AI & Big Data in Tourism for Decision Making. Ecuador Case

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Abstract. This research presents a systematic review of the literature on the application of Artificial Intelligence (AI) and Big Data in tourism, with an emphasis on Ecuador. The main objective is to analyse approaches from empirical studies, scientific articles and industry reports from the last 20 years. The focus is on AI techniques such as machine learning, natural language processing, computer vision and Big Data analysis methods. These are applied to massive data from travellers and online platforms. The methodology combines a comprehensive systematic literature review of Scopus, Web of Science and Dimensions with a field survey of 25 tourism companies in Quito, Guayaquil and Cuenca using non-probabilistic convenience sampling. The survey gathered data on AI and Big Data adoption, perceived impact, investment plans and barriers to adoption. The results show that AI and Big Data have broad applications in areas such as market segmentation, experience personalisation, price optimisation and trend analysis. However, adoption gaps exist in developing countries such as Ecuador. Preliminary results suggest great potential to boost the competitiveness and sustainability of Ecuadorian tourism through AI and Big Data by adapting existing approaches to the local context. Future research areas and the need for integrative methodological frameworks are highlighted.
Keywords: Information Management , Tourism Management, Artificial Intelligence , Big Data, Decision Support Systems, Systematic Literature Review

INTRODUCTION

1.1The Impact of Artificial Intelligence on Tourism

Artificial intelligence (AI) is significantly impacting the tourism industry, offering various benefits and challenges. AI technologies are being inte-grated into tourism to improve convenience (Tammi, L., Richardson. (2023). Smart tourism uses AI to provide efficient travel services, such as through task-oriented chatbot systems (Myeong-Cheol, Jwa., Jeong-Woo, Jwa. 2023). The role of AI in urban tourism analysis is also crucial, as it helps to understand tourism activities and promote urban development (Şirvan, et al 2023).

The post-pandemic deployment of AI in travel and tourism has raised trust concerns, with a proposed framework exploring trust formation in AI technologies for travelers (Xinyan, Huang. 2023). Overall, AI is reshaping how tourism works, from improving customer services to analyzing urban tourism activities, albeit with privacy, data security, and trust building in mind.

Artificial intelligence (AI) plays an important role in the tourism industry by improving services and marketing strategies. AI interventions can improve human mindfulness, offering opportunities for AI-assisted mindfulness in the tourism, hospitality, and events industries Yao-Chin, Wang., Muzaffer, Uysal. (2023).

In China, AI is used to improve tourism services, simplify management functions, and enable precision marketing within a smart tourism system. (Meng, Xu., 2023) (Carl, Johan, Ekman. 2023).

1.2 Digital transformation driven by big data and AI in tourism

The digital revolution, driven by the proliferation of data and the advance of AI, is radically transforming tourism. Big data and AI are essential to optimize decision-making, personalize services and improve customer experience (Liqin, 2022; BDAI, 2023). Big data enables the analysis of large volumes of data from various sources, which allows a better understanding of tourists' preferences and behaviors (Hafner and Elena, 2022). AI applications, such as booking systems and intelligent travel agencies, improve service quality and efficiency (BDAI, 2023).

Furthermore, the synergy between big data and AI optimizes operational processes and helps to create smart tourism platforms, forecasting tools and decision support systems. This improves the management and attractiveness of destinations (BDAI, 2023; Liqin, 2022).

Big data clustering algorithms also improve intelligent judgment by using tourism metadata for efficient decision making and surveillance automation, freeing police from manual supervision (Wen, Liang, and Tang, 2023).

In addition, AI, along with big data, is transforming the tourism sector by automating processes such as ticketing, booking and online reservations, ultimately improving destination attractiveness ((2023). Big Data and Artificial Intelligence).

The use of AI and robotic technologies in tourism marketing provides personalized travel opportunities, reduces operating costs, improves staff productivity and ensures a competitive advantage through the systematic analysis of customer information ((2023). Application of Artificial Intelligence and Robot-ics in Tourism and Hospitality Marketing).

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1.4 AI in Value Co-Creation (VCC) in Tourism

Value Co-Creation (VCC) in the context of hospitality and tourism refers to the collaborative process where customers actively engage with businesses to create value.

Factors influencing VCC include customers' perceptions, attitudes, trust, social influence and previous experience, along with technologies such as AI, service bots, chatbots and machine learning.

The use of AI and automation facilitates personalized interactions, anticipates customer expectations and saves time and effort, improving the VCC process.

Factors such as customer perceptions, attitudes, trust and social influence play an important role in co-creating value through collaboration.

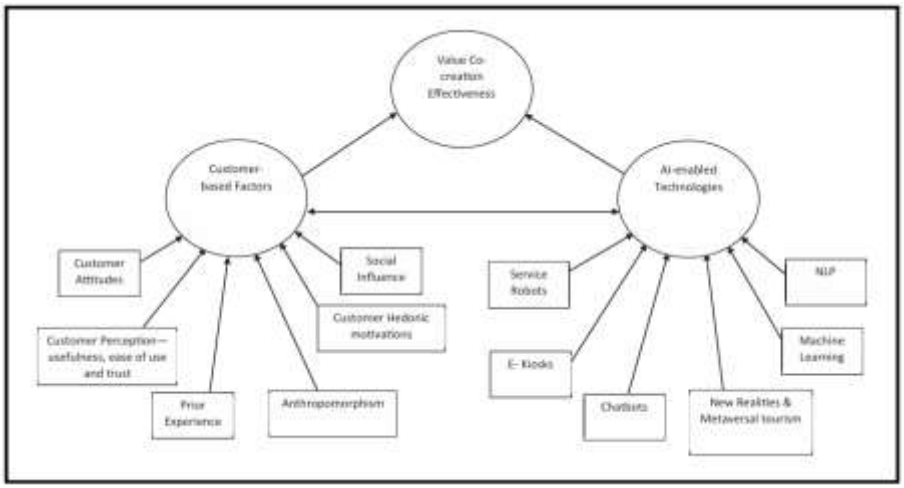

Fig. 1. AI in Value Co-Creation (VCC) in Tourism. (Mehraliyev et al, 2020)

Figure 1 presents a conceptual framework of the antecedents of the effectiveness of value co-creation (VCC) in the era of artificial intelligence (AI) and related technologies.

It synthesizes existing literature to identify relevant variables and their relationships, guiding future empirical validation and quantitative research designs.

The framework aims to provide a theoretical landscape for future research on CCV in the context of hospitality and tourism, focusing on the complexities and interactions between the proposed variables.

1.5 AI and big data initiatives in Ecuador

Artificial intelligence (AI) in Ecuador faces challenges and opportunities in various sectors. The country's AI ecosystem lags behind regional leaders such as Argentina, Brazil, Chile, Colombia and Uruguay, showing limited adoption and a lack of supportive policies. (2023). Status of Artificial Intelligence in Ecuador.

Artificial intelligence (AI) is being explored in Ecuador's tourism sector, particularly in the improvement of virtual learning environments in higher education (Guananga. H, Chavez. S. 2020). . The country's tourism industry, an important source of revenue, is evolving with a focus on communication 2.0 to promote tourism internally and externally (Altamirano, V. et al. 2018). Additionally, research is being conducted to analyze the strengthening of community tourism using the Anholt hexagonal model, with the objective of leveraging cultural and resource capacities in localities such as the Pondoa community tourism center in the province of Tungurahua.

Despite the challenges, Ecuador's tourism sector shows signs of recovery in 2021 after the economic slowdown of 2020, with the province of Pichincha being a key contributor to sales in the tourism sector. The potential of AI in Ecuador's tourism industry is being exploited to improve educational environments and communication strategies for sustainable growth.

In Ecuador, the Ministry of Tourism recognizes the importance of big data and AI to boost the competitiveness of national tourism.

The Strategic Plan for the Development of Destinations and Tourism Products 2022-2025 (Ministry of Tourism, 2022) seeks to implement data analysis tools and intelligent systems to better understand market trends, improve destination management and offer

personalized experiences to visitors. It highlights the strengthening of technological and digital capabilities in Ecuadorian tourism to fully benefit from big data and AI.

These initiatives are essential because tourism is an important economic engine. According to the Boletín Trimestral de Estadísticas Turísticas (Ministry of Tourism, 2023), the sector contributed 5.7% of GDP in 2022, which demonstrates its strategic importance.

The adoption of advanced technologies such as big data and AI can further enhance the growth and competitiveness of Ecuadorian tourism, while optimizing the industry's management, marketing and decision-making processes.

The comprehensive review is crucial due to the global expansion of the use of Artificial Intelligence and Big Data in tourism. According to the World Tourism Organization (2019), these technologies enhance tourism competitiveness and sustainability. For example, recommendation systems with AI personalize travelers' experiences. Moreover, analyzing Big Data allows understanding demand patterns and optimizing resources (UNWTO, 2019). However, implementing AI and Big Data presents challenges: investing in infrastructure, training personnel and protecting data privacy (Mehraliyev et al., 2020).

In Ecuador, the Ministry of Tourism (2022) recognizes the importance of adopting these technologies in its Strategic Plan 2022-2025. However, studies indicate a significant gap in the implementation of AI and Big Data in Ecuadorian tourism (Maldonado-Guzmán et al., 2021). This systematic review seeks to contribute to closing that gap by providing a comprehensive and updated view of the state of the art, highlighting opportunities, challenges and future trends for tourism in Ecuador.

2 METHODOLOGY

This study employed a mixed methodology combining a systematic literature review and a field survey.

The systematic literature review involved the following stages:

- Search in academic databases (Scopus, Web of Science, ScienceDirect) using keywords related to artificial intelligence, big data, tourism and Ecuador.
- Review of reports and publications of official bodies such as the Ministry of Tourism of Ecuador and the World Tourism Organization (UNWTO).
- Application of inclusion and exclusion criteria to filter relevant results published in the last 20 years.
- Content analysis and synthesis of information through techniques such as thematic analysis.
- Structuring of results in thematic sections: applications in destination management, personalization of services, understanding tourist preferences, decision making and challenges.

Field data collection was carried out through an online survey of 25 tourism sector companies located in Quito, Guayaquil and Cuenca, using non-probabilistic convenience sampling. The survey collected information on:

- Adoption of artificial intelligence and big data.
- Perceived impact of these technologies
- Future investment plans
- Barriers to adoption

The survey data were analyzed using descriptive statistics, including frequencies, proportions, and correlations between key variables.

This mixed methodology allowed us to obtain a comprehensive view of the state of the art, complementing the systematic literature review with current field data specific to the Ecuadorian context in the tourism sector. This provides a solid basis for a high-impact article that combines existing academic evidence with practical information on the local reality.

3 RESULTS

3.1 Descriptive Statistics

The dataset comprises responses from companies located in Quito, Guayaquil, and Cuenca, representing sectors such as hotels, tour operators, and restaurants. Medium-sized companies are the most common in the sample.

AI and Big Data Usage.

AI usage is reported by 32% of companies, while 36% do not use AI and 32% are unsure. Big Data usage is similarly varied, with 28% using it, 36% not using it, and 36% unsure.

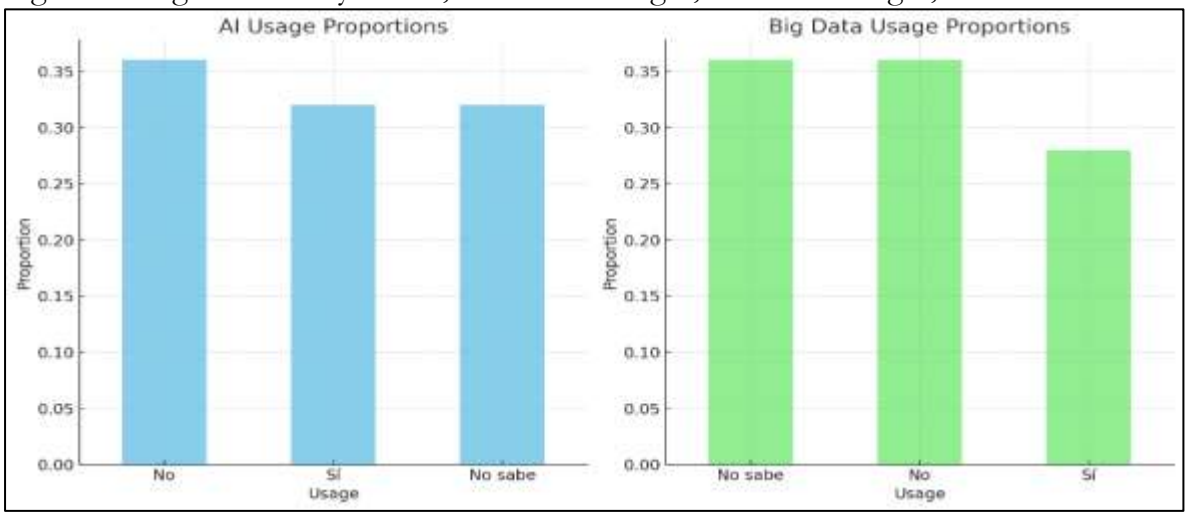

Fig. 2. AI and Big Data Usage Proportions

The usage of AI and Big Data is relatively low, with a significant portion of companies being unsure about their usage. This indicates a potential area for growth and education in the tourism sector.

. Correlation Analysis.

Weak correlations were found among key performance metrics. Operational efficiency shows a positive correlation with cost reduction (r=0.39r = 0.39r=0.39), while customer satisfaction has a weak positive correlation with operational efficiency (r=0.21r = 0.21r=0.21).

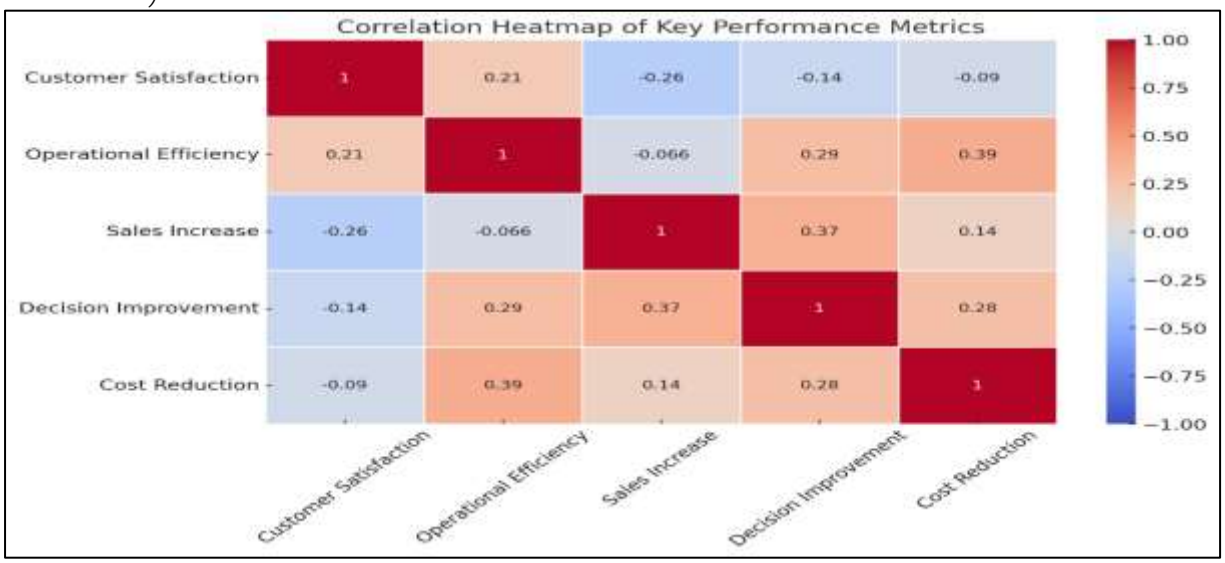

Fig. 3. Correlation Heatmap of Key Performance Metrics

Customer satisfaction shows a weak positive relationship with operational efficiency, suggesting that higher operational efficiency may slightly improve customer satisfaction. Operational efficiency also positively correlates with improvement in decisions and cost reduction, indicating that efficient operations contribute to better decision-making and cost-saving measures.

Perceived Impact.

The perceived impact of AI is mixed, with 24% viewing it as very negative, 24% as negative, and 24% as neutral. Only 8% see it as very positive. Big Data perceptions are similarly varied, with 32% viewing it negatively and 16% very positively.

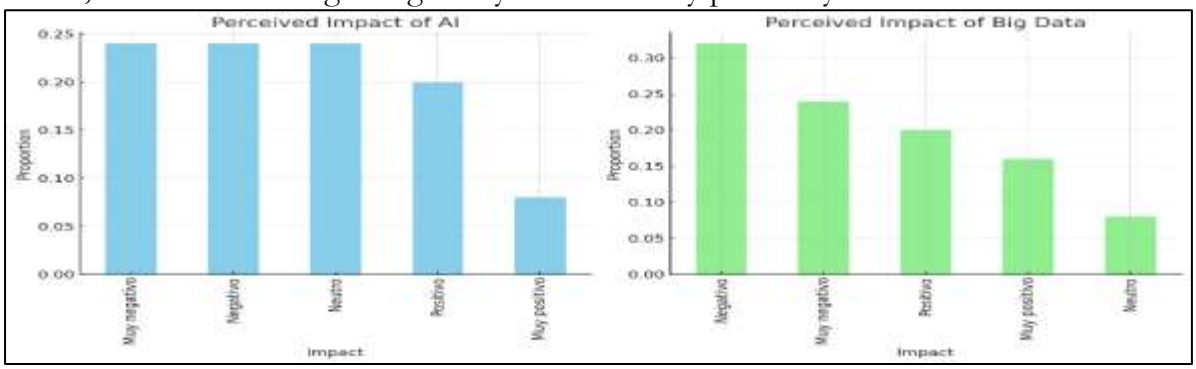

Fig. 4. Perceived Impact of AI and Big Data

The perceptions of AI and Big Data impact are varied. While a significant portion views these technologies negatively, there is also a notable percentage that views them positively, especially in the case of Big Data. This indicates a need for better implementation strategies to maximize positive impacts.

Investment Plans.

Overall, 36% of companies plan to invest in AI and Big Data, while 32% are unsure and 32% do not plan to invest. Small companies show the highest investment intent (50%), while large companies show no investment intent.

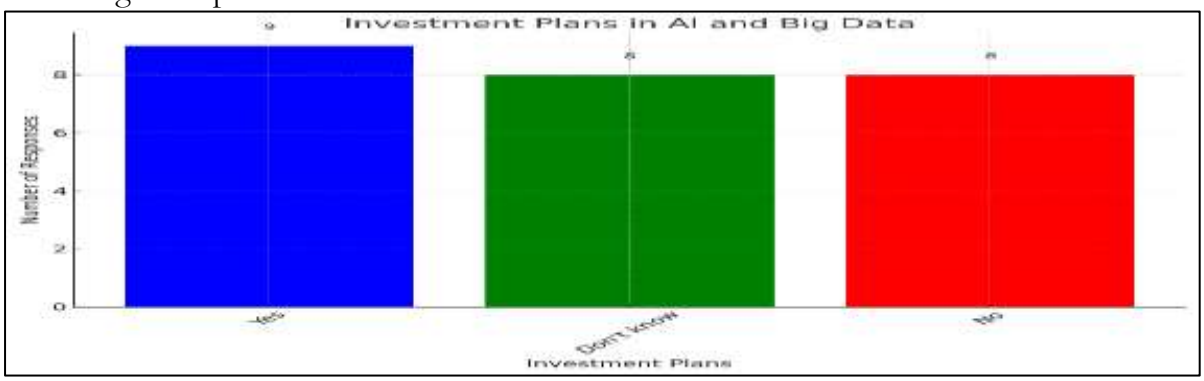

Fig. 5. Investment Plans in AI and Big Data

Investment plans vary significantly by company size. Small companies exhibit the highest intent to invest in AI and Big Data, suggesting they may see these technologies as critical for gaining a competitive edge. Large companies, on the other hand, show no investment intent, potentially due to existing infrastructures or different strategic priorities.

Barriers to Adoption.

The most significant barriers include technological infrastructure (60%), privacy and security concerns (56%), and high costs (52%). Technical knowledge is the least reported barrier (32%).

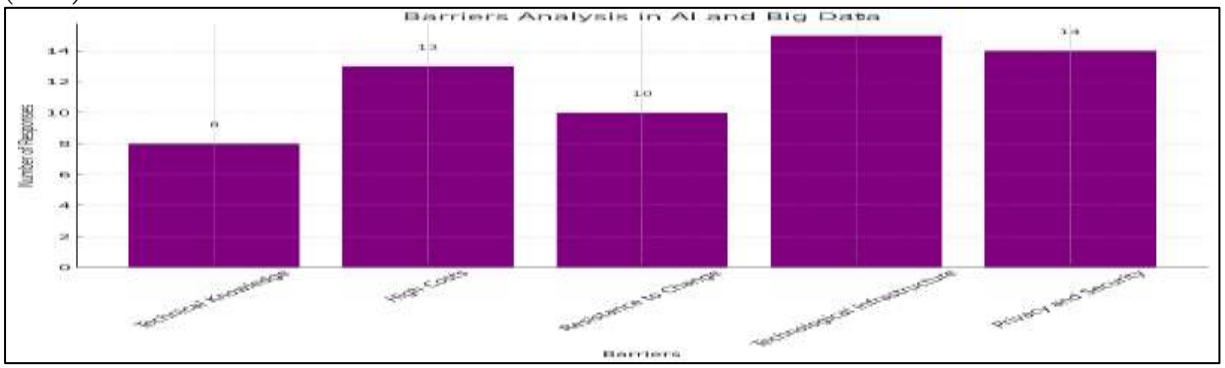

Fig. 6. Barriers to AI and Big Data Adoption

Inadequate technological infrastructure and privacy concerns are the most significant barriers to AI and Big Data adoption. High costs also pose a major challenge, indicating that financial and security considerations need to be addressed to facilitate broader adoption.

Customer Satisfaction and Operational Efficiency.

Companies not using AI but unsure about Big Data report the highest customer satisfaction (0.5). Companies using AI and Big Data report lower operational efficiency (0.0), indicating potential challenges in implementation.

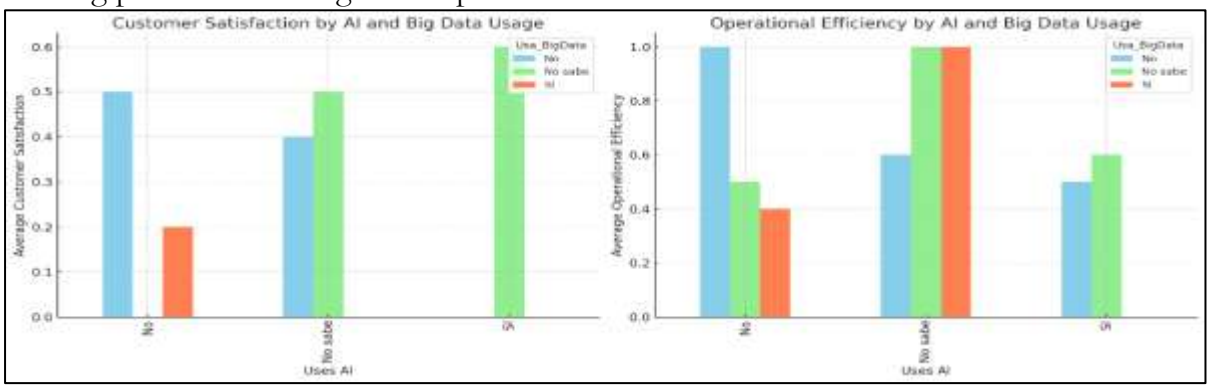

Fig. 7. Customer Satisfaction and Operational Efficiency by AI and Big Data Usage

There is a mixed relationship between AI/Big Data usage and customer satisfaction/operational efficiency. Companies using AI but not Big Data have the highest customer satisfaction, suggesting that partial adoption may positively impact customer experience. Conversely, companies using both AI and Big Data report lower operational efficiency, highlighting challenges in effectively integrating these technologies.

4 DISCUSSION

The findings highlight the diverse perceptions and levels of adoption of AI and Big Data in the Ecuadorian tourism sector. While there is a notable intent to invest in these technologies, significant barriers remain, particularly in terms of technological infrastructure and privacy concerns. The mixed impact on customer satisfaction and operational efficiency suggests that while these technologies have potential, their effective implementation is crucial.

One key barrier identified is the lack of adequate technological infrastructure in many Ecuadorian tourism companies. This makes it difficult to collect, store and process large volumes of data, which is essential to leverage the benefits of Big Data and AI. Substantial investments in hardware, software, and personnel training are required to overcome this gap. Additionally, concerns about data privacy and security are a major obstacle, as the tourism sector handles sensitive customer information. It is necessary to establish robust regulatory frameworks and data protection practices to build trust and facilitate the adoption of these technologies.

Another aspect to consider is the need to adapt AI and Big Data approaches to the local Ecuadorian context. While there are numerous success cases globally, the unique characteristics of tourism in Ecuador, such as its cultural, natural, and activity diversity, require tailored solutions. This involves engaging local experts, understanding the preferences and behaviors of domestic and international tourists visiting the country, and developing specific AI applications and Big Data analytics to optimize the tourism experience and destination management in Ecuador.

This discussion highlights the key challenges and opportunities for effective adoption of AI and Big Data in Ecuadorian tourism, providing valuable insights for professionals, researchers, and policymakers in the sector.

5 CONCLUSION

This research provided a comprehensive systematic review of the literature on the applications of Artificial Intelligence and Big Data in tourism, with a special focus on Ecuador. The results show that these technologies have a wide range of applications, such as market segmentation, experience personalization, price optimization, and trend analysis. However, significant adoption gaps were identified in developing countries like Ecuador.

The findings from the field survey revealed relatively low levels of AI and Big Data adoption in Ecuadorian tourism companies, with key barriers such as lack of technological infrastructure, privacy and security concerns, and high costs. These challenges must be addressed to facilitate broader and more effective implementation. Additionally, it is crucial to adapt existing AI and Big Data approaches to the local Ecuadorian context, considering the unique characteristics of tourism in the country.

Overall, the preliminary results suggest great potential to boost the competitiveness and sustainability of Ecuadorian tourism through Artificial Intelligence and Big Data. However, coordinated efforts between companies, the government, and academic institutions are required to develop integrated methodological frameworks, strengthen technological capabilities, and address the identified barriers. Future research should focus on empirically validating the findings and proposing practical solutions for the successful adoption of these disruptive technologies in Ecuador's tourism sector.

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