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Lyndon Nixon Aarni Tuomi Peter O'Connor *Editors*

Information and Communication Technologies in Tourism 2025

Proceedings of the ENTER 2025 eTourism Conference, Wroclaw, Poland, February 17–21





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Foreword

Today, tourism is at a crossroads. The tourism industry is expected to achieve the 3Ps of sustainability: people, planet, profit. Tourism must make people happy, whether travelers or residents. Tourism has to be ecologically sustainable. And, as an economic activity, tourism needs to improve the economy of the destination, on the assumption (currently under discussion) that more economy brings more well-being to the residents.

In recent years, especially since the recovery of tourism after the pandemic, we have seen protests and demonstrations against tourism in many destinations. Probably because local people do not perceive the benefits that tourism is supposed to bring to them and instead experience some of the problems that tourism causes.

So, as IFITT evolves over the next years, we, as researchers and practitioners, need to move forward in two main areas. On the one hand, there are technologies that need to be developed to help the tourism industry. Technologies such as AI, blockchain, extended realities and metaverse, just to name a few.

On the other hand, we need to find ways to apply these technological developments in tourism in order to improve the industry and to achieve the 3Ps mentioned above. For example, research needs to be done on how to collect, store and process big data. And research also needs to focus on how to use that big data, in conjunction with AI, to create a better tourism industry overall. The intersection between technology and tourism has always been one of the main strengths of IFITT and it should keep being our strength as AI becomes pervasive in society.

For example, one of the benefits of tourism that has been widely mentioned in the past is its ability to create jobs. But as automation based on AI and robotics begins to take place in the service industry and in tourism, we need to develop research that helps humans find a proper place in this conundrum. We need to focus on how technology can help tourism. Helping tourism means helping tourists, helping residents and helping policymakers.

These proceedings are a collection of papers presented at the ENTER25 conference in Wroclaw, Poland, under the theme "eTourism towards 2060". They cover a wide range of topics that shed light on every debate that the industry is currently facing. From the role of AI and metaverse in the tourism industry to peer-topeer accommodation, including research on sustainability, social media, automation, gamification and the impact of technology on tourism destinations. I hope that they can help all stakeholders understand where the industry is going and how technology can be used for the good of the industry.

I would like to end this foreword by thanking all of those who have made the ENTER25 eTourism conference and these proceedings possible. Starting with our hosts, the WSB Merito University in Wroclaw, led by its Chancellor, Prof. Joanna Nogieć. Wiktoria Król-Cieciorowska and her team at the Convention Bureau of Wroclaw, who took care of all the details of organizing the conference. The Chair of ENTER25, Professor Dimitrios Buhalis, whose countless hours made the conference possible. The IFITT Board has also been fundamental in supporting the organizing process. An integral part of these proceedings are the Research Track chairs, Dr. Lyndon Nixon, Dr. Aarni Tuomi and Professor Peter O'Connor, I would also like to thank the experts who helped review the submissions, whether full papers, working papers or posters, and who helped select the candidates for the awards. And the chairs of the Ph.D. Workshop, Professor Ulrike Gretzel, Dr. Kasha Minor, Professor Rodolfo Baggio, Dr. Arkadiusz Tomczyk and Dr. Agnieszka Pawlak-Wolanin. Finally, I would like to thank all the authors for their willingness to share their latest research at ENTER25 Wroclaw. Without their efforts, the conference would not have been possible.

> Prof. Jacques Bulchand-Gidumal President of IFITT University of Las Palmas de Gran Canaria Las Palmas de Gran Canaria, Spain

Preface

ENTER25 eTourism Conference: "eTourism Towards 2060"

This proceedings contains the Full Papers accepted for presentation at ENTER25, the annual e-tourism conference hosted by the International Federation for Information Technology and Travel & Tourism (IFITT), held 17–21 February 2025 in Wrocław, Poland.

This year's conference theme, "eTourism Towards 2060" called on researchers and industry to look further than ever into the future of technology and tourism. For over three decades, the annual ENTER conference has consistently led discussions on the evolving impacts of information and communication technologies (ICTs) within the travel, tourism, and hospitality sectors. Now, perhaps more than ever, we recognize that the pace of technological change is unprecedented, and that the transformation these advancements brings is reshaping our industry in profound and complex ways.

Currently we stand on the brink of a new era of tourism where advanced ICTs such as Generative AI, service robotics, Internet of Things (IoT), and Extended Realities (XR) are becoming central to how we experience and manage travel. Yet, with great potential comes the need for careful reflection. As the influence of these technologies grows, so too do the managerial, ethical, and societal considerations that challenge both researchers and practitioners. For example, who should be accountable if an AI assistant mismanages a booking or promises terms and conditions that do not exist? What are the implications of customer service bots and robots for human employment, and how will this influence the experience of both tourists and workers? These are just some of the questions that emerge as we contemplate the future of eTourism.

The ENTER conference continues the longstanding tradition of gathering diverse voices from academia, technology, industry, and policy to explore these urgent questions and their emerging issues. Together, we examine the role of emerging technologies in creating a sustainable, resilient, and inclusive tourism ecosystem. Through interdisciplinary exchanges, we see that emerging technologies can help adapt to the

demands of a world in constant flux, accelerating sustainable development, while simultaneously enhancing the experiences of customers and employees alike.

This year's conference offered a platform for cutting-edge research and real-world case studies, bridging theory and practice. A total of 59 submissions for full papers were received, which were distilled into the 38 papers included in this volume using a double-blind review process involving evaluation by at least three expert reviewers. This 64% acceptance rate is a testament to the high quality of research which forms part of the ENTER25 conference.

The accepted papers delve into topics that address how ICTs can shape a sustainable future for tourism, foster organizational agility, transform education in tourism and hospitality, and mitigate potential risks posed by technological disruption. In addition, contributions to the book reflect on how these innovations can enhance tourism management and policy, enrich user experiences, and create resilient businesses equipped for tomorrow's challenges.

As we present the works of the academic and professional eTourism community, we look forward to sparking meaningful discussions that will prepare stakeholders for the exciting road ahead. On behalf of the ENTER25 Scientific Committee, we extend our sincere gratitude to all contributors and reviewers whose commitment has ensured the quality and relevance of this year's conference proceedings. Special thanks go to the IFITT Poland Chapter and our dedicated conference chair, Professor Dimitrios Buhalis, as well as the entire IFITT Board for their ongoing support and vision.

We are delighted to welcome you to enjoy the fruits of ENTER25 conference and look forward to engaging with the insights and innovations shared in the book as we work together towards a forward-looking, responsible, and inclusive future for tourism.

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About the Editors

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Technology for Smartness and Disruption

Prepared for the Smart Future? Empirical Results on Data Literacy and Information Needs of European DMOs



Dirk Schmücker (), Daniel Iglesias (), Dolores Ordóñez-Martínez (), and Urška Starc Peceny

Abstract We surveyed European destination management organisations (DMOs) and other stakeholders in the European tourism system within a project aiming at creation of a Competence Centre to support data management in tourism destinations. 226 answers were collected via a fully structured questionnaire in the period April through June 2024. The study covers DMOs from almost all EU countries, spatial levels and landscape types. We can assume that participants are more interested in the topic of smart destination management than the average European DMO. Results show that the majority of European DMOs in this study are severely restricted in terms of data use and implementation of insights and express a great need for support. The potential self-selection effect in the sample makes the results even more unsettling. With the current level of expertise, DMOs will struggle to participate appropriately in using data to make tourism more sustainable, and to absorb the business opportunities coming from European Data Spaces–let alone taking an active role.

Keywords Smart tourism destinations (STD) \cdot Destination management \cdot Digital readiness \cdot Data sharing

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1 Introduction and Objective

This study aims to shed empirical light upon the status of data-literacy of European destination management organisations (DMOs) in the year 2024 and on their data and information needs. Previous research has shown a lack of empirical data [1, p. 411], and we want to assist in closing this data gap.

If smart tourism destinations (STDs) are a "new kind of destinations" [6, p. 285], then new needs for competences in DMOs and new support for DMOs also arise.

This is all the more true as DMOs function as gatekeepers, situated between other stakeholders, like tourists and locals [8, 26].

1.1 Data-Driven Destination Management

The concept of data-driven destinations is intricately linked to the broader frameworks of smart destinations and smart tourism, yet it is essential to differentiate these terms to understand their interdependencies and unique contributions. Gretzel et al. [14] define smart tourism as a data-driven approach using advanced technologies to create efficient, sustainable and enriched on-site experiences and business value propositions. On the other hand, smart tourism destinations can be viewed as locations that leverage technological tools and techniques to facilitate collaboration between demand and supply. This collaboration aims to generate value, enjoyment, and unique tourist experiences, while simultaneously creating wealth, profit and advantages for organisations and for the destination [4].

Smart destinations are based on the concept of smart cities, but they differ in their geographical scope, encompassing both urban and rural areas [5]. Furthermore, although administrative boundaries demarcate city limits, destination boundaries are less clearly delineated, generally being determined by visitor flows which establish the geographic regions that comprise destinations [23]. Additionally, while smart cities prioritise their inhabitants, smart destinations consider both visitors and locals, fostering a more inclusive environment [26]. This extensive geographical reach of smart destinations encompasses a crucial aspect: the substantial increase in the number of stakeholders involved. Coordinating these stakeholders and balancing their diverse interests and goals becomes crucial [15].

Data-driven destination management takes the concepts of smart tourism and smart destination further by systematically leveraging data to drive decision-making and optimise destination management. This approach ensures that destinations are not only smart but also continuously improving and adapting, based on data-driven insights in areas such as enhancing sustainability, supporting mobility, optimizing resource availability, enhancing quality of life of visitors and residents alike, boosting operational efficiency, and promoting innovation and competitiveness [5, 14, 23, 24].

There are few instances of data-driven destination management in the literature, with only a handful of cases cited [13]. In the context of smart cities, the number

of published papers showcasing such initiatives is greater, while pilots or proofof-concept applications are frequently mentioned in both instances. In contrast, production-ready, holistic initiatives are seldom addressed in academic research, except for that conducted by Novotny et al. [20], which, however, has certain limitations regarding the generalisability of its findings to European DMOs due the mixed method approach among Canadian DMOs with a very limited number of respondents.

DMOs should modernise management frameworks to address the complexities of the tourism ecosystem and steer away from technology-centric approaches [25]. As pointed out by Ivars-Baidal & Vera Rebollo [17], DMOs need to avoid dependence on tech companies or data owners by developing their own data analysis capabilities and skills so that they can become self-sufficient agents from a technological point of view, assume leadership in data-driven destinations, and become active players in the European data spaces. Finally, to accomplish the goal of becoming data-driven destinations, DMOs must undergo organisational adaptation and equip their staff with new training in both technical and non-technical skills [7].

1.2 Smart Destinations and Data Spaces

The role of data is becoming essential in the tourism sector, facilitating the evolution of conventional destinations towards smart destinations. In this sense, the creation and consolidation of a tourism data space is presented as a primary resource which, if properly implemented, has the potential to refine decision-making, drive the emergence of innovative business models and strengthen both the competitiveness and the sustainability of destinations and the sector as a whole [21].

Data generated through different digital technologies are being used to enrich the tourism experience and improve and strengthen destination management [19]. These initiatives have ranged from implementing smart signage systems and interactive mobile applications to data management platforms and IoT sensors for environmental and visitor flow monitoring [3, 18].

Tourism data spaces emerged as a new paradigm to take a further step in the transition towards the true intelligence of smart destinations by sharing data from public and private entities and using new digital tools such as geo-dashboards to support decision-making and solve real problems at destinations, including human pressure, floods exposition of tourists accommodations; municipal land-cover changes and tourism uses in urban areas [22].

1.3 DMO Data Literacy and Information Needs

It is important to note that 99% of EU tourism companies are small or medium enterprises (SMEs) [11] that often lack the necessary skills, advanced training [7], and resources to capture and analyse data. This limits their ability to participate

actively in the smart destination ecosystem. DMOs could take a lead on this to play a crucial role as catalysts in providing the necessary assets to SMEs.

The DSFT project [10] showed that data on the environmental and economic impacts of tourism have highest value and priority for DMOs, with environmental impact data being much less accessible and analysable. An analysis of the data sources used shows that most of the top sources provide highly aggregated statistics (Eurostat, UNWTO, ETC and TourMIS). A notable exception is the *STR Global* database. Respondents were asked for currently inaccessible but desired data categories. The results showed that key performance indicators relating to tourism's economic impact (such as expenditures, profitability, occupancy rates, and similar) were ranked highest by 45% of respondents, followed by visitor flow/spatial/real-time data (36%) and sustainability/climate change-related data (26%). The large majority, 75%, expected data to be free.

The DATES project revealed that "the three most important data to be shared in the tourism sector are data regarding tourists' behaviour, mobility data and demand and offer data" [16, p. 8], but the responses in this survey are very heterogeneous. The highest reported priorities among the 194 initiatives assessed were the facilitation of data access and the provision of open data.

Both projects published a joint blueprint report. It states that "data that are accessible are often incomplete, not interoperable, and not timely updated" and that "availability of time and financial resources, insufficient data analytics skills among the tourism workforce and the lack of the sector's cooperation and collaboration regarding data sharing are considered to be significant limitations for both data analysis and data sharing" [9, p. 18]. At the same time, the report observes a lack of maturity when it comes to the ability of stakeholders to organise their data sharing ecosystem. GDPR regulations are also a major concern. In another survey the authors found a preference for public funding of data.

2 Methods

This paper mainly draws upon results from a standardised survey.

The field time for the survey was April–June 2024. We used the EUSurvey platform for a fully standardised questionnaire of 18 closed-ended questionsplus two open-ended questions for additional comments and recommendations. The primary target groups were DMOs on local, regional, state/national and supranational level. Secondary target groups were umbrella organisations (tourism associations), research institutions, solution providers and others. The survey was prepared in five languages (English, French, Spanish, German and Italian). After cleaning for incomplete or incoherent answers, 226 responses were analysed. From these, 127 were from DMOs and 99 from other institutions. This paper draws upon the results from DMOs only.

The resulting sample is a convenience sample which cannot claim representativity for the European DMOs. In parallel to all other studies analysed, it is not possible to implement a random sampling scheme or equivalent because the population is not known: there is no such thing as a comprehensive list of European DMOs. However, the sample covered 26 of 27 EU countries, all levels of DMOs and all landscape types [2] and therefore can reasonably well provide information about the topics in question.

Respondents assessed themselves as being ahead of (43%), rather than behind (13%), comparable organisations when it comes to skills and expertise in the context of data-driven, smart destinations. Data tend to reflect a stratum among European DMOs that is more interested and more competent in the topic in question than the average.

3 Results

From the survey, we can report results on various aspects of data literacy and information needs of European DMOs:

Data literacy:

- 1. Information accessible to DMOs
- 2. Strategic implementation and key performance indicators (KPIs)
- 3. Data use by spatial level
- 4. Use and helpfulness of data sources

Information needs:

- 5. Support needed in a five-stage model
- 6. Topics and formats.

3.1 Information Accessible to DMOs

For the majority of DMOs, only two information sources (out of eight in the list) are easily available: the monthly number of overnight tourists and an accommodation establishment registry (Table 1). We did not ask for the availability of accommodation statistics, because these are available in all EU member states following a harmonised methodology [12]. Therefore, the monthly number of overnight tourists reported here includes establishments outside the accommodation statistics.

In the group of local and regional DMOs, 20% have access to yearly data on residents' perception of tourism. In the group of national and supra-national DMOs this number rises to almost half of respondents. It might be argued that residents' perception of tourism is very much dependent on the local situation, and that data averaged on a national or even supra-national level might tend to conceal more than they show.

	All DMO (%)	(Supra-) National DMO (%)	Local & regional DMO (%)
Monthly number of overnight tourists (including establishments outside the accommodation statistics)	60	68	58
Accommodation establishment registry	56	44	59
Registry of tourism businesses	34	20	37
Yearly data on residents' perception of tourism	25	48	20
Number of enterprises and resources with service quality or sustainability certifications	21	20	22
Monthly employment figures in tourism	20	20	21
Monthly number of daytrips	20	12	22
None of the above	13	0	16

Table 1 Information accessible to DMO

Source Authors

3.2 Strategic Implementation and Key Performance Indicators

Less than one in ten DMOs surveyed (9%) had a specific smart destination strategy, but almost four in ten (36%) claim to have smart destination elements in their destination strategy. Altogether, less than half of DMOs did cover smart destination aspects strategically. For the other half, it can only be speculated whether they did not cover "smart" aspects in their strategy or whether they did not have a strategy at all.

The positive response rates continued to drop when asking for Key Performance Indicators: less than three in ten (29%) of the DMOs surveyed could provide any KPIs. Within this group, more than half of the respondents relies on overnight stays (53%), another 24% on arrivals. 35% mentioned tourist expenditures or revenue from tourism.

Roughly one in five of these DMOs (18% within the 29% who reported on KPIs) mentioned that guest satisfaction is one of their KPIs—interestingly on the same level as resident's satisfaction (20%).

Among other KPIs, a wide range of categories was mentioned, but always in very small numbers: marketing indicators (brand awareness, campaign activities, visitors in tourist information bureaux), price indicators (ADR, RevPAR), supply indicators (number of beds, number of flights), demand volume (day visitors, guest origin), regional income and employment and (in four cases) carbon footprint.

3.3 Data Use by Spatial Level

DMOs use regional and local data more frequently than national, supranational and global data. This is specifically true for local and regional DMOs: 10% used global data (at least monthly, based upon the previous five years), 15% used European and supranational data, 52% used national data, and 85% regional and local data.

National DMOs, however, tend to have a broader view: 50% use global data (at least monthly), 67% European data, and more than 80% national and regional or local data.

Real-time access to data is very limited: 4% of DMOs reported having real-time access to national data, and 16% to local or regional data. Other data sources did not extend to more than 1%.

3.4 Use and Helpfulness of Data Sources

DMOs assessed eleven different data sources in terms of frequency of use and perceived helpfulness. Both dimensions are somewhat related, though not very strongly (Fig. 1). In the "high frequency/helpful" quadrant we find accommodation statistics (ACC), data from online marketing activities (ONL) and data from reservations and bookings (R&B). For local/regional DMOs, data on Points of Interest (POI) also fall into this quadrant, while for (supra-) national DMOs, survey data (SURV) are in this top group.

Frequently used, but not as helpful, are other official statistical data (STAT) and data from offline marketing activities (OFFL). Data on the economic and social impacts of tourism (ECON, SOC) are perceived as helpful by local/regional DMOs (but not so by (supra-) national DMOs), and are used rather infrequently. Lastly, data on the ecological impact of tourism (ECOL) are perceived as not helpful and are not used frequently. For (supra-) national DMOs, visitor flow data (FLOW) and data on PoI (POI) also fall in this category.

3.5 Support Needed in a Five-Stage Model

We used a five-stage model to ask for the support needs of DMOs (Fig. 2). Respondents were asked to indicate on a five-point scale whether they needed "no support" (1) or "very much support" (5) on the topics of "Data & Statistics" (access to raw data or aggregated statistics), "Tools" (access to the software tools and platforms needed to analyse or visualise data and statistics), "Expertise" (availability of human resources to professionally handle tools and data/statistics, including legal aspects), "Insights" (ability of the organisation to generate knowledge and insights from data



Fig. 1 Use frequency and helpfulness of data sources (Source Autors)

and statistics for forming subsequent action), and "Action" (ability of the organisation to actually put the insights into action and implement adequate measures).

We found that 19% of DMOs needed very much support (scale point 5) and 41% of DMOs needed much support (scale point 4 or 5) in all five steps. For all elements of the five-stage model more than 70% of DMOs stated a moderate support need (points 3, 4 or 5) and more than 50% needed much support for each individual item, with highest support needs for "Tools" and "Action".



Fig. 2 Five-stage model of support needs (Source Authors)

3.6 Topics and Formats

The most important thematic wishes of participants related to learning through good examples ("best practices"), creating transparency ("catalogue of data, statistics, tools and their costs") and the implementation of sustainability indicators (all more than 70% approval). The implementation of destination-wide dashboards, the use of the European Data Space for Tourism and other data spaces and, like the best practice examples, hands-on examples with success factors for smart tourism destinations achieved just under 70% approval. Data catalogues and the data spaces are particularly interesting to (supra-) national DMOs.

Asked for their preferences for learning formats, DMOs again valued best practices most, followed by interactive dashboards, Massive Open Online Courses (MOOCs), webinars, online presentations and video tutorials. Other formats, like benchmarking, individual consultations or reports and in person meetings were rated as less attractive.

4 Discussion and Conclusion

Although discussions in theory and practice assign a pivotal role to DMOs when it comes to smart and data-driven destination management, the reality is sobering. The majority of European DMOs in this study are severely restricted in terms of data use and implementation of insights generated from data, and express a great need for support. 70% were not able to provide any KPIs, almost half of DMOs require support in all stages of data-handling, and accommodation statistics is still the main information source for many of them (although fewer than one in ten uses the Eurostat database on tourism statistics, or the EU or UN tourism dashboards "frequently"). Only one in ten has real-time access to data from their own online marketing activities, while data on reservations and bookings are available to only 2% of DMOs.

This study covers DMOs from almost all EU countries, spatial levels and landscape types, and we can assume that participants are more interested in the topic of smart destination management than the average European DMO. This potential bias in the data makes the results even more unsettling.

Within the EU, two strategic pathways are emerging. Digitalisation is intended to help make tourism more sustainable, while data spaces will bring new business opportunities to tourism stakeholders. At their current level of expertise, DMOs will struggle to participate adequately in both these developments, let alone to play an active role.

References

- Baggio, R., Micera, R., & Del Chiappa, G. (2020). Smart Tourism Destinations: A Critical Reflection. *Journal of Hospitality and Tourism Technology*, 11(3), 407–423. https://doi.org/10. 1108/JHTT-01-2019-0011
- Batista e Silva, F., Barranco, R., Proietti, P., Pigaiani, C., & Lavalle, C. (2021). A New European Regional Tourism Typology Based on Hotel Location Patterns and Geographical Criteria. *Annals of Tourism Research*, 89, 103077. https://doi.org/10.1016/j.annals.2020.103077
- Berenguer, A., Ros, D. F., Gómez-Oliva, A., Ivars-Baidal, J. A., Jara, A. J., Laborda, J., Mazón, J.-N., & Perles, A. (2022). Crowd Monitoring in Smart Destinations Based on GDPR-Ready Opportunistic RF Scanning and Classification of WiFi Devices to Identify and Classify Visitors' Origins. *Electronics*, 11(6), 835. https://doi.org/10.3390/electronics11060835
- Boes, K., Buhalis, D., & Inversini, A. (2015). Conceptualising Smart Tourism Destination Dimensions. In I. Tussyadiah & A. Inversini (Eds.), *Information and Communication Technologies in Tourism 2015* (pp. 391–403). Springer International Publishing. https://doi.org/10. 1007/978-3-319-14343-9_29
- Buhalis, D., & Amaranggana, A. (2013). Smart Tourism Destinations. In Z. Xiang & I. Tussyadiah (Eds.), *Information and Communication Technologies in Tourism 2014* (pp. 553–564). Springer International Publishing. https://doi.org/10.1007/978-3-319-03973-2_40
- Buonincontri, P., & Micera, R. (2016). The Experience Co-creation in Smart Tourism Destinations: A Multiple Case Analysis of European Destinations. *Information Technology & Tourism*, 16(3), 285–315. https://doi.org/10.1007/s40558-016-0060-5
- Carlisle, S., Ivanov, S., & Dijkmans, C. (2023). The Digital Skills Divide: Evidence from the European Tourism Industry. *Journal of Tourism Futures*, 9(2), 240–266. https://doi.org/10. 1108/JTF-07-2020-0114
- Cerdá-Mansilla, E., Tussyadiah, I., Campo, S., & Rubio, N. (2024). Smart Destinations: A Holistic View From Researchers and Managers to Tourists and Locals. *Tourism Management Perspectives*, 51, 101223. https://doi.org/10.1016/j.tmp.2024.101223
- DATES Tourism Consortium Partners & Data Space for Tourism Consortium Partners. (2023). Blueprint and Roadmap for Deploying the European Tourism Data Space. https://www.tourismdataspace-csa.eu/wp-content/uploads/2024/01/DRAFT-BLUEPR INT-Tourism-Data-Space-v3.3_final.pdf
- Data Space for Tourism Consortium Partners. (2023). Preparatory Actions for the Data Space for Tourism: D2.2 – Tourism Data Inventory and Stakeholder Questionnaire – Summary Report. https://dsft.modul.ac.at/wp-content/uploads/2023/11/D2.2_TDI-Summary-report_ver sion-3.pdf
- European Court of Auditors. (2021). EU Support to Tourism: Need for a Fresh Strategic Orientation and a Better Funding Approach (Special Report 27). https://www.eca.europa.eu/Lists/ ECADocuments/SR21_27/SR_EU-invest-tourism_EN.pdf
- 12. Eurostat. (2014). *Methodological Manual for Tourism Statistics. Version 3.1.* Publications Office of the European Union.
- Femenia-Serra, F., & Ivars-Baidal, J. A. (2021). Do Smart Tourism Destinations Really Work? The Case of Benidorm. *Asia Pacific Journal of Tourism Research*, 26(4), 365–384. https://doi. org/10.1080/10941665.2018.1561478
- Gretzel, U., Sigala, M., Xiang, Z., & Koo, C. (2015). Smart Tourism: Foundations and Developments. *Electronic Markets*, 25(3), 179–188. https://doi.org/10.1007/s12525-015-0196-8
- Gretzel, U. (2021). Smart Tourism Development. In Peter U. C. Dieke, B. King, & R. Sharpley (Eds.), *Tourism in Development* (pp. 159–167). CABI.
- Intellera Consulting. (2023). DATES Deliverable D2.2 Analysis of Gaps and Overlaps (Draft). https://www.tourismdataspace-csa.eu/wp-content/uploads/2023/09/DATES-D2. 2-Analysis-of-gaps-and-overlaps_v2.1.pdf
- Ivars-Baidal, J. A., & Vera Rebollo, J. F. (2019). Tourism Planning in Spain. From Traditional Paradigms to New Approaches: Smart Tourism Planning. *Boletín de La Asociación de Geógrafos Españoles*, 82. https://doi.org/10.21138/bage.2765

- Mitro, N., Krommyda, M., & Amditis, A. (2022). Smart Tags: IoT Sensors for Monitoring the Micro-Climate of Cultural Heritage Monuments. *Applied Sciences*, 12(5), 2315. https://doi. org/10.3390/app12052315
- Mohammed, R. T., Alamoodi, A. H., Albahri, O. S., Zaidan, A. A., AlSattar, H. A., Aickelin, U., Albahri, A. S., Zaidan, B. B., Ismail, A. R., & Malik, R. Q. (2023). A decision modeling approach for smart e-tourism data management applications based on spherical fuzzy rough environment. *Applied Soft Computing*, 143, 110297. https://doi.org/10.1016/j.asoc.2023. 110297
- Novotny, M., Dodds, R., & Walsh, P. R. (2024). Understanding the Adoption of Data-Driven Decision-Making Practices Among Canadian DMOs. *Information Technology & Tourism*, 26(2), 331–345. https://doi.org/10.1007/s40558-023-00281-w
- Ordóñez-Martínez, D., Seguí-Pons, J. M., & Ruiz-Pérez, M. (2023). Conceptual Framework and Prospective Analysis of EU Tourism Data Spaces. *Sustainability*, 16(1), 371. https://doi. org/10.3390/su16010371
- Ordóñez-Martínez, D., Seguí-Pons, J. M., & Ruiz-Pérez, M. (2024). Toward Establishing a Tourism Data Space: Innovative Geo-Dashboard Development for Tourism Research and Management. *Smart Cities*, 7(1), 633–661. https://doi.org/10.3390/smartcities7010026
- Reinhold, S., Beritelli, P., Fyall, A., Choi, H.-S. C., Laesser, C., & Joppe, M. (2023). Stateof-the-Art Review on Destination Marketing and Destination Management. *Tourism and Hospitality*, 4(4), 584–603. https://doi.org/10.3390/tourhosp4040036
- Sedarati, P., Santos, S., & Pintassilgo, P. (2019). System Dynamics in Tourism Planning and Development. *Tourism Planning & Development*, 16(3), 256–280. https://doi.org/10.1080/215 68316.2018.1436586
- Soares, J. C., Domareski Ruiz, T. C., & Ivars Baidal, J. A. (2022). Smart Destinations: A New Planning and Management Approach? *Current Issues in Tourism*, 25(17), 2717–2732. https:// doi.org/10.1080/13683500.2021.1991897
- Sorokina, E., Wang, Y., Fyall, A., Lugosi, P., Torres, E., & Jung, T. (2022). Constructing a Smart Destination Framework: A Destination Marketing Organization Perspective. *Journal* of Destination Marketing & Management, 23, 100688. https://doi.org/10.1016/j.jdmm.2021. 100688