

Smart and Sustainable Tourism in the Azores - The Integration of Technological Practices: A Study of a Hotel Unit in the Region

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Abstract: Tourism growth in the Azores has generated significant economic benefits but also challenges related to sustainability and the risk of overtourism. This qualitative study analyzes how the adoption of emerging technologies can contribute to creating a smart and sustainable tourism ecosystem in the region, reconciling innovation with environmental preservation and sociocultural valorization. The research was based on semi-structured interviews with professionals from the Azorean tourism and business sector, complemented by a case study of a local hotel unit. The results show the growing implementation of technological practices such as consumption sensors, automation, digital platforms, and sustainable resource management solutions, but also reveal structural obstacles, such as resistance to change, infrastructural limitations, and digital skills deficits. It is concluded that the Azores have the potential to position themselves as a smart tourism destination, provided that coordination between public and private entities is strengthened, investment in training is increased, and integration between digital strategies and sustainability practices aligned with the Sustainable Development Goals (SDGs) is enhanced. The study contributes to advancing knowledge about smart tourism in island contexts, proposing replicable frameworks for digital sustainability and strategic communication. Limitations include the lack of long-term data and the absence of tourists' direct perspectives, highlighting avenues for future research.

Keywords: Sustainable Tourism; Technological Innovation; Smart Tourism; Digital Marketing; Azores; Customer Experience.

1. Introduction

Tourism in the Azores has experienced significant growth, generating economic and social benefits, but also increasing structural and environmental pressures, with a risk of overtourism in fragile island contexts. In this global scenario of digital transformation and growing environmental awareness, the concept of smart tourism (Buhalis, & Amaranggana, 2015; Gretzel et al. 2015) has emerged, integrating emerging technologies, data-driven management, digital communication, and collaborative governance to enhance operational efficiency, improve visitor experience, and promote environmental and sociocultural preservation. In the Azores, where natural resources are central to tourism, this integration is particularly crucial.

This study aims to analyze how technological practices can contribute to the creation of a smart and sustainable tourism ecosystem in the Azores, balancing sector growth with the mitigation of overtourism and the preservation of natural and cultural heritage. Specifically, it seeks to explore the relationship between sustainability and technological innovation; identify technological practices already implemented, focusing on a selected Azorean hotel; assess the benefits and barriers of digital transition; examine the role of digital marketing and strategic communication in promoting sustainability; and propose conceptual and practical frameworks to consolidate the Azores as a smart and sustainable tourism destination.

The work is structured into five main sections: 1. introduction; 2. literature review, covering sustainable tourism, emerging technologies and smart tourism, digital marketing, and consumer experience; 3. methodology, detailing the qualitative approach, case study, semi-structured interviews, and thematic analysis; 4. analysis and discussion, integrating empirical evidence with literature, highlighting technological practices, perceived impacts, and structural challenges; and 5. conclusions, which summarize the findings, present the proposed frameworks, and discuss theoretical and practical contributions, limitations, and directions for future research, including longitudinal analyses, comparative island studies, and the inclusion of tourists' perspectives.

The study demonstrates that digital innovation, when strategically aligned with sustainability, can strengthen the competitiveness and resilience of tourism in the Azores.

2. Literature Review

The analysis of specialized literature supporting this study focuses on four fundamental pillars: 1. sustainable tourism and Azores; 2. the application of emerging technologies in the tourism sector; 3. the role of marketing and digital strategies in competitive differentiation; and finally, 4. consumer experience as a driver of innovation and value co-creation. The articulation of these themes provides the necessary theoretical foundation to understand how the Azores can evolve toward a smart and sustainable tourism ecosystem.

2.1 Sustainable Tourism and the Azores

The economy of the Azores has been boosted by the increasing flow of tourists, positioning the archipelago as a unique and paradisiacal destination, sought after for its abundant nature, active volcanism, and distinctive features found only on islands of this kind (Isabel, 2024). The Azores have witnessed a steady increase in tourism, largely driven by its natural beauty, including the unique landscapes shaped by volcanic activity and rich biodiversity. However, as tourism grows, the region faces the challenge of ensuring sustainable development while preserving its environmental and cultural heritage (Lenzen et al., 2018). To address these challenges, there is a growing emphasis on eco-tourism and sustainable tourism practices. Efforts are being made to manage the visitor experience, ensuring that tourism does not overwhelm local resources and that the natural environment is preserved for future generations. The archipelago's positioning as a destination for nature-based tourism offers a promising opportunity to develop tailored experiences for eco-conscious tourists, aligning with global trends that prioritize sustainability and environmental preservation (Isabel, 2024). Despite this natural competitive advantage, the region currently offers a diverse tourism supply that remains relatively impersonal, highlighting the strategic need to develop more sophisticated mechanisms for engaging with different target audience segments. This evolution requires the implementation of differentiated, hyper-personalized, and digitally integrated services that maximize the destination's unique potential through personalized and technologically advanced experiences (Buhalis & Amaranggana, 2015; Gretzel et al., 2015; Sigala, 2020; Ryan, 2017).

Sustainability in tourism is based on the triple bottom line paradigm, economic, environmental, and social, considered by the literature as essential to ensure the long-term viability of destinations (Dwyer, 2005; UNWTO, 2005). Sustainable tourism seeks to balance the generation of economic benefits with the protection of fragile ecosystems and the safeguarding of local cultures. In the case of the Azores, these issues are critical, given that the archipelago presents unique ecosystems that are highly vulnerable to the impact of tourism pressure.

The identified challenges include managing tourist excess at certain points of interest, the difficulty in reconciling short-term revenues with sustainability goals, and the absence of environmental literacy among both visitors and operators. Despite these weaknesses, the literature demonstrates that sustainability is also a strategic opportunity for destinations: it strengthens the authenticity of the experience, increases attractiveness among conscious travelers, and creates economic and social value in the medium and long term (Ritchie & Crouch, 2003).

Furthermore, in a global context where the tourism sector is responsible for approximately 8% of greenhouse gas emissions (Lenzen, 2018), aligning tourism development with the Sustainable Development Goals (SDGs) has become imperative. In the Azores, the application of these principles can contribute not only to mitigating environmental risks but also to consolidating the destination's positioning as a reference in responsible tourism.

2.2 Technology and Smart Tourism

Tourism is frequently identified as one of the sectors that earliest embraced digitalization on a global scale (Buhalis & Law, 2008). Currently, the literature identifies the concept of smart tourism as a natural evolution, sustained by the integration of data from different sources—visitors, operators, governments, and infrastructures—using advanced technologies (Gretzel, 2015). This paradigm has three main objectives: improving the tourist experience, increasing destination efficiency, and promoting sustainability.

Among the main emerging technologies are: artificial Intelligence (AI): used in chatbots, recommendation systems, and analysis of large data volumes to predict demand patterns (Gretzel, 2015); big data and analytics: applied in monitoring tourist flows, avoiding overloads at sensitive points and improving demand management (UNWTO, 2019); internet of things (IoT): applied to smart hotels, connected transport, and environmental monitoring (Buhalis & Amaranggana, 2015); virtual reality (VR) and augmented reality (AR): provide immersive experiences, both in planning and during the trip, facilitating decisions and enriching the visit (Tussyadiah, 2018);

blockchain: increases transparency and security in transactions, reservations, and payments (Önder & Treiblmaier, 2018); drones and 5G: contribute to environmental monitoring, visual promotion of destinations, and real-time connectivity (Sigala, 2020; UNWTO, 2021).

Despite their potential, the implementation of these technologies faces significant barriers, such as investment costs, resistance to organizational change, concerns about data privacy, and inequalities in digital access (Van Dijk, 2020). The literature points out, however, that the articulation between technology and sustainability can offer innovative solutions to mitigate phenomena such as overtourism by redistributing visitors, optimizing resources, and offering hyper-personalized experiences without increasing pressure on the territory.

Recent literature on smart tourism consistently highlights the central role of digital technologies in transforming the tourist experience. Ionescu and Sârbu (2024) demonstrate that smart technologies enhance tourist satisfaction by personalizing and enriching interactions with destinations, while Wu et al. (2024) provide a systematic review showing the convergence of digital tools and emerging trends in the sector.

From a strategic perspective, Anica Popa et al. (2025) propose an integrated model linking AI, IoT, and Big Data to competitive advantages in smart destinations, suggesting that technology is not only an experience facilitator but also a critical economic and managerial resource. Innovatively, Cardoso and Fraga (2024) apply neuroscience methods and immersive technologies to reveal opportunities for understanding tourists' cognitive and behavioral responses, pointing to new research methodologies in the field.

Recent meta-analyses (2023) confirm the consistent positive impact of smart technologies on the tourist experience, supporting empirical findings such as those of Gomes (2025), which emphasize the practical role of technological tools in leisure and overall tourist engagement in smart destinations. Despite these advances, important gaps remain. Most studies focus on European or Asian contexts, leaving space for comparative international analyses. Integrated approaches that combine technological, economic, and behavioral perspectives remain limited, as do investigations into the socio-environmental impacts of technologies on destinations.

Overall, the current evidence suggests that future research should explore not only technological implementation but also its strategic, behavioral, and sustainable effects, consolidating smart tourism as a multidimensional phenomenon centered on the tourist experience.

2.3 Marketing and Digital Strategy

Digital transformation has redefined tourism marketing. Kotler (2021; 2024) introduces the concepts of Marketing 5.0 and 6.0, which combine data analysis, artificial intelligence, and automation with the need to humanize brands and create emotionally relevant experiences. The literature indicates that effective digital strategies must align with the organizational mission, prioritizing loyalty, personalization, and omnichannel experience (Chaffey & Ellis-Chadwick, 2019; Kotler et al., 2021).

In the tourism sector, digital presence on websites, social media, and booking platforms has become determinant for brand trust and awareness (Buhalis & Law, 2008). Data-based digital marketing strategies allow not only real-time campaign adjustments (Ryan, 2017) but also the creation of transmedia narratives that engage consumers across multiple channels (Jenkins, 2006). Emerging trends highlighted by the literature include AI hype, personalization, immersive experiences with AR/VR, conversational marketing (chatbots and voice search), blockchain applied to transparency, social commerce, and the centrality of Environmental, Social, and Governance ESG practices communication (Tussyadiah, 2020; Sigala & Gretzel, 2018). In the Azorean context, these practices can differentiate the region by combining technological innovation with authenticity and connection to nature, central attributes for the destination.

Furthermore, strategic communication is identified as fundamental to ensuring message consistency and aligning sustainable practices with organizational reputation (Cornelissen, 2017). Well-structured communication plans allow for audience segmentation, resource optimization, and strengthening the image of competitive and sustainable destinations (Chaffey & Ellis-Chadwick, 2019).

The continuous growth of tourism in the Azores places the region at risk of overtourism, given its limited insular territory and the sensitivity of its natural and cultural ecosystems. To mitigate this risk, the implementation of a smart tourism ecosystem is essential, enabling strategic management of visitor flows and the promotion of sustainable practices (Castanho & Couto, 2023).

The proposed Blended Communication Plan addresses this challenge by combining sustainability-oriented

digital communication, visitor experience optimization through participatory platforms, and strategic coordination between public and private entities. By prioritizing authentic storytelling, integrating immersive technologies (AR/VR), and monitoring outcomes through KPIs, the model provides tools to guide tourism in a balanced manner, raise visitor awareness of responsible behavior, and protect natural and cultural resources, thereby preventing the negative impacts associated with overtourism.

2.4 Consumer Experience and Value Co-creation

Tourist consumer behavior has undergone profound changes, especially after the COVID-19 pandemic. Risk perception, preference for nearby destinations, and the growing use of digital platforms to plan and book trips reinforce the importance of digitalization and transparent communication (Swarbrooke & Horner, 2007; Ribeiro, 2021). Authors such as Solis (2015) and Kotler (2021) highlight that consumer experience has become the new strategic focus of organizations, surpassing traditional marketing practices. Tourists value authentic, sustainable, and emotionally significant experiences, a trend particularly strong among Millennials and Generation Z (Travel BI, 2022; Trindade, 2017). These segments show high digital affinity, resort to social media and influencers in decision-making, and demonstrate greater concern for environmental issues. The literature on value co-creation (Prahalad & Ramaswamy, 2004) adds that consumers should not be seen merely as recipients but as active partners in constructing the tourist experience. Digital technologies enable this real-time involvement, strengthening the connection between destination and visitor, generating loyalty, and reinforcing reputation.

The literature review demonstrates that the future of tourism depends on the coherent integration of four dimensions: sustainability, technology, digital marketing, and consumer experience. Sustainable tourism provides the ethical and strategic framework; technology provides tools to optimize resources and offer differentiated experiences; digital marketing ensures communication and competitiveness; and consumer experience centers the process on people, enhancing value co-creation. In the Azorean context, these dimensions are particularly relevant, given the delicate balance between environmental preservation and economic development. The literature not only confirms the relevance of the dissertation theme but also highlights the urgency of integrated strategies that allow the Azores to consolidate as a smart and sustainable tourism destination.

3. Methodology

This study employed a qualitative approach, selected for its suitability in exploring phenomena requiring an in-depth understanding of participants' perceptions, meanings, and experiences. The approach aligns with the study's central objective: to analyze how the adoption of technological practices can foster a sustainable tourism ecosystem in the Azores, balancing economic development, overtourism mitigation, and the preservation of natural and cultural resources. By prioritizing interpretive and exploratory analysis, the qualitative methodology captured the complexity of a sector in transformation, where innovation and sustainability are closely interlinked.

The central research question guiding this study was: "How can the adoption of technological practices foster the development of a sustainable tourism ecosystem in the Azores, while simultaneously balancing sectoral growth and mitigating overtourism?" To address this question, a structured methodological framework was implemented, comprising three interrelated components: a systematic literature review, an in-depth case study, and semi-structured interviews with key stakeholders.

The adoption of emerging technologies by hotel units enhances operational efficiency and supports environmental sustainability by enabling more effective resource management, reducing waste, and optimizing costs (Buhalis & Amaranggana, 2015; Gretzel et al., 2015; Ionescu & Sârbu, 2024). At the same time, integrating technological and sustainable practices strengthens tourist trust, satisfaction, and emotional engagement, fostering personalized and authentic experiences aligned with sustainability principles (Sigala, 2020; Gomes, 2025). However, technology alone is insufficient to drive destination transformation. Structural barriers, limited digital skills, and organizational resistance highlight the importance of collaborative governance involving public authorities, private companies, and local communities (Buhalis, 2008; Ritchie & Crouch, 2003).

The transition to a smart and sustainable tourism ecosystem in the Azores depends on three interdependent conditions: (i) reinforcement of digital infrastructures; (ii) continuous investment in training and technological literacy; and (iii) promotion of a collaborative culture among stakeholders. The effectiveness of technological

and sustainable initiatives relies on strategic coordination and equitable access to digital tools. Meaningful digital transformation must therefore be accompanied by organizational and cultural change oriented toward sustainability and shared innovation.

The literature review provided a critical synthesis of theoretical frameworks and contemporary debates regarding sustainable tourism, technological innovation, digital marketing strategies, and consumer experience management. This review informed both the development of the interview protocol and the definition of analytical categories applied in the empirical phase, ensuring conceptual coherence and analytical rigor.

Three propositions structured the dialogue between empirical evidence and theoretical contributions presented in the literature review. The first exploratory proposition suggests that the adoption of emerging technologies by hotel units and other Azorean tourism operators enhances operational efficiency and favors environmental sustainability. The second exploratory proposition points to the positive influence of integrating technological and sustainable practices on tourist experience and value perception. The third exploratory proposition relates to the importance of structural and collaborative factors for consolidating a smart tourism ecosystem in the Azores.

The empirical component focused on a single-case study of a hotel unit located on São Miguel Island, hereafter referred to as "Unit X" for confidentiality. The case was selected using purposive sampling, based on the unit's strategic relevance in the regional tourism sector, its degree of technological adoption, and its willingness to participate. This instrumental case study design enabled a contextualized, intensive analysis of digitalization processes, emphasizing depth over statistical generalization.

Semi-structured interviews were conducted with two participant groups, also selected through purposive sampling. Group 1 comprised two hotel professionals, one internal to Unit X and one external with consolidated industry experience, allowing the triangulation of organizational perspectives with broader sector insights. Group 2 included four specialists in marketing, technological innovation, smart tourism, and sustainability, providing expert technical knowledge to enrich understanding of trends, challenges, and opportunities in the sector.

Participant inclusion criteria were clearly defined to ensure relevance and data quality: (i) recognized professional expertise in the relevant field; (ii) demonstrated experience in at least one of the study's core domains; and (iii) higher education qualifications. These criteria ensured that participants possessed the technical knowledge and practical experience necessary to provide informed and substantively meaningful contributions.

Interviews were conducted in May 2025 via Google Meet, offering temporal and geographical flexibility while maintaining participant comfort and safety. The interview guide was structured around key themes, including tourism challenges and opportunities in the Azores, technological practices, sustainability initiatives, barriers to digital transition, and strategic recommendations. Data analysis followed thematic content analysis procedures (Bardin, 2016), including exploratory reading, identification of categories and subcategories, and interpretive analysis in dialogue with the literature.

Methodological triangulation, combining interview data, theoretical grounding, and strategic analysis of Unit X, including SWOT, PESTEL, and competitive analysis, enhanced the validity and consistency of findings. Ethical considerations were strictly observed. Confidentiality was maintained, the organization was anonymized as "Unit X," and informed consent was obtained from all participants. Data handling complied with GDPR, ensuring anonymity and secure management of collected information.

Overall, the adopted methodology ensured alignment between the research question, objectives, and analytical procedures. By integrating literature review, case study, and semi-structured interviews, the study captured the complexity of an evolving tourism sector, producing insights relevant for both academic research and professional practice in smart and sustainable tourism.

4. Analysis and Discussion of Results

Data analysis was guided by three exploratory propositions, as mentioned in methodology, derived from the theoretical framework and used as an interpretive basis for results discussion. These propositions serve to structure dialogue between empirical evidence and theoretical contributions presented in the literature review. This section's central objective is to understand how technological practices implemented in the Azorean tourism sector contribute to building a smart and sustainable ecosystem, highlighting emerging trends,

challenges, and opportunities.

The first exploratory proposition suggests that the adoption of emerging technologies by hotel units and other Azorean tourism operators enhances operational efficiency and favors environmental sustainability. Analysis of the "Unit X" case study and conducted interviews show that the use of consumption sensors, automation systems, and digital monitoring platforms has allowed more rigorous control of energy and water resources, as well as a reduction of waste and operating costs.

Participants recognize that these practices not only improve companies' economic performance but also reinforce their environmental commitment. As one interviewee stated, "automation brought much more rigorous control over what we consume and waste." This perception is consistent with contributions from Buhalis and Amaranggana (2015) and Gretzel (2015), who argue that digitalization constitutes a driver of sustainable innovation in tourism destinations. However, evidence also reveals that these practices are still poorly disseminated, suggesting the need for regional public policies and incentives for digital transition in smaller companies, to ensure more balanced and inclusive development.

The second exploratory proposition points to the positive influence of integrating technological and sustainable practices on tourist experience and value perception. Interviewees report that visitors demonstrate growing sensitivity to environmental issues and value personalized, authentic experiences consistent with sustainability principles. One participant observed that "tourists want to see environmental commitment in small actions—and technology helps make it visible." This reading suggests that the combination of technological innovation and sustainability contributes to reinforcing trust, satisfaction, and visitors' emotional involvement with the destination.

This interpretation finds support in Ritchie and Crouch (2003), who associate sustainability with destinations' competitive advantage, and in Kotler (2021; 2024), who highlights the importance of technological humanization and hyper-personalization in constructing tourist experience. Despite this convergence, it is important to recognize that the analysis does not include data collected directly from tourists, which limits the depth of understanding about visitor perception and opens space for future quantitative and comparative investigations.

The third exploratory proposition relates to the importance of structural and collaborative factors for consolidating a smart tourism ecosystem in the Azores. Empirical evidence suggests that technology, in isolation, is not sufficient to guarantee destination transformation. Interviews reveal structural barriers, such as infrastructural insufficiencies, resistance to organizational change, and a lack of digital skills. One participant summarized this difficulty by stating that "the barrier is not in technology, but in the lack of training and mentality."

These results reinforce the relevance of the human and institutional dimension of the digital transition process, confirming what Gretzel, Sigala, Xiang, and Koo (2015) designate as smart governance: the need for effective collaboration between public and private entities and local communities. Van Dijk (2020) adds that digital exclusion can worsen regional asymmetries, especially in island contexts, where connectivity and professional qualification play a central role in sustainable development.

Integrative results analysis allows inferring that the transition process to smart and sustainable tourism in the Azores depends on three essential conditions: strengthening digital infrastructures, continuous investment in training and technological literacy, and promoting a collaborative culture among different sector stakeholders. Data suggest that although relevant initiatives and good practices are ongoing, their effectiveness remains limited by a lack of strategic coordination and inequality in technology access. This finding reinforces the argument that digital transformation must be accompanied by organizational and cultural change, oriented toward sustainability and shared innovation.

In summary, the discussion shows that the Azores have high potential to establish themselves as a smart and sustainable tourism destination, provided that technology is understood not only as an operational tool but as an instrument of social, environmental, and economic integration. The study demonstrates that the future of Azorean tourism will depend less on isolated adoption of digital solutions and more on the collective capacity to build a participatory and sustainable governance model, in which technological innovation serves experience quality, resource preservation, and valorization of territory and its communities.

5. Conclusions

The central question that guided this investigation was: "How can the adoption of technological practices contribute to creating a sustainable tourism ecosystem in the Azores, balancing sector development with overtourism mitigation?" The answer to this question results from the combination of literature review and empirical study conducted, which together allow not only confirming trends already identified in previous investigations but also bringing original contributions from the concrete reality of the Azorean tourism sector.

Empirical results demonstrate that the integration of emerging technologies in the region's tourism is already underway, albeit unevenly and fragmentarily. Practices associated with service automation, use of consumption sensors, implementation of intelligent energy management systems, digitalization of reservation and communication processes, as well as waste management and water consumption measures aligned with environmental concerns were identified. These practices reflect, albeit partially, what Gretzel (2015) and Buhalis & Amaranggana (2015) define as smart tourism pillars: an integrated ecosystem that uses data and digital solutions to increase operational efficiency, enrich visitor experience, and promote destination sustainability.

However, it was also verified that the application of these technologies faces relevant obstacles. Structural barriers persist, such as technological infrastructure limitations on some islands, difficulties accessing advanced solutions, and high investment costs. Added to these are cultural and organizational barriers, such as resistance to change and lack of digital literacy training, aspects already widely discussed by Van Dijk (2020) when analyzing digital exclusion risks in technological transition processes. The study confirms that without clear investment in human resource training and organizational change strategies, technology implementation will tend to be slow, partial, and ineffective.

One of the most relevant findings relates to the value perception that tourists themselves attribute to sustainable and technological practices. Study participants recognize that the Azores visitor profile, especially among younger and digitally active segments, values authentic experiences aligned with environmental preservation and supported by digital solutions that increase convenience and personalization. This result resonates with literature from Ritchie & Crouch (2003), which emphasizes sustainability as a differentiating factor in the medium and long term, and in Kotler (2021; 2024), which highlights hyper-personalization and experience humanization as competitiveness drivers.

Thus, the investigation proves that convergence between sustainability and technology is not only desirable but constitutes a direct response to expectations of increasingly conscious and demanding demand. From a strategic perspective, it became clear that the Azores have the conditions to establish themselves as a smart tourism destination, but this path will depend on coordination between three key dimensions: consolidation of robust digital infrastructures, continuous training of professionals in digital and sustainable skills, and creation of collaborative networks between public and private entities. The absence of effective collaboration among stakeholders was identified as one of the main obstacles. This point confirms literature from Gretzel, Sigala, Xiang & Koo (2015), which emphasizes the need for interconnected ecosystems, where data flows, decisions, and responsibilities are shared to ensure effective impact.

Another significant contribution of the study was the construction of digital sustainability and strategic communication frameworks, which present themselves as practical organizational self-assessment tools, conceived as a synthesis of theoretical and empirical results and as practical application instruments:

Digital Sustainability Framework: Proposes a technological maturity model for Azorean tourism organizations, structured in four main dimensions: (1) Operational Efficiency, focused on intelligent management of energy, water, and waste; (2) Technological Innovation, focusing on integration of emerging technologies (AI, IoT, Big Data); (3) Environmental and Social Sustainability, which aligns digital practices with Sustainable Development Goals (SDGs); and (4) Collaborative Governance, which highlights coordination between public and private entities and local communities. This model allows organizations to self-assess their digital maturity level and outline evolutionary strategies toward sustainability.

Integrated Strategic Communication Framework for Smart Tourism: Translates into a three-dimensional model that articulates (1) Sustainable Digital Communication, oriented toward environmental education and regional identity valorization; (2) Visitor Experience and Co-creation, prioritizing participatory digital platforms and authentic storytelling; and (3) Institutional Coordination, promoting cooperation between regional and private organizations through digital performance indicators (KPIs). This model offers tourism entities a strategic planning tool capable of reinforcing destination visibility and consolidating a coherent image of responsible and innovative tourism.

These frameworks represent theoretical contributions by proposing unprecedented integration between technology, sustainability, and communication in the island context; practical, by providing diagnostic and planning tools accessible to tourism organizations; and social, by valuing the role of local communities and visitors as active agents of sustainable digital transition. More than conceptual proposals, they are configured as operational instruments that allow Azorean organizations to advance in a structured manner in integrating technological solutions aligned with sustainability objectives.

In answering the research question, it is concluded that the adoption of technological practices can effectively contribute to creating a sustainable tourism ecosystem in the Azores, provided it is accompanied by investment policies, training programs, and collaboration strategies. Technology alone is not sufficient; it is its articulation with clear sustainability objectives and involvement of local communities that will allow achieving a lasting balance between economic growth, environmental preservation, and cultural valorization. This vision is aligned with the sustainable tourism paradigm advocated by the World Tourism Organization (2005), which seeks to integrate visitors', communities', and industries' needs in a dynamic balance logic.

From an academic perspective, the study contributes to expanding knowledge about smart tourism in island contexts, a still underexplored area. By analyzing the Azores case, empirical evidence is added about how emerging technologies can be applied in peripheral and geographically fragmented territories, characterized by fragile ecosystems and strong dependence on tourism activity. From a practical perspective, the conclusions offer useful guidelines for managers, policy makers, and entrepreneurs, reinforcing the importance of aligning technological innovation with sustainability objectives.

6. Limitations and Future Research Directions

Despite its contributions, this study presents some limitations that must be acknowledged. First, the empirical analysis focused primarily on a single hotel unit and a limited number of interviews, which constrains the generalizability of the results. Second, the absence of direct input from tourists limits understanding of the visitor experience, an essential dimension for evaluating the effectiveness of the proposed technological and sustainability strategies. Third, many technological practices in the Azores are still in early stages of implementation, making it difficult to assess their long-term impacts on operational efficiency, environmental sustainability, and visitor satisfaction.

Building on these limitations, several avenues for future research are recommended: Inter-island comparative studies, to identify unique dynamics, challenges, and opportunities across different islands of the Azorean archipelago; quantitative studies on visitor perceptions, to measure tourist satisfaction, preferences, and the perceived value of sustainable and technological practices and Integration of emerging technologies – including Artificial Intelligence (AI) and Big Data Analytics, for real-time monitoring of tourist flows, predictive management of carrying capacity, and enhanced decision-making.

Ethics Declaration

The research presented in this article did not involve the collection of personally identifiable data, nor did it involve animals. Therefore, submission to or approval by a research ethics committee was not required.

Artificial Intelligence Declaration

Generative artificial intelligence tools were used exclusively for grammatical and stylistic language revision of the manuscript. No AI tools were employed in the conception of research, data analysis or interpretation, or in the formulation of conclusions. The authors critically reviewed and validated all content and assume full responsibility for the final manuscript.

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