



Digital Innovations for Sustainable Tourism Management

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Abstract: *This paper explores how digital innovations, particularly travel applications, contribute to promoting sustainable tourism. By analyzing user-generated content, interface features, and eco-certifications in selected travel apps, this study highlights how digital tools could foster cultural and environmental sustainability. It examines publicly available data from apps like TripAdvisor, Airbnb, and Booking.com to assess their effectiveness in encouraging responsible tourist behavior. The findings reveal how these apps integrate sustainability features and communicate them to users, offering practical recommendations for destination managers and digital marketers.*

1. INTRODUCTION

Sustainable tourism has emerged as a critical component in addressing global challenges such as environmental degradation, cultural erosion, and economic inequality. The United Nations World Tourism Organization (UNWTO) points out that tourism can significantly contribute to all 17 Sustainable Development Goals (SDGs), particularly those related to inclusive economic growth, sustainable consumption, and the preservation of marine and terrestrial ecosystems (UNWTO, 2017). However, the rapid expansion of the tourism industry has often led to adverse effects, including environmental pollution, overuse of natural resources, and the commodification of local cultures (Gössling & Peeters, 2015). This approach involves minimizing the negative impacts of tourism activities while enhancing the well-being of local communities and ensuring the conservation of natural and cultural resources for future generations (Butler, 1999). In the context of climate change, sustainable tourism practices are essential for reducing greenhouse gas emissions and promoting resilience among destinations vulnerable to environmental changes (Scott et al., 2012). Sustainable tourism addresses the issue of overtourism, where the influx of visitors exceeds the capacity of destinations, leading to environmental degradation and diminished quality of life for residents (Milano et al., 2019). Implementing sustainable practices can help mitigate these challenges by promoting responsible travel behaviors, supporting local economies, and preserving cultural identities.

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Sustainable tourism is vital for reducing the negative impacts of tourism on the environment and societies. Aligning tourism development with sustainability principles helps address global challenges such as climate change, biodiversity loss, and social inequity. Digital innovations like IoT, AI, and blockchain enable smart tourism ecosystems, enhancing resource efficiency and minimizing environmental impacts (Rodrigues et al., 2023).

AI-driven applications personalize tourist experiences and suggest eco-friendly options, promoting responsible behaviors (Giourgali, 2023). Technologies such as IoT and AI optimize resource use, while blockchain ensures transparency in the tourism supply chain, building consumer trust and supporting ethical practices (Giourgali, 2023).

Digital platforms have helped promoting lesser-known destinations, easing overtourism pressures on popular sites. Using social media and digital marketing, tourism boards highlight unique attractions, distributing traffic more evenly and supporting local economies (European Commission, 2024). Digital innovations enhance operational efficiency, personalize eco-friendly experiences, ensure transparency, and promote equitable activity distribution, aligning the tourism industry with global sustainability goals. However, challenges remain, such as unequal access to technology between developed and developing regions, exacerbating sector inequalities (UNWTO, 2023). Digital tools risk contributing to “greenwashing”⁴, emphasizing the need for transparency and accountability (Giourgali, 2023). Additionally, rapid commercialization can undermine cultural representation and environmental stewardship. Balancing commercial objectives with authenticity demands careful consideration of technological and socio-cultural impacts (European Commission, 2024). Understanding how digital tools foster sustainable practices is crucial for tourism stakeholders.

This paper aims to address these challenges by examining the role of digital innovations in promoting sustainability within tourism. By analyzing travel applications and their features, the study explores how these technologies support responsible behavior, equitable resource use, and cultural preservation. The findings will offer actionable insights for destination managers, digital marketers, and policymakers striving to align tourism practices with global sustainability goals.

2. OVERVIEW OF SUSTAINABLE TOURISM AND DIGITAL INNOVATIONS

Sustainable tourism seeks to balance economic growth with environmental conservation and cultural preservation. Digital innovations have emerged as a cornerstone for achieving this balance by transforming tourism practices and promoting sustainability through technology-driven solutions.

Smart tourism technologies provide a framework for integrating real-time data and digital tools into sustainable practices. These technologies enable optimized resource management, improved decision-making, and enhanced visitor experiences. Research emphasizes the role of real-time systems in tourism, such as the concept of “nowness”, which focuses on immediate responsiveness to consumer needs while minimizing resource consumption (Buhalis & Sinarta, 2019). Similarly, foundational studies on smart tourism highlight the potential of digital platforms to promote responsible behaviors through interactive and data-driven engagement (Gretzel et al., 2015). User-generated content (UGC) on platforms like YouTube has transformed how destinations are represented and experienced. Digital narratives by influencers and users strongly influence tourist behavior, often supporting sustainability goals. Research highlights how YouTube

⁴ Greenwashing refers to the practice of misleading consumers by exaggerating or fabricating environmental benefits of products, services, or practices to appear more eco-friendly than they truly are.

vlog narratives shape perceptions (Vlahović et al., 2023), which allows cultural authenticity and environmental consciousness. Storytelling in digital spaces emerges as a key tool for promoting sustainable tourism. Ethical dimensions in digital communication are equally critical, with transparency and authenticity in influencer marketing being pivotal for building trust and encouraging responsible travel (Ercegovac & Tankosić, 2023). Ethical communication enhances the credibility of sustainability campaigns, aligning them with sustainability objectives.

Strategic digital communication is essential for integrating sustainability into tourism management. Research indicates that businesses can enhance operational efficiency and consumer engagement by aligning their digital communication strategies with sustainability principles (Tankosić & Ercegovac, 2023). These strategies support tourism operators in embedding sustainability into their core practices while maintaining competitive advantages in the digital landscape.

The entrepreneurial impact of digital platforms further illustrates the transformative potential of technology in tourism. Social media influencers have evolved from content creators to business innovators, using platforms like YouTube to drive entrepreneurial ventures and promote sustainable practices. This evolution underlines the growing role of influencers in shaping consumer behavior and supporting sustainability through innovative business models (Ercegovac et al., 2023).

Advances in tourism technologies highlight the interdisciplinary nature of digital innovation. Emerging tools connect the environmental concerns with consumer preferences, demonstrating how digital solutions can meet diverse stakeholder needs while addressing global sustainability challenges (Sigala, 2018). These innovations provide actionable pathways for integrating technology into sustainable tourism practices. Digital innovations have become integral to advancing sustainable tourism. Through smart technologies, user-generated narratives, ethical communication, and entrepreneurial initiatives, digital tools offer transformative opportunities for promoting sustainability while addressing various demands of the tourism industry.

3. ROLE OF TRAVEL APPLICATIONS IN INFLUENCING TOURIST BEHAVIOR

Travel applications have transformed the tourism experience by shaping how travelers plan, interact with, and reflect on their journeys. These digital tools influence tourist behavior through personalized recommendations, gamification features, real-time updates, and their integration of eco-conscious options.

Personalization has been identified as one of the most important features of travel applications that enhances the tourist experience. By leveraging data analytics and user preferences, applications offer tailored recommendations for accommodations, activities, and destinations, improving user satisfaction and engagement. Research shows that personalized tourism recommendations significantly enhance the e-tourism user experience by making trip planning more efficient and aligned with individual interests (Yang et al., 2023). These apps cater to diverse user needs by integrating cultural and contextual factors into their interfaces, enabling more meaningful travel experiences (Coves-Martínez et al., 2023).

Gamification features in travel apps have emerged as a significant factor in increasing user engagement and loyalty. Gamification features like rewards and challenges enhance user engagement, guiding tourists toward sustainable activities and lesser-known destinations (Abou-Shouk & Soliman, 2021). Innovative gamification designs, such as those utilizing tourist-generated images, enhance visitor engagement at tourist sites by offering interactive experiences (Pitakaso et al., 2023).

Travel applications influence eco-conscious behaviors by promoting sustainable options like eco-friendly accommodation filters and green transportation. Research shows that eco-friendly hotels promoted through apps offer resilience and sustainability opportunities in the tourism sector (Vrabcová et al., 2024). Traveler reviews and sentiments significantly impact eco-conscious bookings, as noted in studies on user-generated content (Chirica et al., 2023). Real-time updates and smart functionalities in these apps enhance tourist behavior, allowing for dynamic planning based on weather, traffic, or events (Akhla et al., 2023). Smart tourism products using big data frameworks further improve service delivery and user satisfaction, boosting app engagement (Hu & Li, 2023).

Travel applications play an important role in influencing tourist behavior by integrating personalized recommendations, gamification, real-time functionalities, and sustainability features. These tools enable a more engaging, informed, and responsible travel experience, aligning user preferences with broader goals of sustainable tourism development.

4. CULTURAL AND ENVIRONMENTAL SUSTAINABILITY IN THE TOURISM INDUSTRY

Cultural and environmental sustainability are core principles in tourism, safeguarding heritage and ecosystems while fostering economic growth. Integrating these dimensions ensures the long-term viability of destinations and benefits local communities. Cultural sustainability emphasizes preserving unique identities, traditions, and heritage. Tourism initiatives involving local communities create ownership and celebrate cultural values, enhancing authenticity (Duxbury, 2021; Terzić et al., 2014). Environmental sustainability minimizes tourism's ecological footprint through resource conservation, emissions reduction, and biodiversity protection. The United Nations World Tourism Organization (UNWTO, 2023) calls for low-carbon practices, aiming for a 50% emissions reduction by 2030, supported by green transportation, energy-efficient accommodations, and waste reduction efforts.

The integration of cultural and environmental sustainability practices can yield significant benefits for both tourists and host communities. For instance, eco-friendly accommodations and sustainable tours not only reduce environmental impacts but also attract a growing segment of eco-conscious travelers (Vrabcová et al., 2024). Similarly, sustainable tourism practices can drive economic benefits by creating local employment opportunities and fostering cultural exchange, thereby enhancing community resilience and preserving local heritage (Pagaldiviti & Rai, 2025). Cultural and environmental sustainability play a significant role in the holistic development of the tourism industry. By adopting practices that prioritize the protection of cultural heritage and natural ecosystems, tourism stakeholders can ensure the long-term appeal and integrity of destinations while contributing to global sustainability goals.

5. METHODOLOGY

This study employs a qualitative research methodology to investigate how travel applications contribute to promoting sustainable tourism practices. By analyzing user-generated content, interface features, and eco-certifications within selected travel applications, the study aims to identify patterns and themes that illustrate their role in influencing tourist behavior and supporting cultural and environmental sustainability.

5.1. Research Design

A qualitative content analysis was employed to evaluate how sustainability-related features are integrated into the textual, visual, and functional elements of selected travel applications. This

approach facilitated a comprehensive exploration of the ways these platforms communicate sustainability and engage users in environmentally and culturally responsible practices.

5.2. Selection of Applications

Three popular travel applications—TripAdvisor, Airbnb, and Booking.com—were selected for analysis based on their industry prominence and demonstrated efforts to integrate sustainability features.

Table 1. Sustainability Features in Travel Apps

Platform	Key Features Related to Sustainability
TripAdvisor	User-generated reviews, limited visibility of the GreenLeaders badge
Airbnb	Promotion of local hosts, indirect eco-friendly initiatives
Booking.com	Verified eco-certifications, search filters for sustainability

Source: Own research

5.3. Data Collection

The study collected data from the following sources within the selected applications:

User Reviews:

- A total of 50 user reviews from each platform (150 reviews in total) were analyzed. These reviews were filtered for sustainability-related keywords such as “eco-friendly,” “green,” and “cultural heritage.”
- Reviews were selected to ensure diversity in user perspectives, with a focus on identifying recurring themes and sentiments.

Property Descriptions:

- Sustainability-related features were documented for 30 properties (10 properties per platform).
- Each property’s description was analyzed for mentions of eco-certifications, green practices, and cultural engagement initiatives.

Interface Features:

- The interface of each platform was examined to identify tools, filters, and certifications promoting sustainable tourism.
- Examples include eco-friendly accommodation filters, badges for cultural heritage, and real-time updates.

5.4. Sample Data

The following is a summary of the sample data:

Table 2. Sample data summary

Platform	Properties Analyzed	Reviews Analyzed	Main Features Documented
TripAdvisor	10	50	GreenLeaders program, user reviews highlighting waste reduction (recycling) or green practices.
Airbnb	10	50	Local host engagement, user feedback on eco-friendly stay.
Booking.com	10	50	Sustainability certifications, descriptions emphasizing eco-practices.

Source: Own research

5.5. Data Analysis

The coding process combined principles from thematic analysis and grounded theory, applying a three-stage structure (Braun & Clarke, 2006; Strauss & Corbin, 1998):

- **Open Coding:** Initial identification of codes based on recurring sustainability-related terms and ideas in user reviews, property descriptions, and interface features.
- **Axial Coding:** Organization of codes into broader categories to explore relationships between themes, such as the interaction between cultural sustainability and user engagement.
- **Selective Coding:** Integration of categories into overarching themes that answer the research questions, such as the role of eco-certifications in building consumer trust.

5.6. Ethical Considerations

This study relied exclusively on publicly accessible data from the selected travel applications. As no private or sensitive user information was collected or analyzed, the research adhered to ethical guidelines for data use and privacy protection.

5.7. Ensuring Reliability and Validity

To ensure the reliability and validity of the data, the process of collection and analysis was carried out systematically, with additional checking and coding carried out independently by two researchers. In this way, greater consistency was achieved in the identification and interpretation of thematic patterns. Also, triangulation was carried out by comparing data from three sources: user reviews, accommodation descriptions and interface options, which enabled a multi-layered view of sustainable practices within the analyzed platforms.

The proposed methodology offers a robust framework for understanding how travel applications promote sustainability in tourism. By examining user-generated content and application features, the study provides actionable insights for tourism stakeholders seeking to align digital innovations with cultural and environmental sustainability objectives. To enhance data reliability, cross-validation of coded data was conducted by multiple researchers to ensure consistent interpretation and coding across the sample.

6. RESULTS AND DISCUSSION

6.1. Sustainability Features in Travel Applications

The evaluation of TripAdvisor, Airbnb, and Booking.com reveals varying approaches to integrating sustainability features. While some initiatives have been introduced to highlight eco-friendly practices, their implementation and accessibility present challenges.

TripAdvisor's "GreenLeaders" program, which awards accommodations with badges for implementing eco-friendly practices, was notably absent as a filter option during the search process. Although reviews occasionally referenced the program, its limited visibility as a searchable feature may hinder its effectiveness in guiding users toward sustainable choices. This gap raises concerns about the program's practical utility for eco-conscious travelers, suggesting that the feature is underutilized or insufficiently integrated into the platform's user interface.

Airbnb does not provide a formal sustainability certification program but highlights cultural and environmental features through property descriptions and its "Experiences" section. Listings occasionally

mention eco-friendly practices such as solar energy use or rainwater harvesting. However, these features are not standardized, and there is no systematic way for users to filter for environmentally conscious accommodations. Despite the absence of formal eco-certifications, Airbnb's focus on local experiences aligns with user preferences for sustainable and community-driven tourism (Bialski, 2012).

Booking.com previously implemented the "Travel Sustainable" badge to denote properties that had adopted significant sustainability measures. This badge was awarded based on criteria including waste reduction, energy efficiency, and support for local communities. However, as of March 2024, Booking.com discontinued the "Travel Sustainable" program following feedback from the Netherlands Authority for Consumers and Markets, which found the program's presentation potentially misleading (Schaal, 2024). Currently, Booking.com displays third-party sustainability certifications on property listings and provides filters for users to search for accommodations with such certifications. While this approach ensures that eco-certifications are verified by external organizations, the lack of a unified or standardized program makes it challenging for users to easily identify eco-friendly accommodations. Although filters are available to search for properties with sustainability certifications, their limited visibility and inconsistent use reduce their utility for travelers actively seeking environmentally conscious options.

The findings highlight critical differences and limitations in the integration of sustainability features across TripAdvisor, Airbnb, and Booking.com. The discontinuation of Booking.com's "Travel Sustainable" program illustrates the challenges of maintaining transparency and user trust in promoting sustainability. By shifting to third-party certifications, the platform ensures credibility but sacrifices consistency and usability for users.

Similarly, TripAdvisor's underutilized "GreenLeaders" program suffers from poor visibility and integration, restricting its potential impact. Airbnb, while lacking formal certification systems, indirectly supports sustainability through its emphasis on localized experiences, which appeal to travelers seeking community-driven and culturally immersive options.

Research underscores the importance of prominently displaying sustainability features to influence user decisions effectively (Font & McCabe, 2017). However, the inconsistency across platforms and concerns over greenwashing highlight a need for greater standardization, transparency, and user-centric design. By addressing these gaps, travel applications can better align with the growing demand for sustainable tourism.

These differences reflect the need for digital platforms to better align with sustainability goals by integrating features that are more accessible and transparent for eco-conscious users.

6.2. Sustainability Impact Assessment Using the IODT Index

To quantify the effectiveness of digital platforms in promoting sustainable tourism, a simple Index of Digital Tourism Sustainability (IODT) was developed based on qualitative characteristics identified in the analysis of TripAdvisor, Airbnb, and Booking.com. This index evaluates each platform's sustainability integration using the following criteria derived from the available data: the visibility of sustainable options, which assesses how easily users can find eco-friendly choices (e.g., certifications, green filters); cultural authenticity and local engagement, which measures the platform's emphasis on local culture and authentic experiences; sustainability certifications, which evaluates the presence and visibility of verified sustainability certifications; and user-generated sustainability content, which considers how user feedback and reviews reflect a focus on sustainability.

Detailed scores for each criterion are shown in Table 3, which highlights Airbnb’s strong focus on local engagement and user content, TripAdvisor’s moderate sustainability integration, and Booking.com’s emphasis on verified certifications.

Table 3. IODT Scores for Sustainability Features Across Travel Platforms

Criteria	Airbnb	TripAdvisor	Booking.com
Visibility of Sustainable Options	2	1	1
Cultural Authenticity and Engagement	3	2	1
Sustainability Certifications	0	1	2
User-Generated Sustainability Content	3	2	1
Total IODT Score	8	6	5

Source: Own research

The IODT score for each platform was calculated by summing these criteria (Table 3), with a maximum score of 11. Based on the available data, results are as follows:

- **Airbnb:** 8, showing the strongest sustainability integration through local engagement and user content.
- **TripAdvisor:** 6, reflecting moderate sustainability with limited visibility of sustainable options.
- **Booking.com:** 5, indicating minimal focus on sustainability due to limited local engagement and visible sustainable options.

The IODT index highlights potential areas for improvement across these platforms where each platform could enhance its contribution to sustainable tourism practices, offering clear targets for improvement. Improving the visibility of eco-friendly features, expanding cultural engagement (e.g., Booking.com’s partnerships with local communities), and standardizing sustainability options across platforms could enhance their alignment with sustainable tourism goals (Al-Romeedy & Singh, 2025).

6.3. Cultural Representation in Travel Applications

Travel applications leverage different strategies to present cultural narratives and promote local experiences, reflecting their unique focus and user engagement models.

TripAdvisor emphasizes user-generated content to showcase cultural aspects of destinations. Travelers contribute reviews, photos, and forum discussions, offering diverse perspectives on local attractions, cuisine, and traditions. This crowdsourced information provides potential visitors with insights into cultural experiences, though the quality and depth of information can vary based on individual contributions.

Airbnb actively promotes cultural immersion through its “Experiences” feature, where local hosts offer activities that highlight regional traditions, crafts, and lifestyles. For instance, travelers can participate in traditional cooking classes, guided historical tours, or artisan workshops, fostering direct engagement with the local culture. This approach aligns with the growing demand for authentic travel experiences that connect visitors with the community (Bialski, 2012).

Booking.com primarily focuses on accommodation listings, with cultural information often limited to brief descriptions of nearby attractions. While some properties may highlight cultural elements in their descriptions, the platform lacks dedicated features to promote cultural narratives or local experiences. This approach may limit users’ ability to discover and engage with cultural aspects of their destinations through the platform.

Airbnb's emphasis on curated local experiences sets it apart in promoting cultural engagement. By facilitating direct interactions between travelers and local hosts, Airbnb enables immersive experiences that contribute to a deeper understanding of the destination's culture. In contrast, TripAdvisor relies on user-generated content to provide cultural insights, which, while diverse, may lack the depth and authenticity of structured experiences. Booking.com's limited focus on cultural representation suggests an area for potential development to meet the increasing traveler interest in cultural immersion.

The effectiveness of these platforms in promoting cultural narratives depends on their ability to facilitate authentic interactions and provide comprehensive cultural information. Platforms that prioritize cultural engagement can enhance travelers' experiences and support the preservation of local traditions and heritage.

6.4. User Perception of Sustainability Features in Travel Applications

The analysis of user reviews reveals that very few travelers explicitly address the sustainability or eco-friendly features of their accommodations. This lack of discussion highlights two significant issues: limited user awareness and the insufficient promotion of sustainability features by the platforms themselves.

User reviews occasionally reference sustainable practices, such as energy-saving measures or recycling initiatives, but these mentions are sporadic and lack depth. The absence of a filter for the "GreenLeaders" program further compounds this issue, as users are not actively encouraged to prioritize sustainability when making accommodation choices. Without clear integration of sustainability features into the search process, users may overlook such options entirely, reducing their presence in post-stay feedback.

Airbnb reviews demonstrate a stronger emphasis on cultural experiences and local engagement rather than specific eco-friendly practices. While some hosts highlight green initiatives in their property descriptions, these features are not standardized or prominently displayed. As a result, travelers often focus their reviews on the overall quality of their stay rather than on sustainability-specific attributes. The lack of formal eco-certifications or filters for sustainable accommodations may contribute to this trend by failing to signal the importance of these features to users.

With the already mentioned discontinuation of the "Travel Sustainable" program as of March 2024, Booking.com now relies solely on third-party sustainability certifications for properties. While this ensures external verification, it also reduces the visibility of eco-friendly options for users. User reviews reflecting on sustainability are minimal, which may indicate a lack of awareness or interest. The absence of prominent filters for eco-friendly accommodations reduces users' ability to actively search for and review properties with sustainable practices, further contributing to their marginal presence in user feedback.

The minimal focus on sustainability features in user reviews across all three platforms reflects a broader gap in user awareness and platform promotion. Platforms like Booking.com and TripAdvisor, which previously offered sustainability-specific features, have scaled back or failed to integrate them effectively into the user experience. The lack of filters or visible eco-certifications likely diminishes their influence on booking decisions and post-stay reviews.

Research suggests that when sustainability features are not actively promoted or visible, users are less likely to engage with or value them. This lack of emphasis could explain the sparse mention

of eco-friendly accommodations in reviews, despite a growing global focus on sustainable travel. To address this, platforms need to reinstate or enhance features like filters, badges, and prominent sustainability descriptions to encourage user interaction and feedback.

The absence of a strong emphasis on sustainability in user reviews underscores the need for platforms to take a more proactive approach in promoting eco-friendly options. By making these features more visible and integral to the booking process, travel applications can raise user awareness and foster greater engagement with sustainability practices.

These findings resonate with the principles of the Triple Bottom Line framework, which emphasizes the integration of economic, social, and environmental objectives in sustainable development (Elkington, 1997). The study also reflects aspects of media richness theory, demonstrating how digital platforms enable rich, contextualized communication that supports informed and sustainable decision-making (Daft & Lengel, 1986). By linking user-generated content and app functionalities to these theories, the research underscores the role of digital tools in advancing holistic sustainability goals.

7. CONCLUSION

Studies have shown that eco-friendly consumer behavior has received increasing attention over the past five years (Nimri et al., 2019; Sadiq et al., 2022). For example, data from Booking.com in 2019 revealed that 73% of travelers expressed a desire to stay in eco-friendly accommodations, marking a 5% increase compared to the previous year. Similarly, Lee and Cheng (2018) found that consumers place a growing emphasis on environmental consciousness and have heightened expectations for hotels to adopt green practices (Pagaldiviti & Rai, 2025). However, the findings of this research show that such environmental awareness is not visibly reflected in user-generated content on leading travel applications, which indicates a gap between declared preferences and actual user behavior on the platforms.

This study shows that sustainable features on tourism platforms are not sufficiently visible or standardized, which reduces the usability and further impact on user behavior. The analysis of user reviews in this paper shows that sustainable aspects are rarely mentioned or evaluated in practice. Such disparity points to the need for more efficient integration of sustainable options into digital interfaces, as well as the importance of educating users about their availability and importance.

The theoretical contribution of the paper is reflected in the development and application of the Index of Digital Sustainability in Tourism (IODT), which, based on qualitative characteristics, can systematically assess the presence and functionality of sustainable elements on digital tourism platforms. This index provides a basis for further research on digital practices in sustainable tourism, especially in the context of evaluating user engagement and visibility of sustainable options. The practical contribution refers to recommendations for managers of tourist destinations and platform designers, who through better positioning of tags, introducing filtering and encouraging user engagement can significantly improve the promotional and informative functions of applications in the field of sustainable tourism.

This research relies on publicly available data and focuses on three global platforms, which may limit the transferability of findings to other digital tools/platforms or local contexts. Having that in mind, future studies could include comparative analyses between regional and global apps, as well as longitudinal research to track the evolution of sustainable practices and the impact of changes in app design on user behavior.

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