdf/10.1080/13683500.2023.2229480

[17] Cai, R., Cain, L. N., & Jeon, H. (2022). Customers' perceptions of hotel AI-enabled voice assistants: does brand matter?. International Journal of Contemporary Hospitality Management, 34(8), 2807-2831.

[18] Castillo, D., Canhoto, A. I., & Said, E. (2021). The dark side of AI-powered service interactions: Exploring the process of co-destruction from the customer perspective. *The Service Industries Journal*, *41*(13-14), 900-925. https://bura.brunel.ac.uk/bitstream/2438/21143/2/FullText.pdf

[19] Cheong, F., & Law, R. (2023). Human employees versus robotic employees: Customers and hotel managers' perceived experience at unmanned smart hotels. *Cogent Social Sciences*, *9*(1), 2202937. https://www.tandfonline.com/doi/pdf/10.1080/23311886.2023.2202937

[20] Chi, O. H., Gursoy, D., & Chi, C. G. (2022). Tourists' attitudes toward the use of artificially intelligent (AI) devices in tourism service delivery: moderating role of service value seeking. *Journal of Travel Research*, *61*(1), 170-185. https://journals.sagepub.com/doi/full/10.1177/0047287520971054

[21] Chiang, A. H., & Trimi, S. (2020). Impacts of service robots on service quality. *Service Business*, *14*(3), 439-459. https://link.springer.com/article/10.1007/s11628-020-00423-8

[22] Choi, S., Mattila, A. S., & Bolton, L. E. (2021). To err is human (-oid): how do consumers react to robot service failure and recovery?. Journal of Service Research, 24(3), 354-371. https://journals.sagepub.com/doi/abs/10.1177/1094670520978798

[23] Cimbaljević, M., Demirović Bajrami, D., Kovačić, S., Pavluković, V., Stankov, U., & Vujičić, M. (2024). Employees' technology adoption in the context of smart tourism development: the role of technological acceptance and technological readiness. *European Journal of Innovation Management*, *27*(8), 2457-2482.

[24] Corrêa, S. C. H., & Gosling, M. D. S. (2021). Travelers' perception of smart tourism experiences in smart tourism destinations. Tourism Planning & Development, 18(4), 415-434. https://www.tandfonline.com/doi/abs/10.1080/21568316.2020.1798689

[25] Czyz, M., & Javed, M. (2025). REVOLUTIONIZING TRAVEL: THE ROLE OF SMART TOURISM TECHNOLOGIES IN ENHANCING TOURIST SATISFACTION AND SHAPING SUSTAINABLE DESTINATION IMAGES: INSIGHTS FROM ISTANBUL. GeoJournal of Tourism and Geosites. https://doi.org/10.30892/gtg.58141-1426.

[26] Dhiman, N., & Jamwal, M. (2023). Tourists' post-adoption continuance intentions of chatbots: integrating task–technology fit model and expectation–confirmation theory. foresight, 25(2), 209-224. https://doi.org/10.1108/FS-10-2021-0207

[27] Du, H., Li, J., So, K. K. F., & King, C. (2024). Artificial intelligence in hospitality services: examining consumers' receptivity to unmanned smart hotels. *Journal of Hospitality and Tourism Insights*. https://doi.org/10.1108/JHTI-06-2024-0548

[28] Duy, N. T., Mondal, S. R., Van, N. T. T., Dzung, P. T., Minh, D. X. H., & Das, S. (2020). A study on the role of web 4.0 and 5.0 in the sustainable tourism ecosystem of Ho Chi Minh City, Vietnam. *Sustainability*, *12*(17), 7140. https://www.mdpi.com/2071-1050/12/17/7140

[29] Fang, S., Han, X., & Chen, S. (2024). Hotel guest-robot interaction experience: a scale development and validation. *Journal of Hospitality and Tourism Management*, *58*, 1-10. https://www.sciencedirect.com/science/article/abs/pii/S1447677023001900

[30] Gajić, T., Vukolić, D., Bugarčić, J., Đoković, F., Spasojević, A., Knežević, S., ... & Dávid, L. D. (2024). The Adoption of Artificial Intelligence in Serbian Hospitality: A Potential Path to Sustainable Practice. Sustainability, 16(8), 3172. https://www.mdpi.com/2071-1050/16/8/3172

[31] Gidumal, B.J., William Secin, E., O'Connor, P., & Buhalis, D. (2024). Artificial intelligence's impact on hospitality and tourism marketing: exploring key themes and addressing challenges. Current Issues in Tourism, 27(14), 2345-2362.

[32] Gupta, S., Modgil, S., Lee, C. K., Cho, M., & Park, Y. (2022). Artificial intelligence enabled robots for stay experience in the hospitality industry in a smart city. *Industrial Management & Data Systems*, *122*(10), 2331-2350. https://doi.org/10.1108/IMDS-10-2021-0621

[33] Ho, T. H., Tojib, D., & Tsarenko, Y. (2020). Human staff vs. service robot vs. fellow customer: Does it matter who helps your customer following a service failure incident?. International Journal of Hospitality Management, 87, 102501. https://www.sciencedirect.com/science/article/abs/pii/S0278431920300530

[34] Huang, T. (2022). What affects the acceptance and use of hotel service robots by elderly customers?. *Sustainability*, *14*(23), 16102. https://doi.org/10.3390/su142316102

[35] Hussain, S., Singh, A. M., Mohanty, P., & Gavinolla, M. R. (2023). Next generation employability and career sustainability in the hospitality industry 5.0. *Worldwide Hospitality and Tourism Themes*, *15*(3), 308-321. https://doi.org/10.1108/WHATT-01-2023-0011

[36] Hussein Al-shami, S. A., Mamun, A. A., Ahmed, E. M., & Rashid, N. (2022). Artificial intelligent towards hotels' competitive advantage. An exploratory study from the UAE. *foresight*, *24*(5), 625-636. https://doi.org/10.1108/FS-01-2021-0014

[37] Ioannou, A., Tussyadiah, I., & Lu, Y. (2020). Privacy concerns and disclosure of biometric and behavioral data for travel. *International Journal of Information Management*, *54*, 102122. https://www.sciencedirect.com/science/article/abs/pii/S0268401219317311

[38] Ionescu, A., & Sârbu, F. (2024). Exploring the Impact of Smart Technologies on the Tourism Industry. Sustainability. https://doi.org/10.3390/su16083318.

[39] Ivkov, M., Blešić, I., Dudić, B., Pajtinková Bartáková, G., & Dudić, Z. (2020). Are future professionals willing to implement service robots? Attitudes of hospitality and tourism students towards service robotization. *Electronics*, *9*(9), 1442. https://journals.sagepub.com/doi/pdf/10.1177/00472875211028313

[40] Jayasinghe, G. Y., Perera, T. A. N. T., Perera, H. A. T. N., Karunarathne, H. D., Manawadu, L., Weerasinghe, V. P. A., Siriwardana, B.G.N., Haroon, M.H., Malalgoda, C., Amaratunga, D., & Haigh, R. (2024). A systematic literature review on integrating disaster risk reduction (DRR) in sustainable tourism (SusT): Conceptual framework for enhancing resilience and minimizing environmental impacts. International Journal of Disaster Risk Reduction, 104742. https://doi.org/10.1016/j.ijdrr.2024.104742

[41] Jerez-Jerez, M. J. (2025). A study of employee attitudes towards AI, its effect on sustainable development goals and non-financial performance in independent hotels. *International Journal of Hospitality Management*, *124*, 103987. https://www.sciencedirect.com/science/article/pii/S0278431924002998

[42] Jin, S. V., & Youn, S. (2023). Social presence and imagery processing as predictors of chatbot continuance intention in human-AI-interaction. *International Journal of Human–Computer Interaction*, *39*(9), 1874-1886. https://www.tandfonline.com/doi/pdf/10.1080/10447318.2022.2129277

[43] Kang, J., Shin, H., & Kang, C. (2024). Hospitality labor leakage and dynamic turnover behaviors in the age of artificial intelligence and robotics. *Journal of Hospitality and Tourism Technology*. https://doi.org/10.1108/JHTT-12-2023-0411

[44] Khalil, S., Kallmuenzer, A., & Kraus, S. (2024). Visiting museums via augmented reality: An experience fast-tracking the digital transformation of the tourism industry. *European Journal of Innovation Management*, *27*(6), 2084-2100. https://doi.org/10.1108/EJIM-09-2022-0479

[45] Kim, M. J., Lee, C. K., & Preis, M. W. (2020). The impact of innovation and gratification on authentic experience, subjective well-being, and behavioral intention in tourism virtual reality: The moderating role of technology readiness. *Telematics and Informatics*, *49*, 101349. https://www.sciencedirect.com/science/article/abs/pii/S0736585320300083

[46] Kim, Y. (2023). Examining the impact of frontline service robots service competence on hotel frontline employees from a collaboration perspective. Sustainability, 15(9), 7563. https://www.mdpi.com/2071-1050/15/9/7563

[47] Kong, H., Jiang, X., Zhou, X., Baum, T., Li, J., & Yu, J. (2024). Influence of artificial intelligence (AI) perception on career resilience and informal learning. *Tourism Review*, *79*(1), 219-233.

[48] Kong, H., Jiang, X., Zhou, X., Baum, T., Li, J., & Yu, J. (2024). Influence of artificial intelligence (AI) perception on career resilience and informal learning. *Tourism Review*, *79*(1), 219-233. https://doi.org/10.1108/TR-10-2022-0521

[49] Kong, H., Yuan, Y., Baruch, Y., Bu, N., Jiang, X., & Wang, K. (2021). Influences of artificial intelligence (AI) awareness on career competency and job burnout. *International Journal of Contemporary Hospitality Management*, *33*(2), 717-734. https://doi.org/10.1108/IJCHM-07-2020-0789

[50] Lee, W. J., & Kim, Y. H. (2021). Does VR tourism enhance users' experience?. *Sustainability*, *13*(2), 806. https://www.mdpi.com/2071-1050/13/2/806

[51] Lehto, X. Y., Park, S., Mohamed, M. E., & Lehto, M. R. (2023). Traveler attitudes toward biometric data-enabled hotel services: Can risk education play a role?. *Cornell Hospitality Quarterly*, *64*(1), 74-94. https://journals.sagepub.com/doi/full/10.1177/19389655211063204

[52] Lei, C., Hossain, M. S., & Wong, E. (2023). Determinants of repurchase intentions of hospitality services delivered by artificially intelligent (AI) service robots. Sustainability, 15(6), 4914. https://www.mdpi.com/2071-1050/15/6/4914

[53] Lei, S. I., Shen, H., & Ye, S. (2021). A comparison between chatbot and human service: customer perception and reuse intention. *International Journal of Contemporary Hospitality Management*, *33*(11), 3977-3995. https://doi.org/10.1108/IJCHM-12-2020-1399

[54] Lim, W. M., Jasim, K. M., & Das, M. (2024). Augmented and virtual reality in hotels: Impact on tourist satisfaction and intention to stay and return. *International Journal of Hospitality Management*, *116*, 103631. https://www.sciencedirect.com/science/article/pii/S0278431923002050

[55] McLean, G., & Barhorst, J. B. (2022). Living the experience before you go... but did it meet expectations? The role of virtual reality during hotel bookings. Journal of Travel Research, 61(6), 1233-1251. https://journals.sagepub.com/doi/pdf/10.1177/00472875211028313

[56] Morosan, C. (2019), "Disclosing facial images to create a consumer's profile: a privacy calculus perspective of hotel facial recognition systems", International Journal of Contemporary Hospitality Management, pp. 3149-3172, doi: 10.1108/IJCHM-08-2018-0701. https://doi.org/10.1108/IJCHM-08-2018-0701

[57] Morosan, C., & Dursun-Cengizci, A. (2024). Letting AI make decisions for me: an empirical examination of hotel guests' acceptance of technology agency. *International Journal of Contemporary Hospitality Management*, *36*(3), 946-974. https://doi.org/10.1108/IJCHM-08-2022-1041

[58] Nazir, S., Khadim, S., Asadullah, M. A., & Syed, N. (2023). Exploring the influence of artificial intelligence technology on consumer repurchase intention: The mediation and moderation approach. *Technology in Society*, *72*, 102190. https://www.sciencedirect.com/science/article/abs/pii/S0160791X22003311

[59] Nguyen, T. B. T., Le, T. B. N., & Chau, N. T. (2023). How VR technological features prompt tourists' visiting intention: An integrated approach. *Sustainability*, *15*(6), 4765. https://www.mdpi.com/2071-1050/15/6/4765

[60] Nguyen, V. T., Phong, L. T., & Chi, N. T. K. (2023). The impact of AI chatbots on customer trust: an empirical investigation in the hotel industry. *Consumer Behavior in Tourism and Hospitality*, *18*(3), 293-305. https://doi.org/10.1108/CBTH-06-2022-0131

[61] Nilashi, M., Mardani, A., Liao, H., Ahmadi, H., Manaf, A. A., & Almukadi, W. (2019). A hybrid method with TOPSIS and machine learning techniques for sustainable development of green hotels considering online reviews. *Sustainability*, *11*(21), 6013. https://www.mdpi.com/2071-1050/11/21/6013

[62] Oncioiu, I., & Priescu, I. (2022). The use of virtual reality in tourism destinations as a tool to develop tourist behavior perspective. *Sustainability*, *14*(7), 4191. https://www.mdpi.com/2071-1050/14/7/4191

[63] Orús, C., Ibáñez-Sánchez, S., & Flavián, C. (2021). Enhancing the customer experience with virtual and augmented reality: The impact of content and device type. *International Journal of Hospitality Management*, *98*, 103019. https://www.sciencedirect.com/science/article/pii/S0278431921001626

[64] Pai, C. K., Liu, Y., Kang, S., & Dai, A. (2020). The role of perceived smart tourism technology experience for tourist satisfaction, happiness and revisit intention. *Sustainability*, *12*(16), 6592. https://www.mdpi.com/2078-2489/14/10/546

[65] Pencarelli, T. (2019). The digital revolution in the travel and tourism industry. Information Technology & Tourism, 22, 455 - 476. https://doi.org/10.1007/s40558-019-00160-3.

[66] Phang, I. G., Jiang, S., & Lim, X. J. (2023). Wow it'sa robot! Customer-motivated innovativeness, hotel image, and intention to stay at Chinese hotels. *Journal of China Tourism Research*, *19*(4), 812-828. https://www.tandfonline.com/doi/abs/10.1080/19388160.2022.2155749

[67] Phillips, P., & Moutinho, L. (2014). Critical review of strategic planning research in hospitality and tourism. Annals of Tourism Research, 48, 96-120. https://doi.org/10.1016/j.annals.2014.05.013

[68] Pillai, R., & Sivathanu, B. (2020). Adoption of AI-based chatbots for hospitality and tourism. International Journal of Contemporary Hospitality Management, 32(10), 3199-3226. https://doi.org/10.1108/IJCHM-04-2020-0259

[69] Pitardi, V., Bartikowski, B., Osburg, V. S., & Yoganathan, V. (2023). Effects of gender congruity in human-robot service interactions: The moderating role of masculinity. International Journal of Information Management, 70, 102489.

[70] Prentice, C., Wong, I. A., & Lin, Z. C. (2023). Artificial intelligence as a boundary-crossing object for employee engagement and performance. *Journal of Retailing and Consumer Services*, *73*, 103376. https://www.sciencedirect.com/science/article/pii/S0969698923001236

[71] Qiu, H., Li, M., Bai, B., Wang, N., & Li, Y. (2022). The impact of AI-enabled service attributes on service hospitableness: the role of employee physical and psychological workload. *International Journal of Contemporary Hospitality Management*, *34*(4), 1374-1398. https://doi.org/10.1108/IJCHM-08-2021-0960

[72] Rafiq, F., Dogra, N., Adil, M., & Wu, J. Z. (2022). Examining consumer's intention to adopt AI-chatbots in tourism using partial least squares structural equation modeling method. Mathematics, 10(13), 2190. https://www.mdpi.com/2227-7390/10/13/2190

[73] Reina-Usuga, L., Camino, F., Gomez-Casero, G., & Alba, C. A. J. (2024). Rural tourism initiatives and their relationship to collaborative governance and perceived value: A review of recent research and trends. Journal of Destination Marketing & Management, 34, 100926. https://doi.org/10.1016/j.jdmm.2024.100926

[74] Rosário, A., & Dias, J. (2024). Exploring the Landscape of Smart Tourism: A Systematic Bibliometric Review of the Literature of the Internet of Things. Administrative Sciences. https://doi.org/10.3390/admsci14020022.

[75] Sánchez-Medina, A. J., & Eleazar, C. (2020). Using machine learning and big data for efficient forecasting of hotel booking cancellations. *International Journal of Hospitality Management*, *89*, 102546. https://www.sciencedirect.com/science/article/abs/pii/S0278431920300980

[76] Shin, H. H., & Jeong, M. (2020). Guests' perceptions of robot concierge and their adoption intentions. *International Journal of Contemporary Hospitality Management*, *32*(8), 2613-2633. https://doi.org/10.1108/IJCHM-09-2019-0798

[77] Shin, H.H., Shin, S. and Gim, J. (2023), "Looking back three decades of hospitality and tourism technology research: a bibliometric approach", International Journal of Contemporary Hospitality Management, Vol. 35 No. 2, pp. 563-588. https://doi.org/10.1108/IJCHM-03-2022-0376

[78] Shukla, V., Rana, S., & Prashar, S. (2024). Examining the potential of virtual and augmented reality in enhancing tourism experiences. *The Bottom Line*. https://doi.org/10.1108/BL-05-2023-0139

[79] Sustacha, I., Baños-Pino, J., & Del Valle, E. (2023). The role of technology in enhancing the tourism experience in smart destinations: A meta-analysis. Journal of Destination Marketing & Management. https://doi.org/10.1016/j.jdmm.2023.100817.

[80] Tan, K. L., Hofman, P. S., Noor, N., Tan, S. R., Hii, I. S., & Cham, T. H. (2024). Does artificial intelligence improve hospitality employees' individual competitive productivity? A time-lagged moderated-mediation model involving job crafting and meaningful work. *Current Issues in Tourism*, 1-18. https://www.tandfonline.com/doi/pdf/10.1080/13683500.2024.2391114

[81] Teng, R., Zhou, S., Zheng, W., & Ma, C. (2024). Artificial intelligence (AI) awareness and work withdrawal: evaluating chained mediation through negative work-related rumination and emotional exhaustion. *International Journal of Contemporary Hospitality Management*, *36*(7), 2311-2326.S https://doi.org/10.1108/IJCHM-02-2023-0240

[82] Torabi, Z. A., Shalbafian, A. A., Allam, Z., Ghaderi, Z., Murgante, B., & Khavarian-Garmsir, A. R. (2022). Enhancing memorable experiences, tourist satisfaction, and revisit intention through smart tourism technologies. *Sustainability*, *14*(5), 2721. https://www.mdpi.com/2071-1050/14/5/2721

[83] Tosyali, H., Tosyali, F., & Coban-Tosyali, E. (2023). Role of tourist-chatbot interaction on visit intention in tourism: the mediating role of destination image. *Current Issues in Tourism*, 1-16. https://www.tandfonline.com/doi/abs/10.1080/13683500.2023.2288937

[84] Um, T., Kim, T., & Chung, N. (2020). How does an intelligence chatbot affect customers compared with self-service technology for sustainable services?. *Sustainability*, *12*(12), 5119. https://www.mdpi.com/2071-1050/12/12/5119

[85] Van, N. T. T., Vrana, V., Duy, N. T., Minh, D. X. H., Dzung, P. T., Mondal, S. R., & Das, S. (2020). The role of human–machine interactive devices for post-COVID-19 innovative sustainable tourism in Ho Chi Minh City, Vietnam. *Sustainability*, *12*(22), 9523. https://www.mdpi.com/2071-1050/12/22/9523

[86] Wang, H., Zhang, H., Chen, Z., Zhu, J., & Zhang, Y. (2022). Influence of artificial intelligence and robotics awareness on employee creativity in the hotel industry. *Frontiers in Psychology*, *13*, 834160. https://www.frontiersin.org/journals/psychology/articles/10.3389/fpsyg.2022.834160/full

[87] Wang, P. Q. (2024). Personalizing guest experience with generative AI in the hotel industry: there's more to it than meets a Kiwi's eye. *Current Issues in Tourism*, 1-18. https://www.tandfonline.com/doi/full/10.1080/13683500.2023.2300030

[88] Yang, H., Song, H., Cheung, C., & Guan, J. (2021). How to enhance hotel guests' acceptance and experience of smart hotel technology: An examination of visiting intentions. *International journal of hospitality management*, *97*, 103000. https://pure.hud.ac.uk/ws/files/37388404/IJHM_Smart_Hotel.pdf

[89] Zeng, Y., Liu, L., & Xu, R. (2022). The effects of a virtual reality tourism experience on tourist's cultural dissemination behavior. Tourism and Hospitality, 3(1), 314-329. https://www.mdpi.com/2673-5768/3/1/21

[90] Zhang, Q., Khan, S., Khan, S. U., Khan, I. U., & Mehmood, S. (2024). Tourist Motivations to Adopt Sustainable Smart Hospitality: An Innovation Resistance Theory Perspective. *Sustainability*, *16*(13), 5598. https://www.mdpi.com/2071-1050/16/13/5598

[91] Zhang, Y., & Deng, B. (2024). Exploring the nexus of smart technologies and sustainable ecotourism: A systematic review. Heliyon, 10. https://doi.org/10.1016/j.heliyon.2024.e31996.

[92] Zhang, Y., Sotiriadis, M., & Shen, S. (2022). Investigating the Impact of Smart Tourism Technologies on Tourists' Experiences. Sustainability. https://doi.org/10.3390/su14053048.