COMPARATIVE ANALYSIS OF STAKEHOLDERS PERCEPTIONS ON DIGITALISATION AND ADVANCED TECHNOLOGIES IN TOURISM

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Abstract

The purpose of the paper is to provide qualitative insight into perceptions and experiences of key tourism stakeholders regarding digitalisation and advanced technologies (D&AT). With comparing those perceptions and experiences across scholars, public institution representatives and practitioners (triangulation) in two European countries, Slovenia and Montenegro, the object of the research is to reveal the dimensions of technological adoption in a specific industry and geographical context. Interviews explored three thematic areas: a) understanding of D&ATs, b) perceived advantages, and c) challenges and concerns associated with D&ATs. Data were collected from 27 interviewees and analysed using content analysis, applying thematic coding and matrixes. The findings reveal that while D&ATs in tourism are generally welcomed for their potential to enhance efficiency and service delivery, significant concerns persist regarding the loss of human-to-human interaction, varying levels of

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technological competence, and the strategic use of data. Countries at different stages of technological maturity perceive and experience these issues in distinct ways, yet, the tension between technological advancement and human-centred tourism persists across borders.

Key Words

Digitalisation; advanced technologies; advantages and challenges; Tourism 4.0.

INTRODUCTION

After 2011, the hype around Industry 4.0 (Ghobakhloo et al., 2021) announced the era of digitalisation and the Cyber Physical Systems (Alcácer & Cruz-Machado, 2019). The pillars and technologies of Industry 4.0 have gradually penetrated to other economic sectors, including to tourism. According to Bilotta et al. (2021), technologies of Industry 4.0 have perfectly fit with the new paradigm of Tourism 4.0 and gradually transformed tourism system.

The COVID-19 pandemic and the post-pandemic period offered excellent opportunities for the digital transformation of tourism and hospitality (Noung & Ragawan, 2023). Tourism service providers increasingly implemented technological solutions with minimal human interaction, more so than before. The pace and extent of technological advancement were so rapid that various stakeholders in tourism struggled — mentally, physically, and culturally — to keep up in ways that would benefit them (Stankov & Gretzel, 2020).

Osei et al. (2020) highlight a research gap concerning the inclusion of advanced technologies (ATs) in tourism and hospitality research, particularly research about dimentions of technology adoption in the sector. Although the term digitalisation is widely used in academic literature, policy documents and industry practices, Bloomberg (2018) warns that its meaning remains unclear. There is still no consensus in tourism regarding which AT should be applied in Tourism 4.0 (Osei et al., 2020). Furthermore, several tourism scholars provide synthesis on advantages of D&ATs (e.g., Buhalis, 2020; Buhalis et al., 2023; Akiskali et al., 2022; Townsend, 2017), their challenges and concerns (Stankov & Gretzel, 2020; Pencarelli, 2019). Yet, researchers do not provide empirical evidence to support their assertions. We identified these as a knowledge gap and a problem, with our study contributing to its solution.

This paper intersects two relevant topics: tourism, as one of the fastest-growing economic sectors (World Travel & Tourism Council, 2024), and D&ATs, which remain a key priority in the field (Bekele & Raj, 2025). It is the first study to investigate diverse perspectives on these themes from three distinct stakeholder groups within the tourism sector. The extensive

discussion on D&ATs at the International Tourism Exchange Convention in Berlin (ITB Berlin) in March 2025 underscores the ongoing relevance of this topic and the need for further research.

This study addresses three research questions (RQs):

RQ1: How are digitalisation and advanced technologies (D&ATs) understood among tourism stakeholders?

RQ2: What are the advantages of D&ATs in tourism?

RQ3: What are the challenges and concerns about D&ATs in tourism?

THEORY REVIEW

Tourism 4.0

Since the term Tourism 4.0 entered academic discourse, scholars have proposed various definitions. Stankov and Gretzel (2020) describe it as a vision of technology-driven transformation in the tourism sector, leading to a highly interconnected 'phygital' system — a fusion of physical and digital elements. Pencarelli et al. (2019) defines it as a new tourism value ecosystem, heavily based on advanced technological services and aligned with the principles of Industry 4.0 (e.g., interoperability, virtualisation, decentralisation, real-time data gathering and analysis, service orientation, modularity, etc.).

With the increasing implementation of D&ATs in tourism, new terminology has emerged in academic literature. Empowered to design and, at least partially, produce and consume their own experiences through technology, tourists have been labelled *co-creators* of their experiences (Buhalis, 2020; Neuhofer et al., 2013) or prosumers — simultaneously producers and consumers (Sigala, 2018; Ritzer & Jurgenson, 2010). The concept of the ecosystem has become widely adopted in the sector (e.g., Starc Peceny et al., 2019; Pencarelli et al., 2019; Buhalis, 2020). A range of new terms have been introduced into everyday lexicon and research agendas, such as Web 3 (Guan et al., 2022), metaverse (Wei, 2022), non-fungible tokens (Valeonti et al., 2021), etc.

New terminology and emerging technological solutions have created a broad scope for research into how D&ATs might be applied in tourism. However, they do not provide a unified understanding of how digitalisation in tourism is actually perceived, nor which types of ATs are considered key components of Tourism 4.0.

Digitalisation

While the term digitisation has a straightforward meaning (the process of converting information from analog to digital format so that it can be stored, processed, and transmitted by computers), digitalisation lacks a single, universally accepted definition. Some researchers approach to digitalisaton as to utilisation of digital technologies to alter and optimize existing business processes (e.g., distibution, communication, management) for the purpose

of cost saivings, process enhancement, etc. (Bekele & Raj, 2025). Teubner and Stockinger (2020) describe it as the interaction between digital technologies and social as well as institutional processes. If we consider digitalisation in relation to social life and how people interact, it implies a shift from analog to digital forms of interaction (Bloomberg, 2018).

In a business context, digitalisation is understood as the use of digital technologies to alter business models, create new revenue streams, unlock value-producing opportunities, and transform business operations (Gartner Glossary, n.d.). Since it leverages digital technologies and data to transform both businesses and business ecosystems (Dredge et al., 2019), this definition is relevant and applicable in the tourism sector.

The term digitalisation is often used synonymously with the term digital transformation (Saariko et al., 2020). The terms are interconnected, but from a business point of view we need to differentiate them. The scope of digital transformation is broader than digitalisation and digital transformation usually follows digitalisation (Van Veldhoven & Vanthienen, 2021). Succesful digital transformation might be predicted through digital maturity (Jie et al., 2025), a measure of organisation's ability to create value through digital.

Advanced technologies (ATs)

In tourism, scholars have different approach to ATs in the sector. Starc Peceny et al. (2019) directly adopt certain ATs from Industry 4.0. In contrast, Buhalis et al. (2020) and Buhalis et al. (2023) provide an extensive list of relevant ATs, while Osei et al. (2020) identify only six key technologies that they believe are most practical for implementation. Table 1 illustrates the similarities and differences in how these groups of researchers understand the ATs in Tourism 4.0.

Table 1: Examples of ATs in Tourism 4.0

Starc Peceny et al. (2019)	Buhalis (2020), Buhalis et al. (2023)	Osei et al. (2020)
- High performance computing; - Big data analytics; - Cloud computing; - Internet of things (IoT); - Artificial intelligence (AI); - Wireless connectivity; - Smart sensory; - Virtual reality; (VR); - Augmented reality (AR); - Location based services.	- Fifth-generation mobile network (5G); - Artificial intelligence (AI); - Radio frequency identifications (RFID); - Mobile devices; - Smart phones; - Smart wearables; - Blockchain and cryptocurrencies; - Applications; - Virtual reality (VR); - Augmented reality (AR); - Autonomous devices or agents; - Location based services (including social media); --------------------------	- Cyber-Physical systems; - Cloud computing; - Internet of things, - Artificial intelligence; - Big data; - Robotics.

- Internet of Everything;
- Machine learning;
- Three-dimensional printers;
- Metaverse.

Most existing studies on D&ATs in tourism focus on the conceptualisation of individual technologies, their technical descriptions, potential applications, or suggested research agendas. Only studies concerning service robots provide empirical findings (Zhang et al., 2023; Wu et al., 2023; Liu et al., 2023; Akiskali et al., 2022).

Advantages, challenges and concerns of implementing D&ATs in tourism

Buhalis (2020) provides a broad theoretical synthesis of the advantages that D&ATs have brought to tourism. These technologies have revolutionised communication and information search, enhanced networking dynamics, and facilitated the rise of peer-to-peer platforms and social media. From a management perspective, D&ATs support capacity management, operational efficiency, inventory control, yield and revenue management, financial planning, and reporting. In marketing, they enable more effective research and planning, online reservations and sales, customer relationship management, and personalised services. D&ATs have also transformed distribution channels through disintermediation and enabled review sites, allowing for rapid online word-of-mouth dissemination.

The interconnectivity and interoperability of integrated technologies have reengineered business processes and data flows, enabling innovative tourism services and maximising stakeholder engagement (Buhalis et al., 2023). The dynamic co-creation of experiences, personalisation, context adaptation, and the fluidity between physical and digital interactions have created a new tourism landscape, significantly different from the past, for both tourism service providers and tourists.

While Buhalis's (2020) presentation of D&ATs' advantages is compelling, several challenges and concerns are often overlooked in the existing literature. Stankov and Gretzel (2020) highlight the negative consequences caused by the rapid and high-impact adoption of D&ATs in the sector. They question whether these technologies genuinely enhance tourists' experiences as frequently claimed, noting the lack of empirical evidence and the repetition of untested assumptions. Researchers highlight that in practice, the technological solutions of Tourism 4.0 may not be as human-centric as often portrayed.

Pencarelli (2019) similarly raises concerns, arguing that Tourism 4.0 places excessive emphasis on technological efficiency at the expense of real-life tourist experiences. Other issues include changes in organisational culture, as employee interaction shifts from people to technology (Akiskali et al., 2022), particularly when staff feel their jobs are threatened.

D&ATs also involve significant costs, including investments in installation, system inefficiencies, maintenance, parts replacement, insurance, and legal

liability (Akiskali et al., 2022). Townsend (2017) identifies several "dark sides" of technology, including privacy issues, digital exclusion, knowledge and information loss, threats to language and culture, and the loss of human interaction. Buhalis (2020) adds ethical dilemmas to the list, while Stankov and Gretzel (2020) warn of health and well-being risks (e.g. eye strain from VR goggles, motion sickness, or exposure to harmful frequencies). Stankov and Gretzel (2020) are among the few scholars who also raise concerns about the substantial energy footprint of these technologies and risks associated with the digital footprint.

Another practical issue is the cognitive burden D&ATs may place on tourists, who are often required to engage intensively with systems or digital content (e.g., too many tasks, complex interfaces, unresponsive systems, etc.). This can have a distracting effect, especially for tourists who prefer to disconnect from technology during their vacations A counter-trend to D&ATs is evident in the growing popularity of digital detox tourism (Gong et al., 2023; Nasr, 2025).

METHODOLOGY

A qualitative research design was selected to obtain the most relevant answers to the research questions (RQs). Qualitative methods have been widely used in recent years in social science contexts (e.g., Fošner & Trop, 2024) and in tourism research (Jagodič et al., 2025; Frost & Frost, 2021; Pachlevan-Scarif et al., 2020; Airey, 2013). Corresponding methods and techniques were chosen for each step of the empirical research.

Data were collected in 2022 through field research involving 27 interviewees — representatives from three stakeholder groups (triangulation): scholars, public sector representatives, and practitioners, across two countries: Slovenia and Montenegro (for comparative purposes). Semi-structured interviews were chosen as they rely on direct, in-person interaction with participants.

Triangulation enhances the robustness of findings and is a key criterion in assessing the trustworthiness of qualitative research (Bans-Aukney &Tiimub, 2021; Decrop, 1999). In this study, each of the three stakeholder groups directly or indirectly contributes to the tourism supply side. We also examined whether their understanding of the topic differs.

Slovenia and Montenegro were selected to explore whether and to what extent external factors of the environment might influence perceptions across all groups. Although both counties are relatively small and geographically close, they differ in their economic models, political systems, socio-cultural contexts, and types of tourism offered.

Participants were chosen through convenience sampling — 10 from each group in each country. Invitations were extended to individuals believed to be capable of providing relevant insights. A total of 27 agreed to participate: 15 from Slovenia (five from each group) and 12 from Montenegro (four scholars, three public sector representatives, and five practitioners). Eighteen interviews were conducted in person, three via videoconference,

and six participants submitted written responses via email. All interviews were conducted by the lead researcher and documented through written notes and audio recordings. Transcripts were prepared after each interview.

Data were analysed using content analysis. We followed the coding guidelines of Miles et al. (2014). Given the number of interviews and the richness of responses, we opted for manual thematic coding with the use of matrixes. The analysis proceeded through several steps:

- Detailed review of transcripts;
- Development of thematic codes;
- Independent marking of essential meanings by each researcher;
- Preparation of two first-round matrixes (one per country);
- Filling the matrixes with key ideas;
- Text condensation and quantification;
- Preparation of second-round matrixes.

Findings are presented descriptively, as a synthesis of interviewee responses. We use interpretive methods and quotations to highlight notable expressions or opinions from individual participants. Comparative insights between the two countries and among triangualtion gruops are discussed in the discussion section.

RESULTS

Results are presented in three subsections:

- Demographic statistics,
- Analysis of interviews from Slovenia,
- Analysis of interviews from Montenegro.

Interview analysis follows the thematic codes aligned with the research questions (understanding of D&ATs, advantages of D&ATs, challenges and concerns related to D&ATs). We begin analysis with the scholars' group, continue with public sector representatives, and end with practitioners.

Demographic statistics

Demographic information about participants from Slovenia and Montenegro is shown in Table 2. Gender distribution in both countries is nearly balanced. More than half of participants are between 30 and 50 years old. All scholar participants have the highest academic qualifications, while the majority of other participants from both countries hold higher or university-level education.

Table 2: Gender, age group and education level of participants from Slovenia (SLO) and Montenegro (MNT)

Criteria	Gender	Age group	Education
Triangulation	N	N	N
group	SLO	SLO	SLO
	MNT	MNT	MNT

Scholars	M	2	4	> 30 y	0	1	vocational	0	1
	F	3	0	30 –	3	0	high/uni	0	0
				50	2	4	master,	5	4
				< 50			Phd		
Public sector	M	0	0	> 30 y	0	0	vocational	0	1
	F	4	3	30 –	3	3	high/uni	3	2
				50	1	0	master,	1	0
				< 50			Phd		
Practitioners	M	5	1	> 30 y	0	2	vocational	1	3
	F	1	4	30 –	5	3	high/uni	5	2
				50	1	0	master,	0	0
				< 50			Phd		
TOTAL		15	12		15	12		15	12

Results of analysis of interviews from Slovenia

Understanding D&ATs

Under the umbrella term D&*ATs*, *scholars* understand technologies related to information communication technology (ICT, including most of the examples listed in Table 1: virtual and augmented reality (VR, AR), robots, chatbots, smartphones, smart glasses, computers and software, social media, artificial intelligence (AI), blockchain, big data analytics, the Internet of Things (IoT), and sensors. They describe digitalisation as the process where "services are partially or completely performed via machines with no human presence," and its main purpose at to "digitise data and optimise business processes in tourism companies." Additionally, digital services are seen as tools to "enhance the tourist experience."

A *public sector interviewee* pointed out that digitalisation in tourism is still largely understood in a rather "basic way," referring to activities such as digital promotions, websites, reservation systems, social media, online images, virtual markets, interactive tables, etc. In tourism destinations, digitalisation provides a tool for managing various processes and activities through contemporary ICT, especially in managing large numbers of tourists. Technologies such as robots, drones, and virtual/augmented reality were cited as relevant examples.

*Practitioner*s primarily focused their responses on the practical application of certain ATs in the sector. These included reservation platforms, email communication, digital information systems, electronic hotel room keys, QR codes, e-bills, digital maps, sensors, hardware and software tools, digital offers, and digital reporting systems. Some also mentioned more advanced technologies like big data analytics, AI, robots, social media, and IoT.

Advantages of D&ATs

The benefits of D&ATs were vividly illustrated by a *scholar'*s analogy: "We can cultivate the earth with a shovel or with a tractor; the end result is the same, but the way of achieving it is much easier with the latter approach." Scholars identified numerous advantages of D&ATs, including real-time data access, improved statistical insights, instant guest satisfaction assessment,

quicker supplier response to changes, better adaptation to tourist needs, and service personalisation. Other noted benefits include staff cost savings, reduction in routine work, easier workflows, interconnectivity of software and organisational units, faster business decisions, improved tourist segmentation, and immediate service delivery.

Public sector representatives echoed many of these points. They emphasised increased productivity, better work organisation, process optimisation, and streamlined operations. Additional benefits included added value creation, cashless payments, AI-generated solutions, cost reduction, improved monitoring, more accessible and affordable promotion, enhanced human resource management, and better internal communication. Staff could focus more on core tasks rather than administrative duties. They also highlighted improved communication, broader perspectives (e.g. 360° views), and instant feedback from tourists.

*Practitioner*s' views aligned closely with those of scholars and public actors. They most often cited internal process optimisation, rationalisation and economisation of operations, improved productivity, and maximised tourist experiences.

Challenges and concerns about D&ATs

Scholars emerged as the most critical group regarding D&ATs. They expressed concerns about "invasive selling from tech providers" and solutions that are "too often partial or difficult to integrate with existing software." They argued that "people need to understand the content of the technology, not just the solutions themselves." Without this understanding, ATs may be useless, and their purchase perceived by users as a "waste of money" or even a "theft of data," particularly in cases involving technologies like facial recognition. A major concern is the high initial investment D&ATs require. This is especially problematic for small and medium-sized tourism enterprises (STMEs), which often lack both financial and technological resources. A lack of digital infrastructure and technological literacy can also frustrate tourists, for example, "if you don't have an app, you cannot order food or enter the bus." Scholars further criticised algorithmic manipulation, the rigidity of e-forms, and the limited creativity of many ATs. Another key issue was that "big data is available, but not transformed into usable insights for decision-making."

Public sector representatives identified the loss of genuine hospitality and personal contact as a significant disadvantage. While some digital and tech solutions are "fascinating," they are "not necessarily useful." Their concerns included partial solutions, low accessibility for non-tech-savvy users, complex tech vocabulary, and the lack of capacity to process and interpret big data. Although they acknowledged the democratisation of social media, they also warned of long-term damage caused by negative online reviews for individual tourism providers or destinations.

Practitioners repeated many of these concerns. The use of D&ATs, they said, often results in a "lack of personal approach," which is particularly problematic in the provision of high-end and luxury services. Some

technologies may "disturb guests' stay" and "jeopardise personal data and security." They also cited a lack of skilled staff and frequent issues with "incompatibility between new tech solutions and existing systems." The high cost of implementation (particularly for STMEs) and the frequency of malfunctions were additional concerns. For example, while robots might amuse children, they are "not suitable for adults or staff." Hotel rooms with too many digital features were described as "stressful for the majority of guests."

Results of analysis of interviews from Montenegro

Understanding of D&ATs

Scholars in Montenegro define digitalisation as the "transformation of business activities from traditional paper-based systems to online formats," or as the use of "digital communication channels" such as email. Most of them associate digitalisation primarily with online bookings and marketing. Among ATs, they cited QR codes, animations, social media, applications, and computer software. Notably, one scholar stated that the "use of D&ATs depends on the nature of the destination."

Public sector representatives took a similar view, identifying D&ATs with booking platforms, digital guides, promotional use of virtual reality, and smart infrastructure such as smart benches. One interviewee stressed the need to consider digitalisation from both the supply and demand perspectives.

Practitioners defined D&ATs as "new tools we use for the same operations as before, but in a different way," emphasising that they help people perform their work more effectively. They see them as "modern technological solutions that improve daily operations and enable control over all areas of business." Examples mentioned included e-bookings, computer software, social media, virtual reality, gamification apps (e.g. for museums), QR codes, and chatbots.

Perceived advantages of D&ATs

Scholars broadly agreed that D&ATs enable "more efficient business operations and the development of new services," such as short-term rentals through platforms like Airbnb, which can be more easily adapted to demand. Integrated systems facilitate better management, process standardisation, and inter-departmental connectivity. Communication becomes easier and more affordable, with wider promotional reach, especially via social media, which enables visibility for local stakeholders and small businesses. Other benefits include the reduction of human error, improved sustainability, faster data transmission, and better access to guest information.

Public sector representatives highlighted increased visibility for destinations and suppliers, process optimisation, and more cost-effective promotion (e.g. via social media and video content). They also noted savings on energy, quick problem-solving, and improved information accessibility, noting that "machines are cheaper than staff."

One of the most frequently emphasised benefits by *practitioners* was improved accessibility of destinations. Participants also highlighted the power of electronic word-of-mouth (eWOM) via social media, easier research and planning, innovative payment options, and more informed decision-making. D&ATs also supported better event management, real-time issue detection, and greater overall efficiency. As one practitioner said, "apps have become the new way to achieve pleasure."

Challenges and concerns about D&ATs

Although fewer challenges were raised by Montenegrin *scholars*, several significant concerns emerged. These included the reduction of face-to-face communication, the fast pace of technological implementation, and the potential consequences of technical failures; as one participant put it, "no electricity – no tech."

Public sector representatives shared concerns similar to those of scholars, including the loss of direct personal contact and the "alienation" of service providers from tourists/guests. A major issue was the lack of control over promotional platforms, where "one negative review can be devastating."

Practitioners stressed the "loss of hospitality," "alienation from tourists," and "dehumanisation of interpersonal relationships"—all considered essential aspects of tourism. They noted that technology does not necessarily lead to "savings in human resources." One interviewee explained: "In tourism, effectiveness and efficiency can be contradictory: we might do more, but the quality of services would not be the same." A lack of technological skills, especially among older employees, was also identified as a barrier. Practitioners expressed particular concern about the impact of negative social media publicity. While e-booking was seen as beneficial for sales, the self-reservation model "undermines the traditional sales system of selling 'warm beds,'" which was a common practice in high-season leisure destinations.

DISCUSSION

The analysis reveals important distinctions and overlaps in how D&ATs are understood across countries and stakeholder groups. Slovenian and Montenegrin *scholars* tend to adopt a conceptual and technological understanding of D&ATs, referring to broader ICT frameworks and advanced tools like AI, big data analytics, virtual/augmented reality, IoT, and blockchain. Those are technologies frequently associated with Tourism 4.0 in existing literature (e.g., Buhalis et al., 2023; Osei et al., 2020; Starc Peceny et al., 2019). The depth of understanding, however, is more developed among Slovenian scholars, who associate D&ATs with digital transformation and optimisation of business processes. This understanding reflects Bekele and Raj's (2025) and Dredge et al.'s (2019) view of digitalization as driver of business efficiency. Montenegrin scholars, in contrast, mostly relate D&ATs to online bookings and marketing tools,

suggesting an early stage-focus consistent with Van Veldhoven and Vanthienen's (2021) distinction between digitalization and digital transformation. *Public sector representatives* in both countries generally perceive D&ATs in more applied and managerial terms, often listing digital tools for promotion, tourist flow management, or basic ICT infrastructure (e.g., web pages, smart benches, virtual tours). This aligns with Buhalis's (2020) view that digitalization improves communication, promotion, networking, etc. Yet, Slovenian public stakeholders demonstrate slightly more awareness of advanced tech applications and challenges. *Practitioners* approach D&ATs from a functional and utilitarian perspective. They focus primarily on digital tools that directly support day-to-day operations (e.g., reservation systems, digital communication, room access technologies, QR codes, etc.). Findings reflect Buhalis's (2020) arguments about practical advantages of D&ATs for capacity management, operation efficiency and customer service.

The level of understanding seems to be shaped by the role and exposure of each group to technological tools and the position of triangulation group in tourism system. Scholars tend to be more theoretical and future-oriented, public actors are concerned with governance and destination management, and practitioners focus on immediate benefits and limitations.

There is a strong convergence across all groups and both countries regarding the perceived advantages of D&ATs. They were most often described with expressions like easier-more-better-faster-cheaper, consistent with Buhalis's (2020) and Buhalis et al.'s (2023) identification of efficiency and optimisation as the core benefit of D&ATs. Other descriptors of the advantages and benefits of the D&ATs are the words with "-tion" endings, e.g., rationalization, economisation, maximisation, optimisation, personalisation, reflect the formative qualities outlined in existing literature.

Among advantages of D&ATs, Slovenian scholars and public actors highlight interconnectivity of systems, reduction of routine tasks, and faster business decisions, also pointed by Buhalis et al. (2023). In contrast, Montenegrin participants emphasise standardisation, promotion of local actors, and the role of social media and apps in improving communication and brand awareness. Practitioners in both countries strongly associate D&ATs with business optimisation, although Slovenians more often mention personalisation and guest satisfaction (as Sigala, 2018), while Montenegrins highlight communication, reporting, and visibility. This indicates different stages of digital maturity of tourism in each country.

The challenges and drawbacks of D&ATs are equally acknowledged in both countries, though more extensively discussed in Slovenia. Scholars in Slovenia are especially critical, raising issues around the ethics and risks of technological adoption, such as data misuse, surveillance concerns, similar as Stankov and Gretzel (2020) are. They also point out the gap between data availability and its use in decision-making, which was not emphasized yet in existing literature. Public actors in both countries raise concerns about the partial nature of some digital solutions, which has also been not revealed in existing literature, and the exclusion of less tech-savvy users, also noted by Pencarelli (2019). They highlight the danger of over-relying on platforms

that they do not control, especially when one bad review can undermine a business. Practitioners most often point out lack of skilled personnel, technical incompatibility, stressful user experiences, and the absence of personal touch in luxury and high-end services, paralleling human-centric concerns expressed by Akiskali et al. (2022). In Montenegro, there's a clear concern that efficiency might compromise service quality, and robotic or overly digitalised interactions might alienate guests. This aligns with Pencarelli (2018) argument that Tourism 4.0 might prioritise technological efficiency over authentic experiences. Additionally, Montenegrin participants are aware of the vulnerability of digital systems.

Interestingly, none of the interviewees has mentioned D&ATs issues related with a vast consumption of energy for D&ATs and a paradox derived from it: we glory the D&ATs and even promote them as green and sustainable, but neglect the vast consumption of energy for it. The environmental research point that driven by grown electricity use, D&ATs more frequently raises energy use; therefore, relationship between D&ATs and energy demand is a complex issue and net effect rather uncertain (Axenbeck et al., 2024).

The study revealed the difference between countries in a maturity and integration of D&ATs in tourism. Both countries show awareness and engagement with D&Ats in tourism, while Slovenia appears to be at a more advanced stage of digital maturity. This is indicated in more detailed understanding of D&ATs among all groups, greater awareness of integration issues and ethical concerns, broader recognition of data-driven innovation. Those are factors consistent with Jil et al. (2025) on digital maturity as a predictor of transformation success. Montenegro's digitalisation efforts appear more focused on visibility, accessibility, and communication, with strong attention to affordability and simplicity, especially for local actors and small and medium-sized enterprises. This suggests that Slovenia may be facing second-generation digitalisation challenges (e.g., ethical use of data, interoperability, service creativity), while Montenegro is still grappling with first-generation issues (e.g., training, infrastructure, etc).

CONCLUSION

This comparative analysis of interviews with scholars, public sector representatives, and practitioners in Slovenia and Montenegro offers important insights into how D&ATs are understood, adopted, and perceived in the tourism of two countries with different levels of digital maturity. A broad consensus emerges on the value of D&ATs for improving efficiency, reducing operational costs, enhancing tourist experiences, and expanding promotional reach. Stakeholders in both countries recognize the transformative potential of digitalisation for the tourism industry. However, the depth of understanding and the focus of application differ across both stakeholder groups and national contexts. Slovenian tourism representatives exhibit a more critical and theoretical engagement with D&ATs, while Montenegrin tend to focus on practical uses of D&Ats.

An important issue is the challenge of preserving the human dimension of tourism. Both Slovenian and Montenegrin respondents warn that over-digitalisation could reduce personal interaction, which remains a core value of hospitality, especially in high-end services. The challenges of implementation, including high investment costs, technological incompatibility, lack of skilled staff, and user frustration, are significant across both countries. Slovenian stakeholders, however, seem to have moved beyond basic adoption concerns.

The study highlights the need for tailored strategies in digital tourism development: countries and destinations must align digital tools with their specific tourism models, infrastructure, and human resources. They should also ensure inclusive approaches that consider the needs of less tech-savvy users and maintain the human touch in service delivery. While D&ATs are widely welcomed for their advantages, a balanced, human-centred, and context-sensitive digitalisation strategy in tourism is essential. For now, hybrid solutions appear to be the most widely accepted approach.

The *theoretical implications* of the study are reflected in two main findings. Firstly, its results empirically confirm the findings on the research themes presented in the existing literature. These themes have often been cited as generally accepted knowledge but lacked empirical validation. Secondly, the results indicate that the perception and applicability of D&ATs depend on the stakeholders' roles within tourism sector and the type or nature of the tourism destination. These two indicators expand current knowledge on the topic and highlight that a 'one-size-fits-all' approach to D&ATs in tourism is not appropriate.

Several *practical applications* can be derived from this study. Since the implementation of D&ATs in tourism is often one of the strategic goals at the state level, the findings may be valuable for tourism policymakers. When determining the pace and scope of D&ATs integration, they should consider the destination's characteristics, key tourist segments, and the overall quality level of tourism. Tourism service managers should recognize that technological solutions may benefit them operationally, but not necessarily appeal to tourists. In particular, D&ATs are not well accepted in luxury or high-end tourism sectors. If implemented in such settings, these technologies must remain simple and deliver a tourist-friendly experience rather than causing frustration.

Certain *limitations* of this study should be acknowledged. The first relates to the scope of the research, which was constrained by human, financial, and time resources. The second limitation is convenient sampling (self-selection bias) which can be related with the nonrepresentative target population. Yet, only those participants have been invited (with a consent of all researchers) who were involved in D&ATs in tourism and were familiar with research themes. There were no emotional pitfalls involved to selection of participants. The results might have differed if different participants were chosen, a larger number of interviewees had been involved or had been more willing to participate. Due to above mentioned limitations, the generalizability as one of the general limitation of qualitative research needs to be mentioned. However, a comparison between the empirical findings and

existing literature suggests that the quality of responses outweighs the quantity and highly eliminates the above mentioned considerations. The third limitation comes out from the qualitative nature of the study; results might have differed if a quantitative approach had been used. Subjectivity of researcher and participants is the fourth and one of major limitations of qualitative research, which can compromise the trustworthiness and credibility of findings in the process of collection, selection, and interpretation of non-numerical data. To minimize this, data collection and analysis were conducted as described in the methodology section. Interviews in both countries were conducted by a single researcher with extensive knowledge of D&ATs in tourism and with familiarity of both cultural contexts to overcome the cultural bias. To eliminate the situation of guiding the participants toward specific response, interviewees were asked only three straightforward opened questions without additional sub questions. Data were recorded, and first analysed independently by all researchers and then compared, with consensus reached before advancing to the second-step matrixes. It is considered to overcome limitations of data interpretation due to possible pre-existing beliefs, expectations, selective collection or omission of contrary evidence. Another potential limitation is the truthfulness of interviewees' responses, which might be socially desirable or inaccurate. We estimate that the content of the research topics is not of personal nature, which is why the answers could either be likable or wrong. Results can vary depending on the geographical context and timing of the research. The findings might differ if conducted in another country or tourism destination. Notably, the fieldwork was carried out shortly before the emergence of generative AI technologies (also known as large language models, such as ChatGPT, Gemini, Copilot, and more recently, Deepseek) and the rising interest in the metaverse. These developments may have influenced how interviewees would respond today, while D&ATs are part of a constantly evolving field.

All the above-mentioned limitations open space for *future research*. A follow-up study, focused on similar research themes but possibly employing a different methodological approach, could be conducted among tourists in Slovenia and Montenegro to investigate their perceptions of D&ATs. This research could also be extended to other destinations with specific types of tourism and/or focus on different tourist segments.

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