Bulletin of the Transilvania University of Braşov
Series V: Economic Sciences • Vol. 17(66) No. 2 - 2024
https://doi.org/10.31926/but.es.2024.17.66.2.4

COMPARATIVE STUDY ON THE USE OF DIGITAL TECHNOLOGIES IN MOUNTAIN RESORTS: AN ANALYTICAL APPROACH

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Abstract: *In recent years, the rapid growth of digital technologies has transformed the tourism industry, with mountain resorts increasingly adopting digital solutions to enhance tourist experiences and improve operational efficiency. This article introduces a diagnostic tool designed to assess the use of digital technologies in mountain resorts. The tool provides insights that help these destinations identify customised strategies to transition into smart destinations. By aligning digital solutions with the unique scale and characteristics of each resort, this approach enhances their ability to remain competitive with larger, more established tourism destinations. The findings show a significant disparity between Romanian and international resorts, especially in terms of mobile applications, online services, and real-time navigation systems. The article concludes by discussing management implications for resorts, recommending increased investment in digital technologies and a stronger focus on social media engagement and smart solutions to enhance tourist experiences and competitiveness.*

Key words: *Smart tourism technologies, digital infrastructure, mountain resorts, Romanian resorts, comparative analysis*

1. Introduction

With the explosive growth of the Internet user base and smart devices, technology is no longer just an auxiliary tool, and the use of digital technologies has become an inevitable requirement for development (Hall et al.,2000). The integration of digital technologies into the tourism industry is logical in this context. The popularisation of smart mobile devices has led to an increase in the number of mobile tourism users. Mobile technology significantly enhances the tourist experience, giving them the ability to use devices such as smartphones and tablets to communicate with anyone, at any time, and from any location. This facilitates interaction and the sharing of travel experiences (Kim & Tussyadiah, 2013). Various social networks have become the main platforms where

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tourists can share travel-related information, transforming the way they share their experiences (Wang, 2021).

Nowadays, the tourist experience is closely tied to the digital approach. In fact, a journey typically begins on the web, which offers a wide range of opportunities and makes user feedback a key decision-making criterion. This is generally followed by the actual travel experience, during which tourists capture images and share their perspectives. Finally, the journey concludes at home, where photos and travel reviews are shared with friends or other potential tourists through online platforms (Rezaei et. al, 2016).

Today's tourists primarily plan their trips online. Consumers seek the opinions of other travellers, interact, and share ideas about a destination. As a result, interactive websites displaying tourism-related content have become highly popular (Munar, 2012). This growing trend of consumer-to-consumer communication on the web is transforming consumption and production processes in tourism (Xiang & Gretzel, 2010). Tourist-generated content competes directly with Destination Management Organizations (DMOs), which have traditionally been the main providers of destination-related information and knowledge (Schmallegger & Carson, 2008). This new reality presents additional challenges for DMOs in managing and promoting tourist destinations. To effectively reach tourists, DMOs must remain relevant in the online space with a well-designed digital marketing strategy.

Digital technologies help tourist destinations improve the efficiency of resource management, contribute to the sustainable development of tourist resources, and enhance the quality of life for both residents and tourists. This digital foundation paves the way for a more advanced stage of innovation: the implementation of smart tourism technologies (STT).

The primary objective of the article is to analyse the use of digital technologies in mountain resorts and compare the digital infrastructure of Romanian resorts (Sinaia, Predeal, Straja, and Rânca) with that of well-known international resorts. The study aims to identify gaps and provide insights into how these resorts can improve their digital offerings, eventually transitioning into "smart destinations." By evaluating various digital characteristics such as website functionality, mobile optimization, social media presence, and online booking capabilities, the research seeks to assess how well resorts are adapting to the digital needs of modern tourists

This study builds on existing literature exploring the role of digital technologies in tourism, particularly focusing on smart tourism technologies (STT) and their impact on decision-making and enhancing tourist experiences. The Material and Methods section details the comparative analysis of four Romanian and six international resorts, evaluating 13 key digitalization characteristics based on the model by Fux et al. (2020). The Results present a comparative analysis showing each resort's performance in adopting digital technologies. The discussion section interprets the findings, comparing the performance of Romanian and international resorts. The conclusions summarise the main findings and discuss their implications for resort management.

2. Literature review

Various technological innovations are transforming the tourism industry. Some of these include: artificial intelligence, machine learning, big data, IoT (Internet of Things), smart devices, social networks, robots, drones, sensors, beacons—small devices that emit short-range radio signals using Bluetooth Low Energy (BLE) technology to communicate with nearby smart devices, such as mobile phones or tablets—virtual and augmented reality, and NFC (Near Field Communication). NFC is a short-range wireless communication technology that enables information exchange between devices a few centimetres apart and is used for secure transactions, such as mobile payments, contactless ticket purchases, quick hotel check-ins, or obtaining information about tourist attractions by simply tapping a smartphone on an NFC tag. Additional technologies are constantly being added to the list (Sigala, 2018).

Existing research (Buhalis and Amaranggana, 2015; Vicini et al., 2012; Egger, 2013; Li et al., 2021), indicates that smart tourism technologies (STT) have a direct impact on tourists' experiences, serving as an important factor influencing their level of satisfaction (Carbonell and Escudero, 2015). As a result, many destinations and tourist attractions have adopted and implemented STTs to provide tourists with a convenient, friendly, and personalised experience, aiming to increase their satisfaction. Research in this field mainly consists of case studies on smart tourist destinations (Boes et al., 2016; Del Vecchio & Passiante, 2017) or the application of STTs in tourist destinations or attractions (Park et al., 2016; Sedarati and Baktash, 2017). An increasing number of tourist destinations have adopted smart technologies to enrich the tourist experience. Tourists use available smart technologies for decision-making, such as organising travel plans on their mobile phones, interacting with other tourists, and sharing their travel experiences (Yang et. al, 2017).

With a focus on the traveller as a user, technologies aim to support travellers by (Yoo et al., 2016):

1. anticipating user needs based on various factors and providing guidance on activities specific to the context, such as dining options, points of interest, and recreational activities;
2. enhancing the on-site experience by providing detailed information, location-based interactive services, and personalised offers;
3. allowing travellers to share their travel experiences, thereby helping to guide other tourists in their decision-making process.

The functions of technology in the tourism sector are diverse and interconnected, contributing to the transformation of both business operations and tourist experiences. First, technology enables personalised expression, allowing tourism companies to shape and communicate their brand identity, while tourists actively share their experiences and information. This exchange of data fosters the development of personal and social identity within the tourism ecosystem.

Moreover, technology serves as a decision-making tool for both firms and tourists. Companies utilise technological instruments to optimise pricing strategies, while tourists benefit from price comparison tools, metasearch engines, and recommendation systems that facilitate informed travel decisions. This process is supported by the integration of

market information systems, which collect, store, analyse, and interpret “big data”. The ability to process such vast amounts of information allows stakeholders to better understand market dynamics, ultimately enhancing both operational efficiency and customer satisfaction.

In addition to decision-making support, technology acts as a resource for e-learning and educational development. As the tourism industry transitions from traditional learning methods to more collaborative, digital approaches, technology facilitates knowledge sharing and continuous professional development. This is further complemented by the use of technology as an automation tool, streamlining predictable tasks and enhancing workforce capabilities through improved decision-making processes.

Furthermore, technology functions as a change agent, enabling the development of new business models and management practices. Examples include the rise of cyber intermediaries, which are reshaping how services are delivered and consumed in the tourism industry. At the same time, technology is transforming the very nature of tourist experiences, offering virtual tours, augmented reality, and other technology-mediated experiences that enhance engagement and satisfaction.

Finally, technology provides a platform for co-creation, empowering tourists and businesses alike to actively contribute to the development of shared value. Review sites, online guides, and peer-to-peer marketplaces allow for greater interaction and collaboration among all tourism participants, fostering an environment of innovation and mutual benefit. By integrating these diverse functions, technology not only enhances the efficiency and competitiveness of tourism enterprises, but it also enriches the overall travel experience for tourists (Sigala, 2018).

3. Material and Methods

In this research, we examine two well-known and medium-sized tourist resorts in Romania, Sinaia and Predeal, along with two smaller and lesser-known resorts, Straja and Rânca, also located in Romania. Additionally, we analyse six resorts from various countries worldwide, each with a strong tradition and extensive experience in mountain tourism.

This comparative study is inspired by the model presented in the article by Fux et al. (2020). A portion of the model proposed by the authors was adopted and adapted to the aspects relevant to this research. As a result, a comparative analysis was conducted between globally representative mountain resorts for which relevant information could be found online. These resorts include Sinaia (Romania), Predeal (Romania), Straja (Romania), Rânca (Romania), Banff and Lake Louise (Canada), Courchevel (France), Cortina D'Ampezzo (Italy), Interlaken (Switzerland), Queenstown (New Zealand), and Bansko (Bulgaria).

Mountain Resorts Comparison Table 1

Resort	Country	Mountain Massif
Sinaia	Romania	Bucegi Mountains
Predeal	Romania	Bucegi Mountains
Straja	Romania	Vâlcan Mountains
Rânca	Romania	Parâng Mountains
Banff and Lake Louise	Canada	Canadian Rockies
Courchevel	France	Alps
Cortina D'Ampezzo	Italy	Dolomites
Interlaken	Switzerland	Bernese Alps
Queenstown	New Zealand	Southern Alps
Bansko	Bulgaria	Pirin Mountains

Source: Created by the authors

Each of the ten resorts analysed in this study offer unique amenities that cater to a variety of tourists, from luxury travellers to budget-conscious adventurers.

Sinaia (Romania) is one of Romania's most popular mountain resorts, located in the Bucegi Mountains of the Southern Carpathians, about 120 km north of Bucharest, the capital of Romania. Known as the "Pearl of the Carpathians", it is a year-round destination offering activities for both winter and summer tourism. Sinaia also offers wellness facilities, adding to its appeal for tourists looking for a combination of adventure and relaxation.

Predeal (Romania) provides well-developed skiing and hiking facilities, including slopes of varying difficulty, ski schools, and equipment rental options. The resort offers various accommodation places, ranging from hotels to guesthouses, and features wellness facilities, making it suitable for tourists seeking both adventure and relaxation.

Straja (Romania) focuses predominantly on winter sports, with a network of over 12 kilometres of ski slopes. Although smaller in size, it attracts visitors looking for a more intimate, less commercialised skiing experience. The resort also provides basic amenities like ski equipment rentals and guest house accommodation.

Rânca (Romania), another smaller Romanian resort, offers moderate skiing and snowboarding facilities with a quieter atmosphere. It attracts tourists looking for a more local and peaceful experience in both winter and summer hiking activities.

In contrast, Banff and Lake Louise (Canada) offer world-class amenities with extensive ski trails, luxurious hotels, fine dining, and wellness services. These resorts are well-known for both winter and summer activities, attracting a large volume of visitors annually due to their iconic natural beauty and high-end services.

Courchevel (France), situated in the French Alps, is renowned for its luxury tourism. It offers ski-in/ski-out facilities, high-end accommodations, Michelin-starred restaurants, and luxury shopping. Courchevel caters to affluent travellers looking for a premier winter sports destination.

Cortina D'Ampezzo (Italy), known as the "Queen of the Dolomites" also offers upscale amenities, including high-end hotels and restaurants, along with a variety of cultural

events. It combines skiing with luxury, attracting international visitors for both its sports facilities and cultural appeal.

Interlaken (Switzerland) stands out for its adventure tourism, offering paragliding, skydiving, and other adrenaline-driven activities, in addition to traditional skiing and hiking. With a variety of luxury accommodations, wellness centres, and cultural festivals, it caters to tourists seeking both adventure and scenic beauty.

Queenstown (New Zealand) is another global adventure tourism hub, providing year-round activities like skiing, bungee jumping, and jet boating. With a range of accommodations from luxury lodges to budget options, and a vibrant nightlife, it attracts adventure seekers from around the world.

Finally, Bansko (Bulgaria) is a popular destination for budget-friendly skiing, offering modern facilities at affordable prices. With a lively après-ski scene, Bansko has become a top choice for travellers seeking value without compromising on amenities.

In summary, luxury resorts like Courchevel, Banff and Lake Louise, Cortina D'Ampezzo, and Sinaia offer high-end services, while resorts like Queenstown and Interlaken focus on adventure tourism. More budget-conscious destinations like Bansko, Predeal, Straja, and Rânca provide excellent skiing options at affordable prices, catering to a broader range of tourists.

In the comparative study, 13 characteristics related to the use of digital technologies in the resorts were analysed as follows:

Characteristic 1 (C1): Presence of an official resort website;
Characteristic 2 (C2): Ranking of the resort's website in Internet search results;
Characteristic 3 (C3): Availability of information on the website in multiple languages;
Characteristic 4 (C4): Availability of an online booking platform on the official website;
Characteristic 5 (C5): Optimization of the website for mobile devices;
Characteristic 6 (C6): Resort's presence on social media;
Characteristic 7 (C7): Resort's presence on review platforms;
Characteristic 8 (C8): Availability of a resort-specific mobile application;
Characteristic 9 (C9): Availability of public Wi-Fi networks in the resort;
Characteristic 10 (C10): Availability of weather condition monitoring systems;
Characteristic 11 (C11): Availability of interactive online maps;
Characteristic 12 (C12): Possibility to make online reservations;
Characteristic 13 (C13): Availability of navigation and guidance systems.

In the comparative study, points were assigned to each resort based on how well they fulfilled specific digital technology criteria. The point system followed a structured approach.

If a resort fully met the requirements of a given characteristic, such as having an accessible and fully functional official website or offering a comprehensive online booking system, it was awarded 1 point. Full compliance indicated that the resort had fully implemented the digital feature in question.

In cases where a characteristic was only partially fulfilled, such as offering limited information in multiple languages or having a partially optimised mobile site, 0.5 points were awarded. This allowed the assessment to recognize efforts where the feature was present but not fully developed.

Finally, if a resort did not meet the characteristics at all, such as lacking an official mobile application or not offering public Wi-Fi networks, it received 0 points. This system provided a nuanced way of evaluating the digital capabilities of each resort, reflecting both complete implementations and partial efforts in integrating digital technologies.

4. Results

Table 2 presents the comparative analysis performed, including the score assigned to each characteristic and the total score for each resort.

Overview of points awarded to each characteristic Table 2

Resort	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	Total
Sinaia	1	0	1	0	1	0.5	1	0	1	1	1	1	0	8.5
Banff & Lake Louis	1	1	0	1	1	1	1	1	1	1	1	1	1	12
Courchevel	1	0.5	1	1	1	1	1	1	1	1	1	1	1	12.5
Predeal	1	0.5	0	0	1	0.5	1	1	1	0	0	1	0	7
Cortina D'Ampezzo	1	0.5	1	1	1	0.5	1	1	1	1	1	1	1	12
Interlaken	1	0.5	1	1	1	1	1	1	1	1	1	1	1	12.5
Straja	1	1	0	0	1	0.5	1	0	0	1	0	1	0	6.5
Rânca	1	0.5	0	0	1	0.5	1	0	0	0	0	1	0	5
Queenstown	1	1	0	0	1	0.5	1	1	1	1	1	1	1	10.5
Bansko	1	1	1	0	1	0.5	1	1	1	1	1	1	1	11.5

Source: Created by the authors

Sinaia and Predeal, two of Romania's well-known medium-sized resorts, scored 8.5 and 7 points, respectively. Sinaia showed strong digital integration, scoring full points for essential characteristics such as the existence of an official website, multilingual information, mobile optimization, and availability of public Wi-Fi and online maps. However, it did not perform well in terms of search engine ranking, online booking capabilities, and the absence of a dedicated mobile application.

Predeal, while also providing core digital services, had lower performance in certain areas, particularly lacking an online booking platform and receiving partial points for social media presence and search engine ranking.

Straja and Rânca, the smaller Romanian resorts, scored 6.5 and 5 points, respectively. Both resorts met basic digital requirements, such as having a website, mobile optimization, and access to online reviews. However, they performed poorly on more advanced digital features like online booking, mobile applications, and the availability of navigation systems, reflecting their smaller scale and less-developed digital

infrastructures.

The top performers in this analysis were the internationally renowned resorts, with Courchevel and Interlaken scoring 12.5 points each, followed closely by Banff & Lake Louise and Cortina D'Ampezzo, each with 12 points. These resorts excelled in almost every digital characteristic, offering well-developed websites, multilingual support, mobile applications, and strong social media engagement across multiple platforms. Additionally, they provided seamless access to online booking, weather monitoring systems, and interactive maps, showcasing their long-standing expertise in utilizing digital technologies to enhance the tourist experience.

Queenstown and Bansko also performed strongly, scoring 10.5 and 11.5 points, respectively. Both resorts demonstrated high levels of digital integration, offering a range of services such as public Wi-Fi, mobile apps, and comprehensive online booking systems, placing them in the top tier of the analysis. As observed in the table above, the Romanian resorts were evaluated across two categories: well-known resorts and smaller resorts. Sinaia, with a total score of 8.5 out of a possible 13, ranks 7th out of the 10 resorts analysed. In contrast, top-ranking resorts like Banff & Lake Louis, Courchevel, Cortina D'Ampezzo, Interlaken, Queenstown, and Bansko scored higher due to their more extensive digitization efforts.

5. Discussion and Conclusions

The results highlight a clear gap between Romanian resorts and their international counterparts in terms of digital technology adoption. While Sinaia and Predeal are making strides in incorporating digital tools, their relatively lower scores in advanced digital services such as mobile applications, online booking, and real-time navigation indicate room for improvement. Straja and Rânca, being smaller and less frequented, face even greater challenges in terms of digital transformation.

In contrast, the leading international resorts, particularly Courchevel, Interlaken, and Banff & Lake Louise, have embraced a comprehensive digital approach, integrating a wide range of technologies to enhance both convenience and the overall tourist experience. These resorts set a high standard in terms of digital engagement, particularly in social media outreach and offering tailored online services to meet tourists' needs.

The findings suggest that Romanian resorts, especially the smaller ones, should invest more in digital technologies to remain competitive with international destinations. Expanding their online presence, improving search engine visibility, and developing mobile applications could significantly enhance their attractiveness to tech-savvy tourists. Furthermore, leveraging social media platforms beyond Facebook and Instagram, as seen in Courchevel and Interlaken, would help Romanian resorts reach a broader audience and improve their digital reputation.

The findings of this study carry important **management implications** for resorts, particularly in Romania. Firstly, it underscores the critical need for Romanian resorts,

especially smaller ones like Straja and Rânca, to improve their digital infrastructure. This includes enhancing website functionality, offering multilingual information, and implementing robust online booking systems. These steps are essential to provide better accessibility for international tourists and to modernise the overall visitor experience.

Additionally, the absence of resort-specific mobile applications represents a missed opportunity for offering personalised services and real-time convenience to tourists. Developing mobile apps could significantly improve how tourists interact with the resorts, from booking accommodations to accessing maps and activity suggestions.

Moreover, Romanian resorts should leverage the power of social media more effectively. While many resorts have established a presence on platforms like Facebook and Instagram, expanding to newer platforms such as YouTube, Pinterest, or TikTok can help engage a broader and younger audience, as seen with top-performing international resorts like Courchevel and Interlaken. A strong, diversified social media presence will enhance brand visibility and foster greater interaction with potential visitors.

Finally, the study highlights the need to focus on smart technologies. Integrating features like public Wi-Fi, real-time weather monitoring systems, and navigation tools would provide practical benefits to tourists and enhance their overall experience. These technologies, when properly implemented, can differentiate Romanian resorts and help them stay competitive in an increasingly digital tourism landscape.

The study opens several avenues for **future research** in the field of digital technologies and tourism. Firstly, a deeper analysis of tourist preferences could be explored. Future research should focus on understanding how specific digital features, such as mobile apps or real-time information systems, impact tourist satisfaction and decision-making processes. This would provide valuable insights for resorts looking to tailor their digital offerings to meet the evolving needs of their visitors.

Secondly, with the rapid advancement of emerging technologies like artificial intelligence (AI), virtual reality (VR), and blockchain, future studies could investigate how these technologies can further revolutionise the tourism industry. Research in this area could explore the potential of AI for personalised marketing, VR for immersive tourism experiences, and blockchain for enhancing security in online transactions and bookings.

Longitudinal studies would also be beneficial in tracking the progress of digitalization in resorts over time. Such research could examine how sustained investments in technology influence a resort's competitiveness and tourist numbers, offering insights into the long-term benefits of adopting smart tourism technologies.

Lastly, cross-cultural comparisons could provide a better understanding of the differences in digital expectations and usage among tourists from various cultural backgrounds. This would help resorts tailor their digital strategies more effectively, ensuring they meet the specific demands of different tourist demographics and further improve visitor satisfaction.

The study has several **limitations** that should be acknowledged. First, there is a limited scope in the research, as it focuses on only four Romanian resorts and six international resorts. This sample size may not fully represent broader trends in digital tourism across various regions and resort types. Expanding the number of resorts analysed in future research would improve the study's generalizability and provide a more comprehensive view of digital adoption in the tourism industry.

Second, the study heavily relies on quantitative scoring for each digital characteristic. While this method provides measurable results, it lacks the qualitative insights that could offer a deeper understanding of the challenges and opportunities resorts face in implementing digital technologies. Including interviews with resort management or feedback from tourists would allow for a more nuanced evaluation of digital strategies and their impact on the tourist experience.

Third, there are potential data limitations, particularly regarding the availability and accuracy of information on tourist numbers and resort capacities. In some cases, data might not be up-to-date or easily accessible, which could affect the reliability of comparisons between resorts.

Finally, there is a degree of geographic bias in the selection of international resorts. The chosen resorts are concentrated in a limited number of countries, potentially overlooking significant innovations in digital tourism occurring in other regions. Including a more geographically diverse range of resorts would broaden the scope and applicability of the study's findings.

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