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The Role of Artificial Intelligence in Transforming Smart Tourism: Enhancing Customer Experience and Service Personalization

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ABSTRACT

Abstract: *This research aims to examine the role of artificial intelligence (AI) in transforming smart tourism, with a focus on improving traveler experience and personalizing services. A Systematic Literature Review approach was used to analyze literature published in the last 10 years from reputable indexers such as Dimensions, DOAJ and Scopus. The results show that technologies such as AI, virtual reality (VR), and augmented reality (AR) have great potential to revolutionize the tourism industry. These technologies enable personalization of services, more efficient management of tourist flows, as well as the provision of real-time relevant information that can improve tourist experience and environmental sustainability. Despite progress in the application of these technologies, research gaps still exist, particularly in developing smart tourism models that integrate local and cultural values, as well as the application of technologies that support ecosystem preservation. In Indonesia, the development of smart tourism models that take into account the richness of local culture and history needs to be further encouraged through further research to create an inclusive and sustainable approach. Therefore, there is a need to develop a smart tourism model that integrates ecosystem sustainability, cultural heritage preservation, and technological solutions to address ethical issues related to the use of travelers' personal data.*

Abstrak: Penelitian ini bertujuan untuk mengkaji peran kecerdasan buatan (AI) dalam mentransformasi pariwisata cerdas, dengan fokus pada peningkatan pengalaman wisatawan dan personalisasi layanan. Pendekatan Systematic Literature Review digunakan untuk menganalisis literatur yang dipublikasikan dalam 10 tahun terakhir dari pengindeks bereputasi seperti Dimensions, DOAJ dan Scopus. Hasil penelitian menunjukkan bahwa teknologi seperti AI, realitas virtual (VR), dan augmented reality (AR) memiliki potensi besar untuk merevolusi industri pariwisata. Teknologi ini memungkinkan personalisasi layanan, pengelolaan aliran wisatawan yang lebih efisien, serta penyediaan informasi relevan secara real-time yang dapat meningkatkan pengalaman wisatawan dan keberlanjutan lingkungan. Meskipun ada kemajuan dalam penerapan teknologi ini, kesenjangan riset masih ada, khususnya dalam mengembangkan model pariwisata cerdas yang mengintegrasikan nilai lokal dan budaya, serta penerapan teknologi yang mendukung pelestarian ekosistem. Di Indonesia, pengembangan model pariwisata cerdas yang memperhitungkan kekayaan budaya dan sejarah lokal perlu lebih didorong melalui riset lebih lanjut untuk menciptakan pendekatan yang inklusif dan berkelanjutan. Oleh karena itu, perlu ada pengembangan model pariwisata cerdas yang mengintegrasikan keberlanjutan ekosistem, pelestarian warisan budaya, dan solusi teknologi untuk mengatasi masalah etika terkait penggunaan data pribadi wisatawan.

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A. INTRODUCTION

The tourism industry has emerged as one of the most significant economic sectors globally, contributing substantially to the Gross Domestic Product (GDP) of numerous countries while creating millions of job opportunities (Camilleri, 2020). As a continually evolving sector, tourism is shaped by shifting consumer preferences, technological advancements, and the ongoing process of globalization. Within this context, technological innovation plays a pivotal role in enhancing the competitiveness of the tourism industry. The adoption of technology not only improves operational efficiency but also enables industry stakeholders to meet the increasingly diverse and personalized demands of the market (V. Kumar et al., 2021). As travelers' expectations grow for experiences that are seamless, convenient, and unique, the integration of advanced technologies becomes indispensable for the industry to maintain its competitiveness in an increasingly intense global marketplace.

Technology has brought about significant changes in how travelers plan, book, and enjoy their travel experiences (Huang et al., 2017). The advancement of digital technologies, such as travel applications, online platforms, and smart devices, has introduced a level of efficiency and convenience previously unimaginable. Travelers can now swiftly access destination-related information, compare pricing options, and read reviews to make more informed decisions (Abulibdeh & Zaidan, 2017). Through online platforms, the process of booking transportation tickets, accommodations, and tour packages has become seamless and secure. Additionally, smart devices, including smartphones and Internet of Things (IoT)-enabled technologies, allow travelers to obtain real-time information, utilize interactive maps, and leverage location-based services during their journeys (Chhatbar, 2024). These innovations not only enhance the convenience of travel but also open new opportunities for the tourism sector to deliver increasingly personalized and creative services.

Artificial Intelligence (AI) is a branch of computer science dedicated to developing systems or machines capable of performing tasks that typically require human intelligence (Grewal, 2014). Broadly speaking, AI excels in processing large-scale data swiftly and efficiently, enabling in-depth analysis of patterns and trends. One of AI's primary contributions lies in its ability to perform predictive analytics, leveraging historical data to forecast future events or outcomes with a high degree of accuracy (Muthukalyani, 2023). Furthermore, AI plays a pivotal role in service personalization by tailoring products or experiences to meet individual preferences and needs (Gao & Liu, 2023). With these capabilities, AI has become an essential element across various sectors, including the tourism industry, where it enhances operational efficiency, enriches customer experiences, and supports strategic decision-making through data-driven insights (Rane, 2023).

Artificial Intelligence (AI) has revolutionized the tourism industry through various applications that enhance customer experiences and operational efficiency

(-, 2024). One prominent application is personalized travel recommendation systems, which utilize machine learning algorithms to suggest destinations tailored to user preferences. Hybrid approaches further enhance recommendation accuracy, simplifying the travel planning process (Badouch & Boutaounte, 2023). AI-powered chatbots also play a vital role by offering 24/7 customer support, addressing inquiries, and assisting with bookings through natural language processing (Ferràs et al., 2020). In pricing management, AI-driven dynamic pricing models optimize strategies by analyzing market trends and consumer behavior (Bulchand-gidumal, 2020). Additionally, sentiment analysis of traveler reviews enables businesses to gain insights into customer satisfaction and refine their services accordingly. Despite these substantial benefits, challenges such as data privacy concerns and the potential impact on the workforce warrant serious attention (Shankar et al., 2024).

The adoption of Artificial Intelligence (AI) in the healthcare sector faces several barriers, including data privacy issues, workforce skill gaps, and technological challenges (Goh et al., 2024). In developing countries, poor data quality and concerns over privacy breaches represent significant obstacles. Additionally, trust in AI is often hindered by the potential for errors and biases in outcomes (Frehywot & Vovides, 2023). A shortage of trained professionals further limits the effective implementation of AI, highlighting the need for training programs and cross-sector collaboration to develop digital competencies. Despite these considerable challenges, the development of structured frameworks and collaborative efforts can support the ethical and effective adoption of AI, ultimately delivering broad societal benefits (Sharma et al., 2022).

While the adoption of Artificial Intelligence (AI) in the tourism industry has demonstrated substantial potential, significant research gaps remain regarding its tangible impact on the growth and sustainability of the sector (García-Madurga et al., 2023). Most existing studies focus on technological advancements or specific applications, while comprehensive investigations into how AI directly influences the economic, environmental, and social dimensions of tourism across regional and global contexts are still limited (Tsaih & Hsu, 2018). The need for more systematic analyses is increasingly pressing, particularly to evaluate the effectiveness of AI implementation in promoting sustainable tourism amid global challenges such as climate change and market dynamics. Such research is crucial to provide deeper insights for stakeholders in designing AI-driven strategies that are not only innovative but also sustainable (Kalusivalingam et al., n.d.).

This study aims to explore and analyze the contributions of Artificial Intelligence (AI) in transforming the tourism sector through a systematic approach. Specifically, the research examines how AI enhances the traveler experience through service personalization, operational efficiency, and technological innovation. Additionally, it focuses on AI's role in promoting sustainable tourism from environmental, social, and economic perspectives, while

addressing global challenges such as data privacy and workforce impacts. Through an in-depth analysis, this study seeks to provide comprehensive insights for stakeholders to optimize the implementation of AI as a strategic solution to address the evolving challenges of the tourism industry in the future.

B. METHODS

This research is a qualitative study using the Systematic Literature Review (SLR) approach. This method is utilized to identify, evaluate, and interpret all relevant research results regarding the application of Artificial Intelligence (AI) in the tourism industry. This approach enables researchers to systematically collect and analyze data from various relevant sources, providing a comprehensive understanding of the topic under study. The data in this study were sourced from the Dimensions database (https://app.dimensions.ai) and Scopus (https://www.scopus.com) with the latest 10-year interval publications to ensure that the data used are current and relevant to the development of AI applications in tourism.

Data eligibility criteria in this study were established to ensure that only relevant and high-quality literature was analyzed. The criteria include (1) scientific articles published in reputable national and international journals; (2) studies that specifically address AI applications in the tourism industry; (3) publications published in the last 10 years (2013–2024); and (4) articles available in full text and in English or Indonesian. The research procedure is as shown in Figure 1.

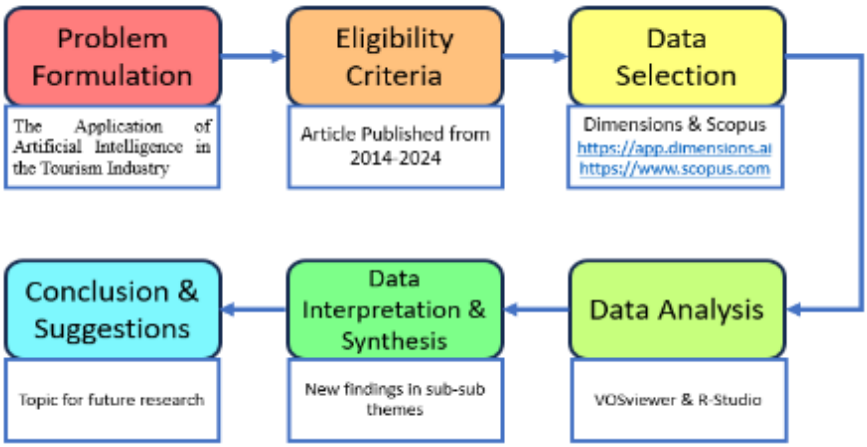

Figure 1. Research Procedures

Figure 1 illustrates that this research was conducted in several stages, namely problem formulation, determining eligibility criteria, data selection, data analysis, data interpretation and synthesis, and drawing conclusions. The problem formulation stage is critical to narrow the topic under discussion, specifically focusing on the role of AI in enhancing the tourism industry. Eligibility criteria

were determined to filter data that fit the topic using relevant keywords such as "Artificial Intelligence," "tourism," "travel technology," and "smart tourism." Next, data were selected from the Dimensions and Scopus databases, and a filter was applied for publications from the last 10 years (2013–2024).

The collected data were then imported into VOSviewer software to visualize the relationship between keywords and themes in the study, and R-Studio was used for descriptive statistical analysis and in-depth data exploration, such as calculating the frequency of recurring themes and conducting trend analysis. The results of data visualization and analysis from VOSviewer and R-Studio were interpreted to explain the critical variables in AI applications in tourism. These results were further utilized to formulate key findings, as well as theoretical and practical implications for AI adoption in the tourism industry. Finally, the researcher drew conclusions and proposed future research directions to advance the field.

C. RESULT AND DISCUSSIONS

1. Results of Data Selection

The results of the search conducted in the indexer database found a total of 191,985 data according to the research topic. Then, the results of data selection found as many as 54,019 articles that are relevant and according to eligibility criteria. Of these, 47,183 journal articles and 6,836 proceedings articles were found. The distribution of data based on the year of publication can be seen in Figure 2 which shows the development of the number of studies related to curriculum management of modern Islamic boarding schools in the last 10 years.

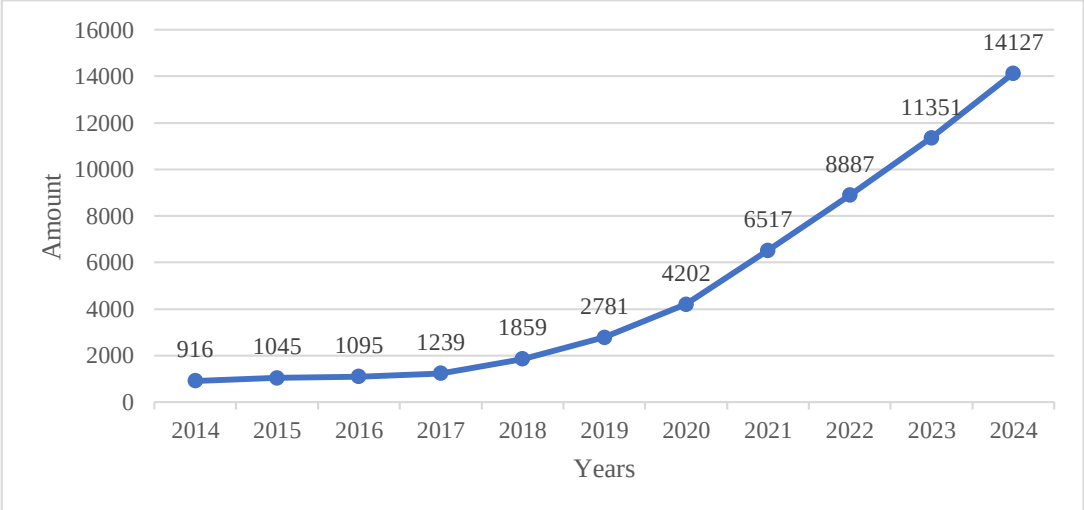

Figure 2. Publications in each year

Figure 2 illustrates the trend in the number of research publications on a specific topic over the past decade, from 2014 to 2024. In 2014, the number of publications was notably low, with only 916 recorded. This figure increased

gradually each year, though it remained relatively modest until 2016. By 2017, the number of publications began to rise significantly, reaching 1,859. This upward trend accelerated markedly, with 4,202 publications recorded in 2020. A major surge occurred in 2021, with the number of publications rising to 6,517, followed by continued growth to a peak of 11,355 publications in 2023. Finally, in 2024, the number of publications increased further to 14,127, reflecting a growing interest in this topic.

2. Distribution of Research in Several Countries

Furthermore, researchers investigated the distribution of publications in several countries. Figure 3 shows that the topic of Artificial Intelligence in Advancing Tourism has been widely researched and collaborated in several countries around the world such as, Germany, China, India, Australia, Korea, France, Spain, Iran, Bulgaria, and USA.

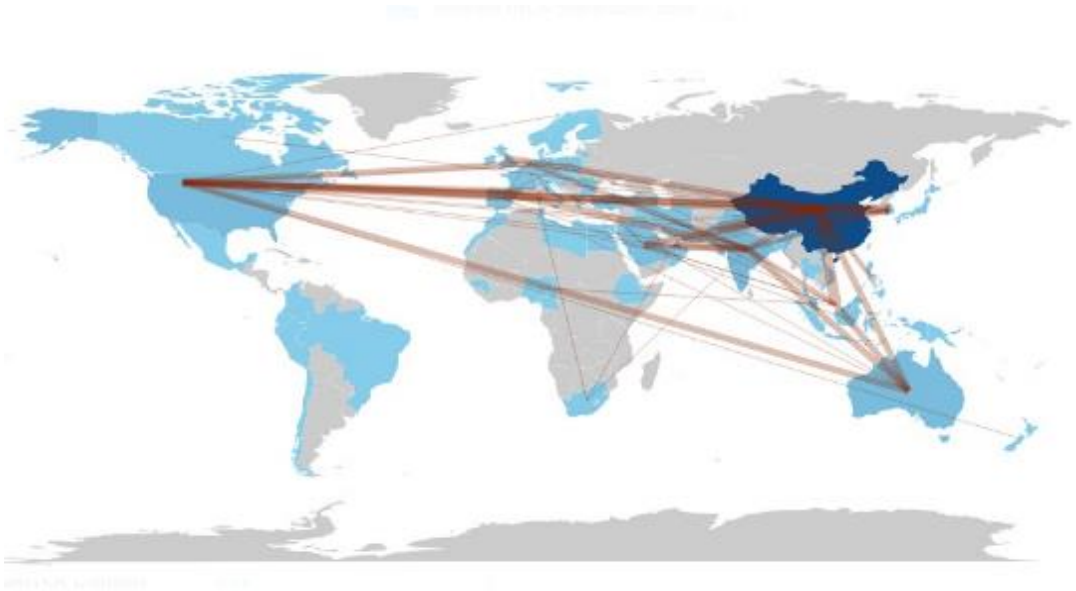

Figure 3. Countries' Collaboration World Map

Figure 3 depicts the relationship between countries with high publication contributions, as reflected in patterns of international research collaboration. Countries with a substantial number of publications tend to have broader connections and are more frequently cited by researchers worldwide. This indicates that a high volume of publications from a given country can enhance its visibility and increase the likelihood of citations, thereby fostering deeper engagement from researchers in other nations and contributing significantly to scientific advancement (Masic, 2022). Furthermore, the data reveal that countries with the highest citation contributions, as illustrated in the figure, demonstrate strong patterns of scientific interaction. This underscores the importance of global collaboration in advancing research within the relevant fields.

Table 2. Most Cited Countries

Country	TC	Average Article Citations
China	1507	7,40
Korea	524	25,00
Australia	432	16,00
India	246	12,30
France	239	29,90
Spain	237	29,60
Iran	206	20,60
Germany	186	37,20
Bulgaria	168	84,00
Usa	157	19,60

Furthermore, Bulgaria and Germany have exceptionally high average citations per article, with 84.00 and 37.20, respectively, indicating that research articles from these two countries receive significant individual attention from the global academic community. This suggests that although China has the highest total citations (TC = 1507), the quality or impact of individual articles from countries such as Bulgaria and Germany is more notable on average. Similarly, France and Spain also demonstrate strong influence, with average article citations of 29.90 and 29.60, respectively. The data highlights that while China and Korea are prolific in terms of total citations, countries like Bulgaria, Germany, and France maintain a more substantial academic influence per publication. This trend reflects a possible emphasis on high-quality research output or groundbreaking studies from these countries. Furthermore, this pattern suggests that the impact of publications is not solely determined by productivity but also by the depth, relevance, and citation potential of individual studies. The variation in average article citations across countries may be influenced by differences in research focus, academic collaboration, and the international visibility of journals in which these studies are published.

3. Network Visualization of Data

Furthermore, researchers visualized all research results using VOSViewer to see the research variables and the relationship between variables. The visualization results are as shown in Figure 4.

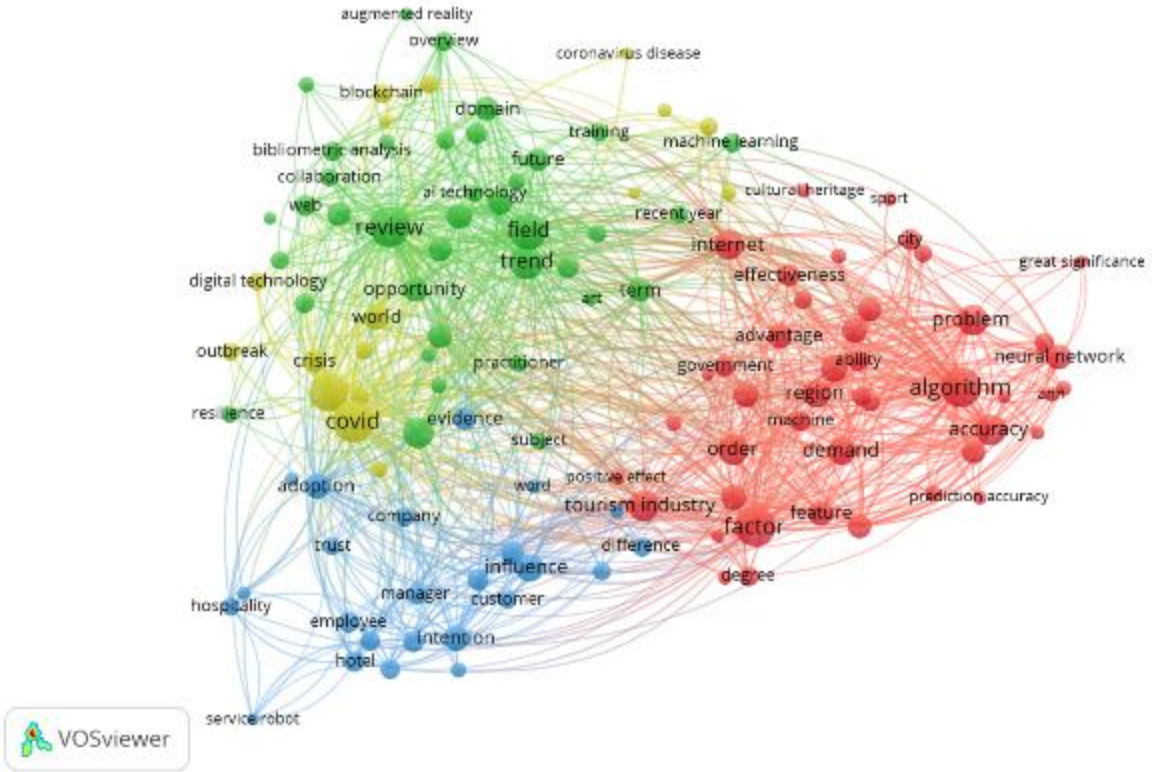

Figure 4. Network visualization of modern boarding school curriculum management

Figure 4 is a network visualization of all variables studied over the past 10 years and depicts four different color clusters: green, red, yellow, and blue. The interpretation is as follows. The green cluster emphasizes the role of AI-driven technology development and innovation trends within the tourism industry. Dominant keywords such as innovation, trend, development, and technology highlight the ongoing efforts to integrate advanced technologies to transform the tourism sector. Terms like virtual reality and platform indicate the use of cutting-edge tools to create more interactive, immersive, and engaging tourism experiences for travelers. Virtual reality, for instance, enables virtual tours and pre-visit experiences, helping tourists explore destinations remotely before physically visiting them. The inclusion of keywords like growth, optimization, and future underscores the importance of sustainable innovation in boosting operational efficiency, expanding tourism markets, and ensuring future readiness for evolving customer demands. This cluster reflects the potential of AI to optimize services and pioneer new approaches to enhance user experiences, positioning AI innovation as a critical driver of tourism growth and technological transformation.

The red cluster focuses on the application of AI in managing the operational aspects of the tourism industry. Keywords such as management, problem solving, strategy, system, and efficiency indicate the role of AI in designing data-driven strategies, solving complex challenges, and improving operational workflows within tourism enterprises. AI technologies enable predictive systems that streamline planning, resource allocation, and operational decision-making. The

inclusion of terms like network and data highlights the use of data analytics and machine learning to assess vast datasets, optimize connectivity among tourism stakeholders, and provide informed decisions for networked systems. This cluster demonstrates that AI plays a pivotal role in enhancing managerial practices, solving operational inefficiencies, and achieving cost-effective solutions while maintaining competitive industry standards. AI-driven systems ensure that tourism management aligns with dynamic market needs and addresses real-time challenges efficiently.

The blue cluster reflects the growing significance of AI in enhancing customer service within the tourism sector. Dominant keywords such as service, customer, experience, and satisfaction showcase AI's transformative role in delivering superior customer experiences. AI-powered technologies, such as personalization and recommendation systems, allow tourism providers to analyze customer preferences, behavior, and feedback to deliver tailored services that meet individual traveler needs. The term smart tourism further emphasizes the integration of AI tools to create smarter, connected, and efficient tourism experiences. AI-based systems in hospitality and tourism enhance customer satisfaction by providing dynamic recommendations, seamless booking processes, and predictive services that anticipate traveler needs. Additionally, reviews and automated support systems ensure real-time feedback, enabling tourism providers to refine their services and improve overall customer experiences. The blue cluster highlights AI's ability to strengthen hospitality services and foster deeper connections with customers, leading to higher satisfaction and loyalty.

The yellow cluster explores the digital transformation and social changes driven by AI applications in the tourism industry, particularly in the wake of the COVID-19 pandemic. Keywords such as covid, policy, social, and remote indicate the significant shift in how tourism services are delivered and consumed during and after the pandemic. AI-enabled tools facilitated remote tourism management, contactless services, and virtual experiences, addressing safety concerns while ensuring business continuity. Words like impact, transformation, and change underline the broad societal implications of adopting AI technologies, which influence workforce dynamics, operational policies, and traveler behavior. Furthermore, sustainability and economy emphasize the need for long-term AI-driven solutions that balance economic recovery with environmental and social sustainability goals. This cluster highlights the broader role of AI in redefining tourism practices, adapting to socio-economic disruptions, and enabling a more resilient and sustainable future for the global tourism industry. Based on the interpretation of each cluster, the researcher can formulate several important points as a synthesis of the curriculum management of modern Islamic boarding schools as follows:

a. Digital Technology Innovation and Virtual Reality in the Modern Travel Experience

Digital technology and virtual reality have transformed the modern travel experience by offering innovative solutions to challenges faced by the tourism industry. The COVID-19 pandemic accelerated the adoption of digital technologies within the hospitality and tourism sectors, particularly in data processing and network-based technologies (Elkhwesky et al., 2024). Augmented Reality (AR) has emerged as a valuable tool for enhancing tourism experiences, especially in the post-pandemic context (Allcca-Alarcón et al., 2023). Likewise, the application of Virtual Reality (VR) in festivals has garnered increasing attention for its ability to provide immersive experiences for remote participants (S. Kumar & Shekhar, 2020). These technological advancements are not limited to urban settings; rural tourism has also significantly benefited, unlocking new opportunities for socio-economic development (Lee et al., 2022). As the tourism industry continues to evolve, the integration of digital technologies such as AR and VR is anticipated to play a pivotal role in shaping future travel experiences. These technologies offer practical solutions for improving visitor engagement, expanding accessibility, and addressing the ongoing challenges faced by the sector.

The innovation of digital technology, particularly through virtual reality (VR), has significantly transformed modern travel experiences by offering more immersive and interactive ways for individuals to explore tourist destinations. This technology not only enhances pre-travel experiences but also plays a crucial role in cultural dissemination and destination marketing. VR creates three-dimensional environments that enable users to experience destinations as if they were physically present, an innovation that gained considerable popularity during the COVID-19 pandemic as a safe alternative to traditional travel (Zeng et al., 2022). Furthermore, virtual tourism experiences have the potential to instill pride among visitors for local cultures while encouraging them to share cultural knowledge, thus promoting broader cultural exchange (Siddiqui et al., 2022). The emotional engagement provided by VR is vital in fostering a deeper connection between tourists and the cultural identity of a destination. From a marketing perspective, VR has become an effective tool for creating compelling imagery of tourist destinations, thereby influencing the decisions of potential travelers. The integration of VR allows destinations to communicate their unique offerings more efficiently, which is especially critical in supporting the tourism sector's recovery in the post-pandemic era (Wang, 2024). However, despite its numerous advantages, VR adoption also presents limitations, such as the potential diminishment of authentic physical travel experiences and the digital divide, which may exclude certain demographic groups from accessing this technology.

Augmented Reality (AR) and Virtual Reality (VR) technologies play a significant role in enhancing the quality of tourism experiences, both in terms of destination marketing and cultural dissemination. VR allows travelers to virtually explore destinations as if they were physically present, serving as an effective solution during the COVID-19 pandemic when mobility was restricted. Meanwhile, AR enriches user interaction by providing real-time contextual information, making the engagement with tourism destinations more immersive and informative. These technologies have the potential to foster greater appreciation for local cultures while expanding global access to tourism experiences. However, challenges such as limited access to digital resources among certain demographic groups remain a significant barrier. Moreover, the implementation of AR and VR must strike a balance between virtual experiences and the authenticity of physical travel to ensure that the core essence of tourism is preserved. Therefore, inclusive policies are essential to ensure equitable access to these technologies across all societal segments, thereby maximizing their benefits for the tourism industry.

b. Optimization of Tourism Management Strategy through Artificial Intelligence Technology

Artificial Intelligence (AI) is increasingly important in tourism and hospitality management, offering solutions for sustainable tourism and enhancing customer experiences. AI methods can improve decision-making and support in these industries, with applications ranging from demand forecasting to behavior pattern analysis (Majid et al., 2023). The adoption of intelligent automation in tourism presents opportunities to address sustainability issues, particularly in economic and sociocultural aspects, though environmental applications are less developed (Ballamudi, 2019). Ethical considerations are crucial when implementing AI in tourism and hospitality, with roboethics playing a significant role in service innovation and customer experience optimization (Hall, 2022). As AI technology advances, it will have varying effects on management, potentially taking over certain managerial tasks and helping address management challenges. Consequently, managers will need to develop new competencies and skills to adapt to AI-based environments (Camilleri & Troise, 2023).

The integration of artificial intelligence (AI) technology in tourism management offers innovative solutions to enhance efficiency, sustainability, and customer satisfaction (Shafiee, 2024). AI technologies, such as recommendation systems and chat-bots, enable the delivery of personalized services tailored to the preferences of tourists, thereby increasing satisfaction and customer loyalty. Predictive analytics helps forecast demand and seasonal trends, supporting the effectiveness of marketing strategies (Zimik & Barman, 2024). In terms of sustainability, AI is used to manage tourist flows and reduce environmental impacts through the integration of IoT and big

data analytics. Additionally, AI improves operational efficiency by automating routine processes and providing accurate predictions using advanced algorithms (Ma, 2024). Although it offers numerous benefits, challenges such as ethical considerations and the need for collaboration among stakeholders must be addressed. Thus, the potential of AI in the tourism sector can be optimized to deliver sustainable benefits (Gu, 2024).

Artificial Intelligence (AI) has a significant impact on tourism management by optimizing various processes that were previously handled manually. AI-based recommendation systems and chatbots allow service providers to offer more personalized experiences, which enhances customer satisfaction and loyalty. AI is also capable of predicting demand and seasonal trends, helping stakeholders design more precise and responsive marketing strategies. In terms of sustainability, AI offers solutions to manage tourist flows, reduce negative environmental impacts, and optimize resource use through big data analytics and the Internet of Things (IoT). However, the implementation of AI needs to consider ethical aspects, such as data privacy protection, and the importance of collaboration among stakeholders. Evaluation shows that AI provides substantial benefits, including operational efficiency, better resource management, and improved tourist experience quality. AI automates routine processes, allowing tourism companies to focus on enhancing service quality. However, ethical challenges and the need for cooperation among parties require further attention. Although AI has the potential to reduce environmental impact, its application in this context is still limited and requires further development.

c. Implementation of Smart Tourism to Improve Tourist Satisfaction and Experience

Smart tourism utilizes information technology and intelligent infrastructure to enhance tourist experiences and service provision (Ye et al., 2020). Recent systematic reviews indicate a growing academic interest in this field, with research focusing on the impact of technology on tourist perceptions, behaviors, and experiences (Si-Tou, 2024). Studies have explored smart tourism from consumer, technological, and provider perspectives, with a focus on mobile technologies and applications (Azevedo Sampaio & Braga, 2023). The concept of Smart Tourism Destinations (STDs) has gained traction, especially in Europe, with research agendas addressing various aspects of smart principles in tourism (Absari et al., 2023).However, gaps remain in sustainability research and practical conceptualizations for smart tourism development. In Indonesia, efforts are underway to develop a conceptual model for smart tourism, considering local values and heritage tourism as a case study (Montero & Sánchez, 2021).

The implementation of smart tourism technologies (STT) significantly enhances tourist satisfaction and experience by leveraging innovative solutions to address challenges in the tourism sector (Li, 2024). By integrating technologies such as artificial intelligence, big data analytics, and personalized services, destinations can optimize resource use and increase visitor engagement. Personalization is crucial for tourist satisfaction, as customized experiences have been proven to enhance revisit intentions (Qian et al., 2023). Smart tourism applications can analyze user preferences to provide relevant recommendations, improving the overall travel experience. Additionally, smart technologies help manage tourist flows, reduce overcrowding, and address environmental impacts, especially in over-tourism scenarios (Rahmawati et al., 2023). The use of Internet of Things (IoT) and big data analytics allows for real-time monitoring of tourist activities, supporting better planning and efficient resource allocation (et al., 2023).

This research indicates that the implementation of smart technology in the tourism sector brings significant changes in the interaction between destinations, service providers, and tourists. Technology enables the personalization of services through applications that analyze tourist preferences and provide relevant recommendations, which contributes to increased customer satisfaction and loyalty. Additionally, the use of big data and the Internet of Things (IoT) to monitor tourist flows in real-time provides a deeper understanding of visitation patterns, which not only reduces crowding but also supports more efficient resource management. However, the implementation of this technology in the context of tourism sustainability is still in its early stages, with most research focusing on crowd management and the negative impacts caused by over-tourism. Another challenge is the development of smart tourism models that can integrate local values and culture, which is particularly important in developing countries like Indonesia. Smart tourism technology offers various benefits, especially in enhancing tourist experiences and operational efficiency at destinations. The successful implementation of technologies such as artificial intelligence (AI) and big data analytics can be seen in its ability to personalize travel experiences, optimize resource management, and reduce environmental impacts through more effective tourist flow management. The application of IoT also provides deeper real-time monitoring, allowing better management of interactions between tourists and destinations. However, a major challenge that needs attention is sustainability, which has not received sufficient focus in this research. Although technology can reduce negative environmental impacts, such as crowding, pollution, and ecosystem damage, its application is still limited to managing tourist flows, while research on how this technology can support sustainability in other aspects, such as cultural preservation and natural resource management, remains very limited.

D. CONCLUSION

Based on the evaluation of the implementation of technology in smart tourism, it can be concluded that technologies such as VR, AR, and AI have great potential to revolutionize the tourism industry by enhancing tourist experiences, operational efficiency, and environmental sustainability. These technologies can personalize services, manage tourist flows, and provide relevant information in real-time. However, challenges that need to be addressed include the existing technological gaps, limitations in sustainability applications, and ethical issues related to the use of tourists' personal data and automated interactions.

Although there has been progress in the adoption of these technologies, research gaps still exist, particularly in developing practical models that integrate local values and culture within the context of smart tourism, as well as the application of technologies that support ecosystem preservation. In Indonesia, while efforts are being made to create a smart tourism model that considers local cultural and historical richness, further research is needed to develop a more inclusive and sustainable approach. Therefore, urgent research topics for the future include the development of smart tourism models that integrate ecosystem sustainability and cultural heritage preservation, as well as finding technological solutions that can address social and ethical issues regarding the use of tourists' personal data. This research will be crucial to ensure that the benefits of technology in tourism can be equitably and sustainably experienced by all stakeholders, while supporting the development of a more inclusive and responsible tourism industry.

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