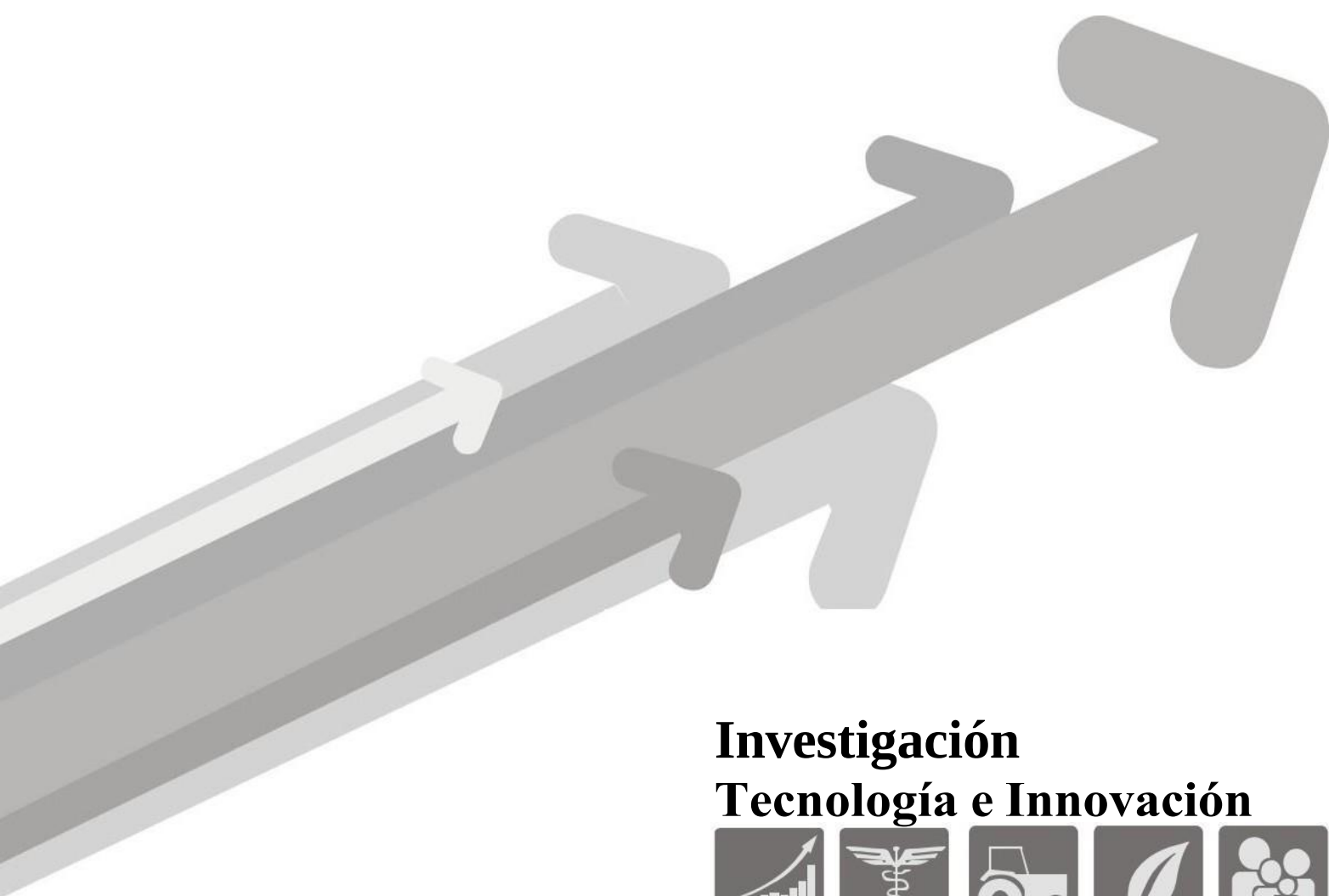


La convergencia entre inteligencia artificial y turismo: perspectivas de desarrollo sostenible y eficiencia operativa

The convergence between artificial intelligence and tourism: perspectives for sustainable development and operational efficiency

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**Investigación
Tecnología e Innovación**



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RESUMEN

Contexto: La convergencia IA-turismo está transformando digitalmente la industria, mejorando eficiencia operativa y experiencias de viaje, pero presenta desafíos éticos en privacidad e inclusión que requieren atención. **Objetivo:** Analizar el impacto de la IA en turismo sostenible mediante el estudio de: (1) hiperpersonalización, (2) automatización de procesos y (3) análisis predictivo, bajo un enfoque de responsabilidad tecnológica. **Metodología:** Revisión sistemática cualitativa PRISMA de 45 artículos (2004-2024) seleccionados de Scopus, Web of Science y Google Scholar, utilizando criterios de rigor metodológico, acceso abierto y relevancia temática. **Resultados:** La Hiperpersonalización mejora la satisfacción del viajero mediante recomendaciones adaptativas, aunque requiere mayores garantías de privacidad y transparencia. La **automatización optimiza** procesos operativos, pero exige estrategias de capacitación laboral para mitigar impactos en empleos y los **predictivos** permiten gestión más eficiente de destinos, aunque su implementación enfrenta barreras técnicas y regulatorias. **Conclusiones:** La IA puede impulsar un turismo más sostenible mediante: Regulaciones éticas específicas para aplicaciones turísticas, programas de formación profesional adaptados y modelos colaborativos entre sector público, privado y academia. **Contribución principal:** Enfoque holístico que integra beneficios tecnológicos con consideraciones sociales y ambientales, superando perspectivas puramente técnicas.

Palabras clave: Inteligencia artificial, Turismo sostenible, Automatización de procesos, Análisis predictivo, Hiperpersonalización.

ABSTRACT

Context: The AI-tourism convergence is digitally transforming the industry, enhancing operational efficiency and travel experiences while presenting ethical challenges in privacy and inclusion that demand attention. **Objective:** To analyze AI's impact on sustainable tourism by examining: (1) hyper-personalization, (2) process automation, and (3) predictive analytics through a technological responsibility framework. **Methodology:** PRISMA-guided qualitative systematic review of 45 articles (2004-2024) from Scopus, Web of Science, and Google Scholar, selected using methodological rigor, open-access, and thematic relevance criteria. **Results:** The Hyper-personalization enhances traveler satisfaction through adaptive recommendations, yet requires strengthened privacy safeguards and transparency protocols. The automation optimizes operational workflows but necessitates workforce reskilling strategies to mitigate employment disruptions and The predictive systems enable more efficient destination management, though implementation faces technical and regulatory barriers. **Conclusions:** AI can drive sustainable tourism through: tailored ethical regulations for tourism applications, adaptive professional training programs and public-private-academic collaborative models. **Primary Contribution:** A holistic framework integrating technological benefits with socio-environmental considerations, advancing beyond purely technical perspectives.

Keywords: Artificial intelligence, Sustainable tourism, Process automation, Predictive analytics, Hyper-personalization

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INTRODUCTION

The technological revolution has driven significant transformation in the tourism sector, establishing artificial intelligence (AI) as a key driver of innovation. However, this transformation is not without challenges, particularly in ensuring sustainability, equity, and ethical management. The convergence between artificial intelligence (AI) and tourism has become a critical area of study in the digital age, driven by the need to address challenges such as environmental sustainability, operational efficiency, and the hyper-personalization of travel experiences (Buhalis, 2020; Ivanov and Webster, 2019). The problem addressed by this study lies in understanding how AI can contribute to sustainable tourism while mitigating social and ethical risks such as data privacy, labor displacement, and digital exclusion. This research is justified by the rapid adoption of AI within the tourism sector, which necessitates an analytical framework capable of balancing innovation with social responsibility (Asif and Fazel, 2024; Tussyadiah, 2020). This research is justified by the rapid adoption of AI within the tourism sector, which necessitates an analytical framework capable of balancing innovation with social responsibility (Gretzel et al., 2020).

A review of the existing literature reveals several significant gaps that hinder a comprehensive understanding of this phenomenon. Firstly, there is a lack of ethical regulations concerning the use of tourism-related data (Mayorga et al., 2024). Secondly, there is a scarcity of longitudinal studies on the impact of automation on employment (Go and Kang, 2023). Thirdly, the limited integration of multidisciplinary perspectives—such as technology, sociology, and sustainability—restricts the development of holistic and contextually relevant solutions (Gómez and Buitrago, 2024). The adoption of intelligent technologies facilitates the development of innovative solutions that enhance efficiency, sustainability, and competitiveness within the industry (Díaz & Varela, 2024; Gómez et al., 2017). AI enables the collection, analysis, and interpretation of large datasets (big data), improving strategic decision-making, process automation, and the anticipation of traveler behavior patterns. These capabilities are essential for service personalization, destination planning, and dynamic pricing management, among other applications (Muñoz et al., 2024; Ivanov & Webster, 2019).

However, the integration of AI in tourism also presents significant challenges. Data privacy, digital exclusion, and employment impacts are among the critical issues requiring ethical regulation and social inclusion policies. Furthermore, transparency and user trust are crucial elements in ensuring the responsible and sustainable adoption of AI technology (Martínez et al., 2024; Nicolalde et al., 2024). Given these considerations, the general objective of this study is to analyze the convergence between AI and tourism, identifying the opportunities, benefits, and challenges arising from the integration of hyper-personalization, process automation, and predictive analytics for the sustainable development of the tourism industry.

The central research question is: How does the integration of artificial intelligence into hyper-personalization, process automation, and predictive analytics contribute to sustainable development and operational efficiency in the tourism sector? To answer this question, the article is structured into several sections. It begins with an introduction that contextualizes the research problem and objectives. The following section details the methodology adopted for data collection and analysis. Subsequently, the study explores the three primary areas of convergence between AI and tourism: hyper-personalization, process automation, and predictive analytics.



Through technical analysis, the study examines the opportunities, benefits, and challenges associated with each dimension, offering an integrated perspective on AI's impact on the tourism industry (Alonso, 2019). Findings are obtained through the triangulation of analytical and emerging categories, consolidating a critical perspective on the relationship between artificial intelligence and sustainable development in the sector. Finally, the discussion, conclusions, and recommendations for future research are presented.

METHODOLOGY

Design and Methodology

This study adopts a qualitative exploratory-descriptive design, focused on analyzing the convergence between artificial intelligence and tourism. The methodological structure is based on a systematic literature review, applying the PRISMA protocol to ensure transparency and reproducibility (Rushforth, 2016; Bensman & Leydesdorff, 2009).

The methodological design is grounded in a combination of narrative synthesis and bibliometric mapping, which allows for a comprehensive understanding of the phenomenon from both analytical and emerging perspectives. Search equations were defined to combine controlled and uncontrolled terms related to the analytical and emerging categories. The keywords used include: "Artificial intelligence" OR "Intelligence Artificial" and "Tourism" OR "Turismo." These equations are applied in recognized academic databases such as Scopus, Web of Science, and Google Scholar, employing Boolean operators and filters by language (Spanish and English), a 20-year observation window (2004–2024), and open-access articles (Tables 1 and 2; Barbosa et al., 2020; Aguilera et al., 2020; Carrizo, 2000).

Table 1. Example of a Search Equation for the Category "Intelligence Artificial" OR "Artificial Intelligence"

DATABASE	Search Equations
WoS	Tema: ("Inteligencia Artificial" OR "Artificial Intelligence ") Índices=SCI-EXPANDED, SSCI, A&HCI, ESCI Período de tiempo=Todos los años
	Tema: ("Inteligencia Artificial" OR "Artificial Intelligence ") Refinado por: Años de publicación: (2016 OR 2017 OR 2010 OR 2013 OR 2015 OR 2012 OR 2009 OR 2011 OR 2014 OR 2008 OR 2020 OR 2021 OR 2022 OR 2019 OR 2018 OR 2006 OR 2005 OR 2004 OR 2003 OR 2002 OR 2001 OR
	2000) Índices=SCI-EXPANDED, SSCI, A&HCI, ESCI Período de tiempo=Todos los años
	Tema: ("Inteligencia Artificial" OR "Artificial Intelligence ") Índices=SCI-EXPANDED, ESCI, A&HCI, SSCI Período de tiempo=Todos los años
	TITLE-ABS-KEY ("Inteligencia Artificial" OR "Artificial Intelligence ")



Scopus	TITLE-ABS-KEY ((“Inteligencia Artificial” OR “Artificial Intelligence “))
	TITLE-ABS-KEY ((“Inteligencia Artificial” OR “Artificial Intelligence”)) AND (LIMIT-TO (PUBYEAR, 2018) OR LIMIT-TO (PUBYEAR, 2017) OR LIMIT-TO (PUBYEAR, 2019) OR LIMIT-TO (PUBYEAR, 2020) OR LIMIT-TO (PUBYEAR, 2016) OR LIMIT-TO (PUBYEAR, 2015) OR LIMIT-TO (PUBYEAR, 2014) OR LIMIT-TO (PUBYEAR, 2022) OR LIMIT-TO (PUBYEAR, 2023) OR LIMIT-TO (PUBYEAR, 2013) OR LIMIT-TO (PUBYEAR, 2012) OR LIMIT-TO (PUBYEAR, 2011) OR LIMIT-TO (PUBYEAR, 2010) OR LIMIT-TO (PUBYEAR, 2009) OR LIMIT-TO (PUBYEAR, 2008) OR LIMIT-TO (PUBYEAR, 2000) OR LIMIT-

Prepared by the authors based on the following sources: Gómez et al., 2024; Rincón & Gómez, 2023; Page et al., 2021; Van Eck & Waltman, 2009).

Table 2. Example of a Search Equation for the Category "Turismo" OR "Tourism"

DATABASE	Search Equations
WoS	Tema: (("Turismo" OR "Tourism")) Índices=SCI-EXPANDED, SSCI, A&HCI, ESCI Período de tiempo=Todos los años
	Tema: ("Turismo" OR "Tourism ") Refinado por: Años de publicación: (2016 OR 2017 OR 2010 OR 2013 OR 2015 OR 2012 OR 2009 OR 2011 OR 2014 OR 2008 OR 2020 OR 2021 OR 2022 OR 2019 OR 2018 OR 2006 OR 2005 OR 2004 OR 2003 OR 2002 OR 2001 OR 2000) Índices=SCI-EXPANDED, SSCI, A&HCI, ESCI Período de tiempo=Todos los años
	Tema: ("Turismo" OR "Tourism Índices=SCI-EXPANDED, ESCI, A&HCI, SSCI Período de tiempo=Todos los años



Scopus	TITLE-ABS-KEY ("Turismo" OR "Tourism")
	TITLE-ABS-KEY (("Circuitos cortos de comercialización or Short food supply chains (SFSCs)) ")
	TITLE-ABS-KEY (("Turismo" OR "Tourism")) AND (LIMIT-TO (PUBYEAR, 2018) OR LIMIT-TO (PUBYEAR, 2017) OR LIMIT-TO (PUBYEAR, 2016) OR LIMIT-TO (PUBYEAR, 2015) OR LIMIT-TO (PUBYEAR, 2014) OR LIMIT-TO (PUBYEAR, 2013) OR LIMIT-TO (PUBYEAR, 2012) OR LIMIT-TO (PUBYEAR, 2011) OR LIMIT-TO (PUBYEAR, 2010) OR LIMIT-TO (PUBYEAR, 2009) OR LIMIT-TO (PUBYEAR, 2008) OR LIMIT-TO (PUBYEAR, 2000) OR LIMIT-

Prepared by the authors based on the following sources: Gómez et al., 2024; Rincón & Gómez, 2023; Page et al., 2021; Van Eck & Waltman, 2009).

Selection criteria

The bibliographic search was guided by clearly defined inclusion criteria: peer-reviewed articles published between 2004 and 2024, in Spanish or English, with open access availability, and high thematic relevance, determined by keywords such as "AI in tourism," "sustainable tourism," and "predictive analytics." These conditions ensured both the currency and relevance of the document corpus (Del Vecchio, 2018; Yin, 2018).

Procedures

The selection process followed the PRISMA flow diagram in four stages:

Identification: 730 articles were retrieved after applying the search equations.

Screening: duplicates and studies not directly related to tourism or artificial intelligence were removed, reducing the sample to 540 articles.

Eligibility: titles, abstracts, and keywords were reviewed, selecting 150 articles that met the inclusion criteria.

Inclusion: Finally, 45 articles were selected for in-depth qualitative analysis, considering their thematic relevance, recency, and methodological rigor (Maldonado, 2016; Van Eck & Waltman, 2009).

Analysis techniques

The qualitative content analysis was performed through triangulation between predefined analytical categories—such as hyper-personalization and automation—and emerging categories identified during coding, such as ethics and inclusion. This strategy allowed for the identification of patterns, opportunities, benefits, and challenges associated with integrating AI into the tourism sector. Additionally, bibliometric techniques were applied using VOS viewer software, enabling the mapping of co-authorship networks and thematic trends within the field (Devi Prasad, 2019; Castro et al., 2017).

Tools

For data collection and organization, thematic synthesis matrices were employed, while the qualitative analysis was conducted using NVivo software, facilitating a structured, rigorous, and systematic coding of the reviewed content. Together, this methodology enabled a comprehensive view of the convergence between artificial intelligence and tourism, integrating technological innovation, sustainability, and social inclusion Camacho et al., 2013; Denzin, 2012).



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RESULTS

Hyper personalization

Hyperpersonalization, driven by the integration of AI within the tourism sector, redefines the traveler's experience through highly customized services based on individual preferences. Our results align with Wang et al. (2020) in demonstrating that AI enhances traveler experience through contextual recommendations, but contrast with Li & Law (2022) by revealing heightened privacy risks in emerging destinations. The deployment of machine learning algorithms and data mining techniques enables the development of comprehensive user profiles derived from analysis of booking histories, browsing behaviors, and explicitly stated preferences. These profiles support the generation of personalized recommendations spanning destination choices, activity suggestions, and ancillary services [Valencia et al., 2024; Rodríguez et al., 2021].

The analysis identified three main contributions of AI to tourism: hyperpersonalization, process automation, and predictive analytics. Hyperpersonalization enhances customer experience by tailoring services based on individual preferences, improving satisfaction and loyalty. This is achieved through dynamic personalization where AI adapts offers in real-time according to user interactions. Context-aware recommendation systems, utilizing geographic location and weather data, optimize traveler satisfaction and enhance perceived service quality [Wang et al., 2020; Buhalis & Leung, 2018].

However, these advancements involve ethical implications and implementation challenges. The approach raises critical concerns, chiefly related to informed consent and the protection of personal data. Ensuring transparency in data management practices and implementing user control mechanisms are fundamental measures to build trust amidst these challenges, particularly in data governance and equitable access [Asif & Fazel, 2024; Dziurakh et al., 2024].

Process automation

AI-driven process automation has fundamentally transformed operational management in tourism, enhancing efficiency and reducing operational costs. Automated systems enable routine tasks such as booking management, payment processing, and customer service to be streamlined. Chatbots equipped with natural language processing facilitate instant, personalized customer interactions around the clock (Gómez, 2018; Rincon et al., 2017).

In logistics, AI improves route optimization, inventory control, and service coordination, leading to increased efficiency and reduced wait times. Additionally, biometric systems and facial recognition technologies expedite check-in procedures at airports and hotels, enhancing security and elevating the user experience [Chi et al., 2020; Gretzel et al., 2020].

However, the adoption of process automation presents challenges related to workforce displacement and the need for workforce reskilling. Implementing comprehensive reskilling policies and ongoing training initiatives is vital to mitigate social impacts and promote inclusive labor practices, thereby supporting the sustainable development of the tourism industry [Go & Kang, 2023; Tussyadiah, 2020].

Predictive analytics



AI-powered predictive analytics has revolutionized strategic planning in tourism by enabling the anticipation of behavioral patterns and the optimization of service offerings. Machine learning models, including neural networks and decision trees, support demand forecasting, customer segmentation, and identification of market opportunities [Tellez et al., 2020; Del Vecchio et al., 2018].

A key advantage of predictive analytics is dynamic pricing management, which allows for real-time fare adjustments based on demand, competitive landscape, and market conditions. Additionally, AI contributes to destination planning by predicting visitor flows and evaluating environmental impacts, thus supporting sustainability efforts and the preservation of natural resources [Korov et al., 2024; Rincón & Gómez, 2023].

However, deploying predictive analytics necessitates the collection and analysis of large datasets, raising concerns about privacy and data security. The establishment of regulatory frameworks and transparent data governance practices are essential to foster user trust and facilitate the responsible adoption of these AI technologies [Mayorga et al., 2024; Gómez et al., 2024].

DISCUSSION

The convergence between artificial intelligence and tourism has a transformative impact on the industry, with profound implications for traveler experience, operational efficiency, and sustainability. The results obtained are consistent with previous studies that recognize the transformative role of AI in tourism (Buhalis & Leung, 2018; Gretzel et al., 2020). However, this article contributes to the literature by integrating the ethical, social, and technological dimensions of AI under a sustainability framework. The three convergence areas analyzed—hyperpersonalization, process automation, and predictive analytics—demonstrate AI's ability to optimize tourism services while also raising ethical, social, and regulatory challenges (Ortiz et al., 2024; Gómez & Velasco, 2024).

Unlike other works that focus solely on technical advancements, this study emphasizes the importance of intersectoral collaboration and the co-construction of regulatory mechanisms. Hyperpersonalization enhances user satisfaction and fosters customer loyalty but requires a balance between personalization and privacy. Process automation, while increasing efficiency and reducing costs, may lead to workforce displacement, necessitating reskilling and continuous training strategies. Meanwhile, predictive analytics enables more efficient and sustainable planning, but its implementation must consider data protection and transparency to prevent the misuse of information (Gómez, 2024; Borràs et al., 2014).

Theoretical implications include the construction of a digital sustainability model that balances innovation with social responsibility. Practical implications suggest the formulation of public policies to ensure inclusive implementation and the development of educational programs for workforce reskilling. Indeed, it is essential for tourism companies to adopt a holistic approach that combines technological innovation with social responsibility. The development of regulatory frameworks, the implementation of ethical standards, and the promotion of digital inclusion are fundamental actions to ensure that AI contributes to the sustainable development of tourism. Additionally, continuous professional training becomes a key strategy to leverage AI's opportunities without compromising social well-being and environmental preservation (Buhalis, 2020; Laverde et al., 2020).

In this context, collaboration between the public sector, private sector, and academia is crucial for building an intelligent, inclusive, and human-centered tourism ecosystem. The convergence between AI and tourism



should be guided by the creation of shared value, where technological innovation translates into tangible benefits for society and the environment (Gómez & Buitrago, 2024; Rattanamanee, 2024; Caputo et al., 2021).

This study contributes to the literature by integrating the technical, ethical, and social dimensions of AI in tourism, an approach that has been scarce in previous works (Buhalis & Leung, 2018). The findings align with Díaz & Varela (2024) regarding the importance of regulation but extend the discourse by proposing labor inclusion strategies beyond automation (Gómez, 2024b), thereby addressing gaps in existing frameworks.

CONCLUSIONS

The convergence between artificial intelligence and tourism represents a paradigmatic transformation, driving operational efficiency, sustainability, and sector competitiveness. AI is reshaping the tourism industry by enhancing efficiency and personalization. Process automation enables the optimization of booking management, customer service, and logistics, reducing costs and response times, ultimately leading to greater business efficiency. However, this process also presents challenges related to workforce displacement, requiring reskilling and training strategies to minimize social impact and promote labor inclusion.

Hyperpersonalization emerges as one of AI's main contributions to tourism, allowing for highly personalized services through the analysis of large volumes of data. This article demonstrates that sustainable transformation is possible when technology is guided by ethical and inclusive principles. This capability enhances the user experience and strengthens customer loyalty, but also raises ethical dilemmas related to privacy and transparency in information usage. The implementation of informed consent mechanisms and the adoption of regulatory frameworks appear as essential strategies to ensure user trust and acceptance.

Predictive analytics, based on machine learning models, has revolutionized strategic planning in the tourism sector by anticipating demand, optimizing service offerings, and assessing environmental impact. The study highlights the importance of developing regulatory frameworks, fostering intersectoral partnerships, and promoting digital literacy. This capability enables more efficient and sustainable management of tourism destinations but requires policies that balance technological innovation with social and environmental responsibility. Collaboration between the public sector, private sector, and academia is solidifying as a fundamental pillar for the creation of an intelligent, inclusive, and sustainability-driven tourism ecosystem.

In sum, the contribution of this paper lies in offering a multidimensional perspective on AI in tourism that bridges the gap between innovation and sustainability. AI transforms tourism through efficiency and personalization, but its success depends on addressing ethical and social challenges. This article offers a holistic perspective that combines innovation with responsibility, expanding the debate on sustainable development. Future research should explore empirical case studies and longitudinal impacts on labor dynamics in smart tourism destinations.

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