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Management Conference



Tertiarization & sustainability new challenges for management in the digital era

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Short Papers

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Tertiarization & sustainability. New challenges for management in the digital era

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Short Papers

edited by

Arabella Mocciaro Li Destri, Marta Ugolini and Lara Penco

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The SITE Model: A Conceptual Framework for Understanding AI and Emerging Technologies in Tourism and Hospitality

NICOLAIA IAFFALDANO¹ ALESSANDRO GIANNATTASIO² LORENZO SAPONARO³
CESARE AMATULLI⁴ MARCO PICHIERRI⁵

Abstract

This study analyzes the role of Artificial Intelligence (AI) and emerging technologies in tourism and hospitality through a literature review. To provide a structured understanding of their adoption, we introduce the SITE Model, a framework that synthesizes the literature into four key areas: Sustainability, Impact, Technology, and Experience. Using the PRISMA approach, a literature review was conducted on 52 articles from 2018 to 2024. Our findings indicate that AI and emerging technologies enhance sustainable mobility, operational efficiency, and customer experience, while also raising ethical and social challenges. Their strategic integration is essential for maximizing engagement and innovation in the sector. By offering a comprehensive perspective, this study contributes to guiding future research and strategy development.

Research framework and purpose. *Research on artificial intelligence (AI) and emerging technologies in hospitality and tourism industry has increasingly grown over recent years due to the pervasiveness of AI-enabled technologies, which are relevant for both scholars and managers. Artificial intelligence (AI) could be defined as a subfield of computer science that explains how machines can mimic human intelligence (Tussyadiah, 2020). Similarly, AI may also refer to “the use of computational machinery to emulate capabilities inherent in humans, such as doing physical or mechanical tasks, thinking, and feeling” (Huang & Rust, 2021, p.31). AI is also considered as a set of technologies capable of imitating human intelligence in learning, problem-solving and decision-making processes. It includes systems that analyze large volumes of data (big data), leverage advanced algorithms, and improve their performance over time through learning processes such as machine learning and deep learning. It is pointed out that AI technology includes both effective technologies and emerging technologies (Doborjeh et al., 2022). Effective technologies concern machine learning, artificial neural networks, and deep learning for analyzing complex data; emerging technologies concern virtual/augmented reality, robotics, and chatbots that are also transforming the tourism industry by offering personalized experiences and improving operational efficiency (Bulchand-Gidumal, 2020).*

Literature has analyzed AI and emerging technologies in tourism and hospitality in a quite fragmented way as separated research fields that consider different perspectives. Moreover, the literature fragmentation calls for a more focused research effort to better understand a comprehensive view that organizes the topics in an organic way. This study aims at providing a more comprehensive understanding of the artificial intelligence phenomenon in hospitality and tourism industry by collecting evidence from the associated literature. We propose the SITE model, a theoretical framework which provides a clear structure for classifying academic research on the role of Artificial Intelligence (AI) and emerging technologies in tourism and in the hospitality into four thematic areas: 1. Sustainability; 2. Impacts; 3. Technology, 4. Experience.

The first thematic area includes studies on the environmental and social impacts of AI and emerging technologies in terms of reducing the environmental impact of tourism and improving the sustainability of destinations. The articles within this category highlight how the adoption of AI, intelligent automation technology and smart technologies can contribute to greener tourism. The second area focuses on how the implementation of artificial intelligence in the hospitality and tourism sector is taking place and what its impacts could be at the organizational and economic level. The third area includes studies on the use of innovative technologies in tourism, such as augmented reality, robotics and machine learning, and analyzes how they are revolutionizing tourism. Lastly, the fourth category includes studies

¹ University of Bari
e-mail: nicolaia.iaffaldano@uniba.it

² University of Bari
e-mail: alessandro.giannattasio@uniba.it

³ University of Bari
e-mail: lorenzo.saponaro@uniba.it

⁴ University of Bari
e-mail: cesare.amatulli@uniba.it

⁵ University of Bari
e-mail: marco.pichierri@uniba.it

investigating how AI and intelligent automation may improve customer experience (for instance, the use of chatbots and intelligent systems to customize tourism offers).

In general, the paper offers a descriptive framework that allows for an organized classification of the literature, serving as a solid starting point for future theoretical developments that could, for example, analyze the causal relationships between the topics included in the proposed model.

Methodology. A literature review was conducted. In order to provide a reliable and bias-free analysis of the empirical evidence, we based our methodology on the PRISMA approach across four stages (Moher et al., 2015; identification, screening, eligibility and inclusion).

Identification. We identified academic articles published in international peer-reviewed scientific journals. The search engine used for this purpose was Scopus and Scholar widely recognized as a major source of academic research (Paschou et al., 2020). We selected two sets of keywords to explore the role of Artificial Intelligence and emerging technologies in tourism and hospitality. The first set of keywords included: 'Artificial Intelligence', 'Machine Learning', 'Smart Tourism Technologies', 'Chatbot', 'Robotics', 'Augmented Reality', 'Virtual Reality', 'Internet of Things' and 'Intelligent Automation'. The second set of keywords included terms such as 'Tourism Innovation', 'Smart Destinations', 'Digitization in Tourism' and 'Hospitality Management'. After defining the final set of keywords, we launched a series of search queries based on data mining criteria to extract the most relevant articles to describe the state of the art. A query was for example: "Title-Abs (("AI" and "Chatbot") and ("Tourism Innovation" or "Hospitality Management")) and pubyear > "2018" and <"2024" and (limit-to (doctype, "ar") or limit-to (doctype, "cp")) and (limit-to (language, "English"))).

Screening. We considered only papers published in the most relevant journals (e.g., *Journal of Hospitality and Tourism Insights*). We focused exclusively on articles written in English in the field of marketing and management applied to the tourism sector. From an initial list of 54 manuscripts, two were excluded and a final sample of 52 articles published between 2018 and 2024 was considered.

Eligibility and Inclusion. Abstracts were screened to include only results consistent with AI and emerging technologies in tourism and hospitality. Through this process, 31 articles were removed because they did not meet the eligibility and inclusion criteria (e.g., because they were not in line with the specific topic of the review). Therefore, for the literature analysis, 21 final articles were considered. For each article, we created summary sheets reporting purpose, methodology and main findings, as well as identifying the key constructs defined by the authors. This process allowed us to structure and categorize the literature facilitating comparative analysis.

Results. Based on the final sample of 21 papers we divided them into four thematic macro areas.

1) **Sustainability** - In this first category we analyzed the environmental and social impacts of AI and emerging technologies on the environment of the destinations. Kim et al. (2023) studied how artificial intelligence contributed to sustainable tourism mobility. According to their research, they stated that AI optimized the efficiency of public transport, for example by facilitating travel planning. More exactly, AI is integrated into the EVAB model as a moderator, showing how it can strengthen the links between personal values, positive attitudes towards sustainability, personal and social norms, and subjective well-being of tourists. This makes it more likely that tourists will adopt green behavior. Also, according to Kim et al. (2024a), AI and smart apps influence public transport usage and reduce CO2 emissions. The authors' proposed research framework explains how AI benefits and awareness, as well as the usefulness and knowledge of smart apps, influence the intention for participation in public transport, considering older and younger population segments and gender. While Kim et al. (2024b) considered that artificial intelligence contributed to the sustainability of space tourism, Majid et al. (2023) studied intelligent automation for sustainable tourism development to facilitate an understanding of how the power of technology can be harnessed in achieving a sustainable tourism agenda. Lastly, Balsalobre-Lorente et al. (2023) highlighted the Information and Communication Technology role in reducing the environmental impact of urbanization, tourism, and natural resources exploitation. Artificial intelligence is not explicitly analyzed as a standalone construct, the article integrates the concept within ICT, implying its role in enhancing technological efficiency and supporting smart decision-making processes in urbanization, tourism, and natural resource management to achieve environmental sustainability.

2) **Impacts** - The articles within this category focused on how the implementation of artificial intelligence in the hospitality and tourism sector is taking place and what its impacts could be at the organizational and economic level. Sharma et al. (2022) examined the impact of artificial intelligence (AI) on the competitiveness of tourism firms. The study has identified 10 key factors impacting AI-driven competitiveness in tourism. The competitiveness of tourism firms is assessed primarily through their financial performance. Tourist satisfaction directly influences financial performance. AI-skilled workforce and infrastructure are foundational for AI adoption. AI-enabled technologies and digital platforms enhance productivity and innovation. Government policies and regulations shape AI implementation. The hierarchical model adopted in the study shows interdependencies between these factors. Therefore, strategic AI adoption boosts competitiveness in the tourism sector according to this research. Similarly, another study identifies human knowledge, including employee education and training, as the most significant factor influencing the adoption of automation and AI in the hospitality and tourism sectors (Jabeen et al., 2022). AI adoption in hospitality and tourism varies by application type according to another study (Huang et al., 2021). It is highlighted that highly adoptable technologies are search/booking engines and virtual agents/chatbots due to personalized and efficient user experiences. Appreciated technologies are AR/VR applications because of their immersive capabilities. Less adoptable technologies are robots, autonomous vehicles, and kiosks/self-service screens due to perceived risks, operational complexity, and low trialability.

Another author presented a research agenda on intelligent automation in tourism (Tussyadiah, 2020). Four research priorities were indicated, namely: designing beneficial artificial intelligence, facilitating adoption, assessing the impacts of intelligent automation on tourism, and creating a sustainable future with intelligent systems. Assessing the impacts of intelligent automation on tourism, Tussyadiah (2020) identified negative and positive impacts of AI. The economic, psychological and social impacts of artificial intelligence are negative.

Economic impacts relates to changes in productivity of intelligent automation: for instance, when tourist and hospitality service jobs are replaced by intelligent machines. Psychological impacts of AI and human-robot interaction, as well as emotional responses to the closeness of robot appearance to that of humans, technostress, loneliness, and isolation are all due to reduced interpersonal interaction and increased solitary activities. By assessing social impacts of intelligent automation, the author highlights the reduction of the need for personal, face-to-face interactions between tourists and residents.

As for the positive impacts of AI, the complementarity between humans and intelligent systems in collaborative decision making and task assignment is considered the first significant impact. As people increasingly use and rely on virtual assistants and robots to manage their daily and travel needs, it is necessary to fundamentally change perception of the role of intelligent agents in society, from simple tools to large and complex social actors. This is the second positive impact of AI.

Mariani and Wirtz (2023) highlighted in their study that the adoption of AI has influenced data analysis in the hospitality and tourism sector. The study is a critical reflection on the extent to which hospitality and tourism management scholars have accurately used the term “analytics”. “Analytics is the scientific process of transforming data into insight for making better decisions” (Boyd, 2012, p. 1). Findings show that there is an exponential growth of articles published in hospitality and tourism academic journals on the topic of “analytics” from 2011 to 2022. A systematic literature review was conducted by Mariani and Wirtz to understand to what extent analytics has been accurately and consistently defined in the hospitality and tourism management literature. It is found that articles rarely defined their interpretation of analytics and the specific type of analytics used.

The last article within this category focuses on how the implementation of artificial intelligence in the hospitality and tourism sector is taking place according to a systematic literature review (Kong et al., 2023). The study emphasized that AI research relating to the hospitality and tourism industry has shown a growing trend since 1991, and that the number of publications and citations has increased significantly since 2018, thus indicating that AI has become a focus for researchers. It suggests that the topic of AI has obtained considerable research attention, which corresponds to the widespread application of service robot (SR) during the outbreak of COVID-19 worldwide.

3) Technology - The third category includes studies on the use of innovative technologies in tourism, such as augmented reality, robotics and machine learning and analyses how they are revolutionizing the tourism sector. Pratisto et al. (2022) provided a comprehensive view of immersive technology in tourism by critically analyzing prior scholarly work. The article explores the use of immersive technology in the tourism sector. Immersive technology concepts can be considered on a reality-virtuality continuum: at the former end is reality environment, and at the latter end is a computer-generated virtual environment. Within that spectrum there are two concepts - augmented reality (AR) and augmented virtuality (AV), which fall under the umbrella terminology of mixed reality (MR). In addition, there is virtual reality (VR), which is a fully virtual environment (Milgram et al., 1995). Therefore, immersive technology includes AR and VR. Whereas AR can overlay the view of the user's current environment with digital objects, VR can create a virtual environment that the user can seamlessly interact with in real time. Thus, AR combines a virtual object with the real environment in real time. AR provides additional interpretation resources to enhance user engagement with the observed object during visitation, significantly impacting the experience. AR device information also needs to be delivered in real time to pique the user's interest and allow an uninterrupted leisure experience (Han et al., 2019). VR as a marketing tool in tourism research was more common than AR, specifically pre-visit tourism destination promotion.

Both AR and VR can increase the quality of visitors' experience of a destination. From this perspective, immersive technology enables tourism stakeholders to enhance tourists' satisfaction since consumers can choose and modify such an experience to a degree that was once considered impossible (Williams & Hobson 1995). Findings show the increasing number of articles published from 2012 to 2020 on the use of immersive technology in the tourism sector. This review provides a comprehensive view of the use of immersive technology in tourism research and the potential challenges it poses. The article examines how AR applications and VR applications usage, - such as AR applications for tour guidance (via smart glasses or mobile device), navigation, education, marketing, heritage preservation, entertainment, accessibility and VR applications for marketing, heritage preservation-, are revolutionising the tourism sector. Therefore AR/VR applications usage to improve the user's experience while exploring location or object. Sustacha et al. (2023) studied smart destinations linked to smart cities, thus considering the urban approach based on the employment of ICTs in economy, environment, mobility, and governance to transform city infrastructures and services (Bakıcı et al., 2013). Moreover, the study investigates the relationship between smart tourism technology (STT) and smart destinations, evaluating how STT may influence experience in smart destinations in terms of accessibility, informativeness, interactivity, personalization, and security. According to Sustacha et al. (2023, p.2) “STTs are the basic infrastructure that integrates hardware, software and networks, travel services, and ICTs to provide real-time data to facilitate smarter decision-making by destination stakeholders. They include a variety of solutions, such as the internet of things (IoT), cloud computing, artificial intelligence, mobile devices and applications, big data, Wi-Fi, virtual reality, augmented

reality, chatbots, wearable devices, QR codes, near field communication (NFC), radio frequency identification (RFID), social networks and beacons". Overall, STTs encompass a broad range of applications that can enrich tourists' experiences and generate additional value at the same time. Findings confirm that STT positively impacts the tourism experience, with interactivity and informativeness being the key attributes that enhance visitor satisfaction. However, security and privacy during the applications usage negatively affect the experience.

The last article within the third category conducts a computer-assisted qualitative data analysis (CAQDA) to analyze hospitality and tourism technology literature, for the purpose of understanding the last 10 years' research trends (Lee, 2022). Moreover, this study divided and compared two groups of analysis: the former from 2010 to 2014 was composed by 78 articles while the latter, from 2015 to 2019, by 140. In the first group the most used and common words were "use", "hotel", "tourism", "technology", "service", "information", "industry", "sites", "analysis" and "systems". In the second group new nouns emerged: "twitter", "smart", "TripAdvisor". Therefore, initially the studies focused on hotel management, performance and websites, while later the attention shifted to social media, smart tourism and digital platforms such as TripAdvisor and Twitter. All that suggests that the topic on the use of innovative technologies in tourism has obtained considerable research attention.

4) Experience - The fourth category includes studies that analyze how AI and intelligent automation enhancing personalization, improving the customer experience, and increasing operational efficiency. Doborjeh et al. (2022) explored the impact of artificial intelligence in the tourism and hospitality sectors. The main findings of the study highlight that artificial intelligence (AI) has a significant impact on the tourism and hospitality sector, enhancing demand forecasting, tourist behavior analysis, and customer experience. The most effective AI technologies include machine learning algorithms, artificial neural networks, and deep learning, particularly for analyzing complex and multimodal data. Additionally, emerging applications such as virtual reality, augmented reality, robotics, and chatbots are transforming the industry by offering personalized experiences and improving operational efficiency. Finally, the study proposes new research approaches, such as personalized AI models and the concept of neuro-tourism, to deepen the understanding of tourist behavior. Similarly, another study explores how AI and big data can enhance individuals' behaviors and attitudes, explorations of visitor attitudes, customer satisfaction and preferences (Lv et al., 2021).

Bulchand-Gidumal (2020) explored the impact of Artificial Intelligence (AI) in the travel, tourism, and hospitality sectors. The article examines how AI applications, such as personalization systems, chatbots, robots, forecasting tools, and language translation applications, are transforming the travel and hospitality industry. Findings of the study highlight that AI is revolutionizing the travel and hospitality industry by enhancing personalization, improving customer experiences, and increasing operational efficiency. Applications such as smart travel assistants, chatbots, and recommender systems help tailor services to individual preferences, while robots and automation optimize resource allocation. However, the study highlights challenges related to AI adoption, including tourists' concerns about privacy, ethical biases in AI, and the risk of human workforce substitution. The future of AI in tourism is seen as a balance between human-AI collaboration and technological advancements, with significant potential to improve sustainability and innovation. Tussayadiah (2020) said the same about it.

Ghesh et al. (2024) explored the AI-enabled customer experience (AICX) in tourism, focusing on customer-facing AI technologies (such as chatbots, service robots, virtual/augmented reality, and intelligent voice assistants) and their impact on customer satisfaction and engagement. The main findings of the study highlight that AI enhances personalization and customer interaction across the journey but requires integration with human touch to address concerns like trust and emotional engagement. Bulchand-Gidumal (2020) underlined the same about service encounter experiences.

Solakakis et al. (2024) explored the factors that affect value co-creation (VCC) through artificial intelligence (AI) and automation in tourism and hospitality. The study identifies customer-based factors such as trust, attitude, and hedonic motivations, as well as technologies like service robots, mixed-reality tools, and chatbots, that drive co-creation. This research adopts a general literature review approach, analyzing existing studies on psychological and technological elements influencing VCC in tourism. The main findings of the study highlight that customer perceptions, trust, social influence, and prior experiences significantly influence participation in VCC processes enabled by AI. Key technologies, such as service robots, AI-powered kiosks, chatbots, and mixed-reality tools, facilitate more personalized and efficient co-creation experiences. These findings suggest that tourism firms should integrate AI strategically to optimize customer engagement and satisfaction while improving service innovation.

Another study examines how artificial intelligence (AI) innovations can enhance tourist satisfaction and encourage continued service usage in the tourism industry. Findings of the study indicate that AI innovation and new product advantages significantly enhance perceived functional benefits, which in turn strengthen tourist satisfaction and their intention to continue using AI-powered services following Ku and Chen's research model validated through both quantitative and qualitative analysis. Therefore, functional benefits play a crucial role in shaping user satisfaction and loyalty. Functional benefits "are regarded as the external advantages of products or services and are usually related to the product attributes tourists select" (Ku & Chen, 2024, p. 3). Continued service usage intention "by tourists reflects a motivational influence that drives their behavior" (Ku & Chen, 2024, p. 4). The results highlight the importance of aligning AI innovation with strategic business goals to maximize its impact on customer experience and service adoption.

Research limitations. One potential limitation of our research is that it only considered articles published between 2018 and 2024: on the one hand this guarantees the topicality of the results, that is reflecting the current state of art, and on the other hand, it excludes that some older contributions can provide useful insights on the historical development of

artificial intelligence and emerging technologies in tourism and in the hospitality, thus representing the latter a limitation of the research. Another limitation is that we do not consider industrial sources and company reports. These documents could offer alternative perspectives and provide additional insights that we may have overlooked, as our evaluation was limited to peer-reviewed academic articles.

Managerial implications. From a theoretical perspective, this paper contributes to the literature on AI in tourism/hospitality field by providing the SITE framework, which provides a model for future research, permitting scholars to examine the development of AI in tourism industry. Moreover, it enables future research to have a less fragmented view of this topic. From a practical perspective, the study offers to tourism marketers some insights on 4 different aspects of the tourism industry. Specifically, results show that AI may be used as a marketing tool during the entire process of purchasing, which is capable of enhancement of the customer experience during the pre-purchase, passing from the experience itself to the post-purchase. Moreover, AI could be implemented as a strategic tool to enhance sustainable tourism, so that managers could customize the tourism experience to attract tourists and to differentiate the service/product. In addition, AI may make tourism less environmentally impactful, and contribute to possible reduction of CO2 emissions (Kim et al. 2024a). Finally, AI offers the opportunity to automate processes and personalize the service using VR, AR as chatbots, robots, instant language translation applications, automatic check-in and check-out, virtual agents which make travel planning less difficult, giving users support during the whole process and along the entire chain (Bulchand-Gidumal, 2020). The SITE framework may also work as a theoretical support for private organizations, managers and scholars, and might serve as a guide for DMOs and policy makers.

Originality of the paper. Unlike existing literature, which analyzes these issues independently - focusing separately on technological, economic or experiential impacts - our study proposes a more structured and mixed approach through the development of the SITE Model. This innovative framework organizes and classifies academic research into four key areas, offering a systematic and integrated view. The SITE Model not only provides a new tool for understanding the adoption and impact of AI and emerging technologies in tourism and hospitality but also underlines the research gaps that need to be filled in, thus supporting academics and practitioners in building more effective strategies for innovative, sustainable and customer experience-driven tourism.

The four proposed dimensions (Sustainability, Impact, Technology, Experience) were identified inductively through a thematic analysis of the existing literature and reflect the most frequently recurring topics in studies focused on the role of digital technologies within the tourism and hospitality sector. This classification is descriptive in nature and provides an initial framework that helps to organize and understand the main areas of interest and research on the subject.

Keywords: Artificial Intelligence; Emerging Technologies; Tourism; Hospitality; Digitalization in Tourism; Hospitality Management

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