INTERNATIONAL JOURNAL OF DIGITAL RESEARCH
Review Article

International Journal of Digital Research
www.ijdr.net
E-ISSN: 3033-179X
Volume 1; Issue 3; 2025, P.p. 46-52

The Impact of ICT on Active Tourism: A Systematic Literature Review of Innovation, Smart Tourism, and Sustainable Development

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https://doi.org/10.63711/ijdr.net20250305

ABSTRACT

This systematic review analysis the impact of Information and Communication Technology (ICT) in active tourism and recreation, its advantages, its disadvantages, and its strategic implication for industry stakeholders. Following the PRISMA guidelines, a systematic research was conducted. Evidences recognize that ICT boosts data-driven management, automation of service delivery and also community participation, improves strategic planning, and boosts crisis resilience. In addition, innovation technologies like gamification, virtual reality, and intelligent infrastructure enrich the tourist experience, particularly for young generations such as Generation Z. However, although the above developments occur, there are challenges that come in terms of digital dependency, unequal access to technology, as well as a potential loss of authenticity in tourist experiences. Overall, ICT is an innovative driver of active tourism, guiding future models of competitiveness, sustainability, and innovation through technology use, marketing, and visitor experience.

Keywords: *Smart tourism, E-tourism, Innovation, Digital transformation, Sustainable tourism*

INTRODUCTION

Active tourism, as a dynamic segment of the tourism industry, is undergoing a profound transformation due to the integration of ICT solutions, which are reshaping both the tourist experience and destination management practices. The development of active tourism is increasingly influenced by the strategic use of ICT, enhancing access to information, optimizing and managing destinations,

and improving service quality. The objectives of this systematic literature review were to evaluate the available literature on the effects of ICT on free and active travel, to identify the main advantages and disadvantages, and to provide recommendations for tourism industry stakeholders.

MATERIALS & METHODS

For this systematic literature review, the standards of reporting article analysis for systematic reviews and meta-analyses were followed (Moher et al., 2009). The main literature search was conducted across three major databases: Web of Science, Scopus, and Google Scholar, which also include studies related to the subject of our research.

The key terms used to search for relevant studies published in the last decade (from 2012 to 2024) were as follows: "Information and Communication Technology (ICT)"; "Systematic Review", "Recreation" or "Active Tourism"; "Smart Solutions"; "Innovation"; "digital transformation".

The following criteria were used to select which studies would be included in this literature review: a) Empirical studies and systematic reviews examining how ICT influences active tourism; b) Studies published in English; c) Studies published in peer-reviewed journals. As a result of the search, 38 articles were identified and selected that met the inclusion criteria.

The main themes concerning the impact of ICT on recreation and active tourism are examined and analyzed in this study. This work is based on the phenomenological method as an approach to conducting a qualitative literature review.

The aim of phenomenological research is to arrive at the essence of the lived experience of a phenomenon (Moustakas, 1994), with the goal of reaching the empirical essence of the studies. In applying the phenomenological method as a review technique, the unit of analysis is the research report.

THEMATIC ANALYSIS

Digital technology and information systems (IS) have transformed tourism and recreation by providing databased services, innovation, and smart tourism ecosystems (Xiang et al., 2021; Malcienė & Skauronė, 2019; Buhalis, 2020).

Improved platforms enhance strategic planning, customer engagement, and destination competitiveness (Buhalis & Leung, 2018; Stankov & Filimonau, 2015; Gretzel et al., 2015; Castillo et al., 2021). Electronic communication techniques play an extremely crucial role in tourism, especially during times of crisis.

During the time of COVID-19, electronic resources enabled transparency and trust among stakeholders (Laato et al., 2020) as well as long-term loyalty through constant interaction (Li et al., 2018). Mobile and social media strengthen satisfaction and destination loyalty through offering timely information and personalized experiences (Fan et al., 2019; Liu et al., 2022; Keelson et al., 2024). Destination image and travel decision are also affected by user-generated content (Ghermandi, 2022; Fisher et al., 2018; Cui et al., 2021).

Artificial intelligence and big data shape the future of tourism, making possible personalized services, prediction, and efficient management (Li et al., 2018; Buhalis & Law, 2013). Increasing evidence highlights their role in driving innovation and sustainable growth in the industry (Bulchand-Gidumal et al., 2024).

Studies show that digital technology and online platforms provide powerful tools for promoting tourism and recreational activities, encouraging participation and involving local communities (Sustacha et al., 2023). Moreover, innovative destination management through data-driven approaches can increase efficiency and sustainability in delivering tourist experiences (Miedes-Ugarte et al., 2024).

Research on the impact of social media and digital marketing indicates that these communication channels play a crucial role in shaping tourists' decisions and building emotional connections with destinations (Liu et al., 2023). ICT has transformed the way active tourism is promoted and experienced. Social media distribution increases engagement and strengthens the destination's image, encouraging participation in activities such as hiking, cycling, and water sports (Blanco-Moreno et al., 2024).

At the same time, ICT plays a role in engaging the younger generation (Generation Z) in tourism, a cohort raised with technology that influences attitudes and employment intentions in tourist destinations, particularly UNESCO World Heritage sites (Bermúdez- González et al., 2023). Furthermore, artificial intelligence is enhancing tourism marketing (personalization, automation, impact measurement, etc.), boosting the competitiveness of active tourism offerings (Bulchand-Gidumal et al., 2024).

Mobile applications, booking platforms, and virtual reality tools allow tourists to plan, personalize, and optimize their activities, thereby increasing engagement (Bulchand-Gidumal et al., 2024; Blanco-Moreno et al., 2024). ICT plays a key role in collecting and analyzing data to improve tourism offerings and tailor programs according to the needs of different groups, including younger generations such as Generation Z, who have high expectations for technology and personalized experiences (Bermúdez-González et al., 2023).

The interaction of ICT with transport policies and the promotion of outdoor activities also brings wide-ranging social, environmental, and economic benefits, fostering the sustainability of active tourism (Ding et al., 2024). The use of technology and careful destination design are essential elements for the development of active tourism and its health benefits.

Gamification – the process of modifying systems by integrating game principles in non-game contexts – can increase participant engagement and satisfaction, positively affecting their loyalty to the destination (Kim et al., 2024). Suitable walking and cycling infrastructures, supported by sustainable urban policies, encourage physical activity among both tourists and local communities (Keelson et al., 2024).

Sport and recreational experiences enriched with emotional elements and set in authentic natural environments strengthen positive memories and enhance tourists' connection to the destination (Jeong et al., 2023). Additionally, access to green spaces and sports infrastructure positively influences physical and social well-being, promoting participation in physical activity and recreation within tourism contexts (Ding et al., 2024).

From a technological perspective, the implementation of smart solutions, digital platforms, AI, and gamification strategies has enabled service personalization, operational process optimization, and increased tourist satisfaction, contributing to more efficient and innovative management of tourism offerings (Kim et al., 2024; Bulchand-Gidumal et al., 2024; Blanco-Moreno et al., 2024; Bermúdez-González et al., 2023).

Simultaneously, the role of social media and digital marketing has gained strategic importance, directly influencing tourists' decision-making processes, enhancing interaction with local communities, and building long-term loyalty to destinations (Keelson et al., 2024; Liu et al., 2023; Sustacha et al., 2023).

Beyond the technological and marketing dimensions, the sensory experience of visitors remains a crucial element in active tourism. Factors such as natural landscapes in the context of active sport tourism have been shown to have a positive impact on the creation of lasting memories and the strengthening of a sport-related identity (Jeong, 2023).

Contemporary approaches to destination management, through the integration of smart ICT solutions and sustainability, are shaping new development models aimed at preserving resources and increasing the competitiveness of tourism offerings (Miedes-Ugarte et al., 2024; Ding et al., 2024).

Table 1. Thematic Analysis grouped by main fields and aspects

Main theme	Key Research aspects	References	No. Articles
Information Systems and Technology in Tourism & Recreation	Application and impact of IS and technology in tourism and recreation	• Malcienė & Skauronė, 2019; • Xiang et al., 2021; • Buhalis, 2020; • Castillo et al., 2021; • Gretzel et al., 2015; • Buhalis & Leung., 2018; • Stankov & Filimonau, 2015.	**7**
Digital Communication Strategies in Tourism Industry	Strategies and impact of digital communication. Information sharing during the COVID-19 pandemic	• Laato et al., 2020; • Li et al., 2018.	**2**
Mobile Technology and Social Networks	Impact on travel satisfaction and destination loyalty	• Fan et al., 2019; • Liu et al., 2022; • Keelson et al., 2024; • Ghermandi, 2022; • Fisher et al., 2018; • Cui et al., 2021.	**6**
Artificial Intelligence and Big Data Analytics	Impact and future of AI & Big Data	• Li et al., 2018; • Buhalis & Law, 2013; • Bulchand-Gidumal et al., 2024;	**3**
Smart Tourism & e-Tourism	Personalization of services, foundations, and developments. Definition, taxonomy, research trends, and critical issues	• Buhalis & Amaranggana, 2015; • Buhalis, 2020; • Gretzel et al., 2020; • Adamo, 2018; • Castillo Vizuete et al., 2021; • Robles, 2012; • Wang et al., 2020; • Lee, 2022; • Miedes-Ugarte et al., 2024.	**9**
Digital Skills, 21st-Century Skills	Flexible thinking, resilience to change, development of theoretical sampling in practice, and skill provision through	• Barak 2018; • Binkley et al., 2012; • Brake, 2014; • Butler et al., 2018; • Franco-Valdez & Valdez-Cervantes, 2020; • Van Laar et al., 2020; • Van Laar et al., 2017.	**7**

	experiential learning		
ICT Adoption in Tourism and Recreation Industry and Marketing Activities	ICT adoption model by tourism operators, online marketing activities, and impact on tourists' behavioral intentions	• Sustacha et al., 2023; • Kim et al., 2024; • Liu et al., 2023; • Blanco-Moreno et al., 2024.	**4**

CONCLUSION

Evidence shows that ICT significantly enhances data-driven management, automation of service delivery, community participation, and strategic planning, while also strengthening crisis resilience. Moreover, innovative technologies such as gamification, virtual reality, artificial intelligence, and intelligent infrastructure enrich the tourist experience, particularly for younger generations such as Generation Z. These developments highlight the transformative role of ICT in reshaping the way active tourism is designed, promoted, and experienced.

At the same time, the review reveals that several challenges remain. Issues of digital dependency, unequal access to technology, cybersecurity risks, and a potential loss of authenticity in tourist experiences must be addressed if ICT is to serve as a sustainable and equitable driver of tourism development. The findings suggest that technology integration should not only focus on operational efficiency and marketing advantages but also on preserving the human, cultural, and environmental dimensions of active tourism.

Overall, ICT emerges as a key driver of competitiveness, sustainability, and innovation, guiding future tourism models through technology use, marketing strategies, and visitor experience enhancement. The study contributes to the existing literature by systematizing current evidence on ICT's role in active tourism and by highlighting gaps where further empirical research is required – particularly in the areas of long-term sustainability impacts and cross-cultural adoption of smart solutions.

Future research should continue to evaluate the effectiveness of emerging digital tools in fostering inclusive, sustainable, and experience-rich tourism. Particular attention should be given to measuring the ecological and social implications of ICT adoption, as well as the readiness of different destinations and communities to integrate these innovations. By combining digital transformation with sustainable development principles, the tourism industry can ensure that active tourism evolves as both technologically advanced and socially responsible.

Declaration by Authors
Ethical Approval: Approved
Acknowledgement: Research Thesis of Sports University of Tirana: "ICT impact on Active Tourism and Recreation"
Source of Funding: None
Conflict of Interest: The authors declare no conflict of interests.

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How to cite this article:

Lile, A., Kalluçi, E., & Kaçurri, A. (2025). The Impact of ICT on Active Tourism: A Systematic Literature Review of Innovation, Smart Tourism, and Sustainable Development. *International Journal of Digital Research, 1*(3), 46-52. https://doi.org/10.63711/ijdr.net20250305

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