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Study on Mastering data for tourism by EU destinations

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1. Introduction

In recent decades, tourism has experienced a continuous and sustained growth, becoming one of the most significant and promising sectors to promote social and economic progress at global and local level. In the European Union, tourism represents one of the main sectors for job and business creation, source of income, and territorial development. Moreover, tourism has social, cultural, and environmental implications, as it can greatly contribute to social cohesion, poverty eradication, and conservation and promotion of cultural and naturalistic heritage.

At the same time, tourism can also generate adverse impacts on destinations and residents if its activities are not managed sustainably. Disparities in regional development, pressure on environmental ecosystems, deterioration of resident population quality of life are just a few of the most common drawbacks in connection with poorly managed tourism activities, which are sometimes worsened by the intrinsic characteristics of the sector, such as seasonality.

For these reasons, it is of the utmost importance to ensure that tourism policies are geared toward an ever-stronger promotion of growth, while at the same time embracing the essential principles of sustainable development. In this context, the diffusion of technologies applied to tourism represent a pivotal element to support effective and efficient tourism management, as well as to unlock the benefits offered by the sector to communities and destinations.

The present report – delivered in the context of the "Smart Tourism Destinations" project funded by the European Commission – aims at contributing to the knowledge base for European destinations wanting to become smarter in their development and management of tourism. In particular, it focuses on how European destinations are nowadays making use of data for tourism, outlining features and enabling conditions, challenges, good practices, trends, cases of cooperation, and proposing a preliminary set of recommendations for future action.

1.1. The impact of COVID-19

Europe is the world's leading tourist destination and tourism is a significant economic sector for many EU Member States. According to the United Nations World Tourism Organization (UNWTO), the EU-27 area registered an all-time peak in 2019, accounting for more than 540 million international tourist arrivals, which is more than one third of the 1.5 billion arrivals registered worldwide.[1]

The outbreak of the COVID-19 pandemic wreaked havoc in the entire sector. The impact on EU tourist destinations has been heavy, particularly on local economies relying more significantly on tourism activities. Despite restriction removals, following the successful application of sanitary measures, the sector is still facing one of its biggest crises ever.[2]

Indeed, according to the latest UNWTO data on the EU-27, international tourist arrivals in 2020 dropped to 180 million (-67% compared to the 2019 peak),[3] a figure below 1980s' levels.[4] Despite modest improvements during the second quarter of 2021 linked to mass vaccination

[1] UNWTO (2021), World Tourism Barometer, Volume 19, Issue 5, September 2021 (Excerpt), available at: https://webunwto.s3.eu-west-1.amazonaws.com/s3fs-public/2021-10/UNWTO_Barom21_05_September_excerpt.pdf?tObUi1QiC40DQFbrkfyryClQWEF3KFf7

[2] European Commission (2021). Regional impacts of the COVID-19 crisis on the tourist sector: final report, Publications Office.

[3] UNWTO (2021), World Tourism Barometer, Volume 19, Issue 5, September 2021 (Excerpt), available at https://webunwto.s3.eu-west-1.amazonaws.com/s3fs-public/2021-10/UNWTO_Barom21_05_September_excerpt.pdf?tObUi1QiC40DQFbrkfyryClQWEF3KFf7

[4] UNWTO (2016), International tourism trends in EU-28 member states - Current situation and forecast for 2020-2025-2030. Report requested by the European Commission, Directorate-General for Enterprise and Industry, available at https://ec.europa.eu/docsroom/documents/16845/attachments/1/translations/en/renditions/native

campaigns and ease of travel restrictions, in 2021 international tourist arrivals decreased by 62% compared to 2019.[5]

Similarly, Eurostat data show that the number of nights spent in EU tourist accommodation establishments in the period January-October 2021 decreased by 40% compared to the same period in 2019. At the same time, modest improvements are being registered, as estimates for the entire 2021 suggest an encouraging increase of 20% compared with 2020.[6] Such positive results appear to be driven by domestic markets: tourists are more willing to travel closer to home[7], which is likely to translate in destinations with a significant share of domestic tourism having a greater capacity to recover rapidly from the crisis[8]. This is particularly important for the EU tourism sector due to its large share of domestic tourism: according to Eurostat, in 2019 almost 73% of the 1.139 million trips made by EU residents were in their own country of residence, while 19,5% in another Member State.[9]

The COVID-19 crisis resulted in the contribution of travel and tourism to gross domestic product (GDP) being cut nearly in half, with a drop from 9.9% to 5.3% according to the estimates of the World Travel & Tourism Council.[10] Based on three potential scenarios linked to the effect of COVID-19 on EU-27 employment, the Joint Research Centre (JRC) estimated that in 2020 between 6,6 and 11,7 million workers (between 3,2% and 5,6% of the total active population of EU, respectively), have been at risk of reduction of working hours or permanent jobs loss. These figures are in line with the 2020 estimation of the European Commission, which foresaw the loss of around six million jobs in the absence of urgent action to support employment, stressing how such losses would be concentrated in regions with no alternative sources of employment and involving low-skilled workers.[11]

Such a crisis appears even more dramatic when considering that the tourism sector is also characterised by a relatively high presence of female workers (59% in 2019, compared with the 46% average of all sectors, although it is to be noted that globally they remian underrepresented in decision-making and managerial roles, while being concentrated in low-paid and low-skills activities[12]), and young people (12% in 2019, compared with the 8% average of all sectors).[13]

Finally, in addition to significantly undermining the turnover and employment of the sector, the pandemic is also generating significant socio-behavioural effects on the demand for tourism services and on tourists' decision-making processes. Visitors are increasingly inclined to

[5] UNWTO (2022), World Tourism Barometer, Volume 20, Issue 2, March 2022 (Excerpt), available at: https://webunwto.s3.eu-west-1.amazonaws.com/s3fs-public/2022-03/UNWTO_Barom22_02_March_excerpt-1.pdf?U1d1hw2v5Ga4TSmloKQRNbFKpr6mNygA

[6] Eurostat (2022), Tourism statistics - nights spent at tourist accommodation establishments, available at https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Tourism_statistics_-_nights_spent_at_tourist_accommodation_establishments#January_to_October_2021:_Up_by_17.25_compared_with_the_previous_year

[7] UNWTO (2021), World Tourism Barometer, Volume 19, Issue 4, July 2021 (Excerpt), available at https://webunwto.s3.eu-west-1.amazonaws.com/s3fs-public/2021-07/UNWTO_Barom21_04_July_excerpt.pdf?VBGz_hsTz2fvBSOn3i1w7kv0qhI2rTgY=

[8] UNWTO (2020), Understanding Domestic Tourism and Seizing its Opportunities. UNWTO Briefing note-Tourism and COVID-19, Issue 3, available at https://www.e-unwto.org/doi/epdf/10.18111/9789284422111

[9] Eurostat (2021), Tourism statistics - top destinations, available at https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Tourism_statistics_-_top_destinations#Spain_was_the_top_foreign_destination_for_EU_residents_in_2019

[10] World Travel & Tourism Council (2021), European Union. 2021 Annual Research: Key Highlights, available at https://wttc.org/Research/Economic-Impact/moduleId/704/itemId/37/controller/DownloadRequest/action/QuickDownload. "Travel & Tourism's total contribution to GDP is calculated as the: Direct contribution; plus indirect supply-chain purchases (domestic only excluding imports), plus government collective Travel & Tourism spending, plus Travel & Tourism fixed investment; plus induced contribution". More details about the Calculation Methodology are available at: https://wttc.org/Portals/0/Documents/Reports/2021/WTTC%20Methodology%20Report%202021.pdf?ver=2021-06-03-165822-823

[11] European Commission (2020), Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: Tourism and transport in 2020 and beyond, available at https://ec.europa.eu/info/sites/default/files/communication-commission-tourism-transport-2020-and-beyond_en.pdf

[12] World Tourism Organization (2019). Global Report on Women in Tourism – Second Edition, UNWTO. Madrid. Available at: https://www.e-unwto.org/doi/book/10.18111/9789284420384

[13] Eurostat (2019), Tourism creates jobs for women and young workers, available at https://ec.europa.eu/eurostat/web/products-eurostat-news/-/edn-20190927-1

choose destinations with lower density and able to offer safe and diversified outdoors activities.[14] Proximity tourism is preferred, combined with the use of alternative modes of transport also due to the reduced possibility to travel by air.[15]

1.2. EU responses to COVID-19

Since 2020, the EU and its Member States have been taking countermeasures to support the recovery of the tourism sector from the impacts of the pandemic. They adopted economy-wide stimulus packages including fiscal, liquidity, and job support measures, based on a tourism ecosystem's estimated basic investment needs for 2020-2021 of EUR 161 billion, the highest out of all those identified and assessed.[16] Among the immediate responses, in March 2020, the European Commission launched the Coronavirus Response Investment Initiative (CRII). It provided an opportunity for Member States to redirect cohesion funds in a view to address the COVID-19 pandemic, including support to SMEs and short-term employment measures.[17] The initiative was soon complemented by a new set of measures under the Coronavirus Response Investment Initiative Plus (CRII+), which introduced flexibility to mobilise all non-utilised resources from the European Structural and Investment Funds. In the same month, the European Commission also adopted a State Aid Temporary Framework to enable Member States to use the full flexibility foreseen under State Aid rules to support guarantee schemes for vouchers and liquidity support schemes for companies. In May 2020, the Council of the European Union adopted a regulation establishing the European instrument for temporary Support to mitigate Unemployment Risks in an Emergency (SURE)[18], providing Member States with financial assistance in the form of loans to address the increase in public expenditure to support the sudden increase in unemployment levels.

Moreover, the various Member States' Recovery and Resilience Plans – funded by Next Generation EU (NGEU) support package – include many horizontal and tourism-specific reforms and investments. They envisage training to tourism operators, support to the digitalisation of tourism public administrations and promotion of data sharing between stakeholders, investments in clean mobility and in renovation of tourism infrastructures to improve energy performance and accessibility.[19] The NGEU also comprises the Recovery Assistance for Cohesion and the Territories of Europe initiative (REACT-EU), which distributes additional resources to Member States in 2021 and 2022 for the most affected sectors, including tourism.[20]

Other important, non-financial measures – included the European Commission's package Tourism and transport in 2020 and beyond – were aimed to support Member States in the gradual lift of travel restrictions and reopening of tourism business. Specifically, they included a recommendation to issue travel vouchers for cancelled travel services (as an alternative to reimbursements), and guidance for the gradual restoration of tourism services and for health

[14] Marques Santos, A., Madrid, C., Haegeman, K. and Rainoldi, A. (2020), Behavioural changes in tourism in times of Covid-19, Publications Office of the European Union, Luxembourg, ISBN 978-92-76-20401-5.
[15] European Commission (2021). Scenarios towards co-creation of transition pathway for tourism for a more resilient, innovative and sustainable ecosystem. Brussels, 21.6.2021 SWD(2021) 164 final.
[16] The investment needs were calculated by applying a combination of the share of the ecosystem in the economy together with the pre-crisis level of investment. More information is available at: https://ec.europa.eu/info/sites/default/files/economy-finance/assessment_of_economic_and_investment_needs.pdf
[17] Regulation (EU) 2020/460 of the European Parliament and of the Council of 30 March 2020 amending Regulations (EU) No 1301/2013, (EU) No 1303/2013 and (EU) No 508/2014 as regards specific measures to mobilise investments in the healthcare systems of Member States and in other sectors of their economies in response to the COVID-19 outbreak (Coronavirus Response Investment Initiative), PE/5/2020/REV/1, OJ L 99, 31.3.2020.
[18] European Commission Website, SURE, available at https://ec.europa.eu/info/business-economy-euro/economic-and-fiscal-policy-coordination/financial-assistance-eu/funding-mechanisms-and-facilities/sure_en
[19] European Commission website, Recovery and Resilience Facility, available at https://ec.europa.eu/growth/sectors/tourism/funding-guide/recovery-and-resilience-facility_en
[20] European Commission website, REACT-EU, available at https://ec.europa.eu/growth/sectors/tourism/funding-guide/react-eu_en

protocols in hospitality establishments.[21] Also, on March 2021, the European Commission supported the creation of an interoperable Digital Green Certificate covering vaccination, testing and recovery, in a view to coordinate Member States' efforts in facilitating safe travel and mobility of people, an obvious essential pre-requisite for tourism.[22] In the same vein, the Commission developed the Re-open EU platform, providing information on travelling rules and restrictions.[23]

Finally, several initiatives were also developed by national, regional, and local governments both on a short and long-term basis, as described in the following paragraph. They provided immediate economic assistance to operators, while strategic measures were also taken to support sector's innovation, sustainability and resilience in the long-term.

1.2.1. A focus on Member States' responses to COVID-19

In addition to the EU measures and initiatives, national, regional and local governments across the EU taken various actions to support the recovery and re-activation of the tourism ecosystem, which is a significant element of many EU national and local economies. Policy initiatives[24] carried out by Member States can be grouped according to two different perspectives and types of responses. The first one is related to the immediate economy stimulus and support measures, while the second to the medium- to long-term actions to support the recovery from the COVID-19.[25]

Short-term responses mainly included economic initiatives to provide flexibility and relief for businesses and workers, providing liquidity injections to support business survival, fiscal and tax relief (e.g. postponed VAT payment), financial instruments such as guarantees and grants, income continuity measures for companies and tourism workers.[26] Some Member States also issued vouchers to support local tourism providing free transport and attractions tickets, or adopted comprehensive tourism restart plan.[27] During the first months after the COVID-19 outbreak, some countries developed data and information sharing tools to support business decision making, with a view to fill shortcomings in data availability highlighted by the crisis, and to inform the sector as quickly as possible on the evolution of the crisis.[28]

Member States also quickly moved beyond immediate responses. Specific measures and policy interventions focused on green and digital transition were developed to reshape the development of the tourism sector, and to address the long-term impacts of the COVID-19 crisis. A recent European Commission report[29] about the regional impacts of the COVID-19 crisis on the tourist sector analysed several COVID-19 related initiatives in areas such as destination management and governance, or research, innovation and technology, proving how the crisis also generated opportunities to rethink a more sustainable, digital, and resilient future for the tourism ecosystem. Similarly, a recent study of European Parliament identified several good practices introduced by Member States at national, regional, and city levels

[21] Communication from the Commission, EU Guidance for the progressive resumption of tourism services and for health protocols in hospitality establishments – COVID-19 2020/C 169/01, OJ C 169, 15.5.2020.
[22] European Commission website. EU Digital COVID Certificate, available at https://ec.europa.eu/info/live-work-travel-eu/coronavirus-response/safe-covid-19-vaccines-europeans/eu-digital-covid-certificate_en
[23] European Union website, Re-open EU, available at https://reopen.europa.eu/en
[24] An overview of the country and international tourism policy responses to mitigate the effects of COVID-19 crisis is provided in the UNWTO COVID-19 dashboard, available at this link https://www.unwto.org/covid-19-measures-to-support-travel-tourism
[25] European Commission (2021). Regional impacts of the COVID-19 crisis on the tourist sector: assessment of policy initiatives and case studies: annex document, Publications Office of the European Union.
[26] OECD (2020). Tourism Policy Responses to the coronavirus (COVID-19). Available at https://read.oecd-ilibrary.org/view/?ref=124_124984-7uf8nm95se&title=Covid-19_Tourism_Policy_Responses
[27] European parliament (2021), Re-starting tourism in the EU amid the pandemic, available at https://www.europarl.europa.eu/thinktank/en/document/EPRS_BRI(2021)696166
[28] OECD (2020). Tourism Policy Responses to the coronavirus (COVID-19). Available at https://read.oecd-ilibrary.org/view/?ref=124_124984-7uf8nm95se&title=Covid-19_Tourism_Policy_Responses
[29] European Commission (2021). Regional impacts of the COVID-19 crisis on the tourist sector: assessment of policy initiatives and case studies: annex document, Publications Office of the European Union.

during the COVID-19 to boost the digital and green transformation of the tourism industry.[30] This also responds to the "Council conclusions on tourism in Europe for the next decade: sustainable, resilient, digital, global and social", which encouraged Member States to develop sustainable, responsible and resilient tourism policies and strategies, including through the promotion of new technologies, digitalisation, ICT and data-sharing initiatives.[31]

1.3. Other key challenges

In addition to the exceptional hardships posed by the COVID-19 pandemic, the EU tourism industry also faces a number of long-term challenges, which can be grouped into four main areas: (i) security and safety, (ii) technology, (iii), economic competitiveness, (iv) markets, and competition.[32] They encompass structural and recent weaknesses that affect the sector's resilience.

The first area – security and safety – includes a variety of issues such as environmental threats, political risks, safety of food, and socio-cultural sustainability challenges. Such issues are extremely important as they constitute the basic pre-condition for a successful tourism development. The tourism sector greatly depends on a healthy environment and fragile natural and cultural ecosystems, as well as on good quality of life at destination. At the same time, its contribution to global carbon dioxide (CO2) emissions ranges from 3.9% to 6% of human emissions[33], and it produces pressure on fragile ecosystems and communities. Therefore, the creation of climate-neutral tourism ecosystems, the development of sustainable mobility strategies, the management of natural and cultural resources are certainly the most important challenges that the EU tourism industry has to face. A recent European Commission's study[34] also highlighted other specific environmental challenges of tourism ecosystems and destinations, including climate mitigation and adaptation needs[35], the need of infrastructures to improve sustainability, actions to mitigate pressures on biodiversity, to reduce disposable materials, waste and pollution, and to improve water use efficiency and sanitation. Actions and measures to make tourism more sustainable and to reduce its ecological footprint highlight the European Green Deal's objectives of green transition and the pivotal role of tourism to contribute to them. [36]

The second area relates to the technological challenge, which refers to the need to keep up with the continuous innovations in information and communication technologies (ICT). It is linked to the recent European Commission's political impetus to accelerate Europe's digital transformation – with a focus on the innovative use of data in the tourism sector, the adoption of emerging technologies and the support to the SMEs digitalisation - as described in paragraph 1.4.1. of this report. According to the recent new EU industrial strategy[37], tourism is also among the ecosystems facing the most important challenges to achieve the twin ecological and digital transition. Therefore, it was the first industrial ecosystem in which a co-

[30] Knezevic Cvelbar, L., Antonucci, B., Cutrufo, N., Marongiu, L., Rodrigues, M., Teoh, T., et al. (2021). Research for TRAN Committee – Relaunching transport and tourism in the EU after COVID-19 – Tourism sector, European Parliament, Policy Department for Structural and Cohesion Policies, Brussels.

[31] Council of the European Union (2021). Council conclusions on tourism in Europe for the next decade: sustainable, resilient, digital, global and social. Available at https://www.consilium.europa.eu/media/49960/st08881-en21.pdf

[32] European Commission website, Overview of EU Tourism Policy, available at https://ec.europa.eu/growth/sectors/tourism/policy-overview_en

[33] University of Cambridge (2014). Climate Change: Implications for Tourism. Available at https://www.cisl.cam.ac.uk/system/files/documents/IPCC_AR5_Implications_for_Tourism_Briefing_WEB_EN.pdf

[34] European Commission (2022). Transition Pathway for Tourism. Publications Office of the European Union, Luxembourg.

[35] A detailed explanation of the climate adaption actions in the tourism sector is available in the European Commission's Study on adaptation modelling Comprehensive desk review: climate adaptation models and tools.

[36] European Parliament (2021). EU strategy for sustainable tourism. Available at: https://www.europarl.europa.eu/doceo/document/TA-9-2021-0109_EN.html

[37] Communication from the commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, Updating the 2020 New Industrial Strategy: Building a stronger Single Market for Europe's recovery. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52021DC0350&from=EN

creation process of the transition pathway was launched to support its green and digital transformation.[38]

Thirdly, the economic competitiveness refers to the issues generated by seasonality[39], regulatory and administrative burdens, taxation, and the training and retaining of highly skilled staff. Measures to improve the competitiveness of the industry have become ever more important in the aftermath of the COVID-19 pandemic. The twin green and digital transition - in particular the better and innovative use of data and the capacity to meet the customer demand for sustainable tourism - was identified as a tool to support the competitiveness of the EU's tourism ecosystem.[40] Actions to encourage the extension of the tourist season are also pivotal to stimulate the competitiveness of the European tourism sector, since they positively affect the stability of revenue flows, the sector capacity to better use infrastructures and manage the workforce.[41] Key implications are also linked to the green, digital, and general improvement of the professional skills of tourism workers, a recurrent theme addressed in several EU policy initiatives.[42]

Finally, the challenge related to markets concerns the growing competition both within the EU and from non-EU destinations, and the increasing demand for customised experiences and new products. The tourism industry is facing increasing global competition from emerging destinations, that should be addressed through sustainable, innovative and high-quality tourism services promoting the richness and diversity of its cultural and natural heritage[43]. Long-term market competition strategies should also focus on cooperation with countries characterised by increasing living standard, since they can provide potential source of visitors.[44] The challenge related to the growing demand for customised experiences and new products concerns the industry need to continuously renovate and diversify the offer. Diversification of tourism products also recently became a strategic action to respond to the behavioural changes caused by the COVID-19 crisis, as well as to exploit the potential of digital technologies to provide new and personalized tourism products and services.[45]

1.4. The concept of smart tourism

The idea of smart tourism is an offspring of the concept of smart city.[46] A smart city is characterised by a pervasive presence and massive use of information technologies to achieve resource optimisation, effective and fair governance, sustainability and quality of life[47],

[38] European Commission (2022). Transition Pathway for Tourism. Publications Office of the European Union, Luxembourg.
[39] According to Eurostat, in 2019 EU residents made nearly one in four trips in July or August. They spent in these months one third of their tourism nights in July or August. For more information, please visit: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Seasonality_in_tourism_demand
[40] European Commission (2022). Transition Pathway for Tourism. Publications Office of the European Union, Luxembourg.
[41] European Commission (2021), Europe, the world's No 1 tourist destination – a new political framework for tourism in Europe. Available online: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52010DC0352&from=EN
[42] European Commission website, Professional skills, available at https://ec.europa.eu/growth/sectors/tourism/support-business/skills_en
[43]Council of the European Union (2019). Council conclusions on the competitiveness of the tourism sector as a driver for sustainable growth, jobs, and social cohesion in the EU for the next decade.
[44] European Commission (2010). Communication from the Commission to the European Parliament, the council, the European economic and social committee and the committee of the regions. Brussels, 30.6.2010. COM(2010) 352 final.
[45] More information on the tourism businesses preparing for the digital future is available at: https://www.oecd-ilibrary.org/sites/f528d444-en/index.html?itemId=/content/component/f528d444-en#section-d1e8563
[46] Gajdošík T. (2019) Big Data Analytics in Smart Tourism Destinations. A New Tool for Destination Management Organizations? And: Katsoni V., Segarra-Oña M. (eds) Smart Tourism as a Driver for Culture and Sustainability. Springer Proceedings in Business and Economics. Springer, Cham.
[47] Bibri, S. E., & Krogstie, J. (2017). The core enabling technologies of big data analytics and context-aware computing for smart sustainable cities: A review and synthesis. Journal of Big Data, 4(1), 38. And: Gretzel, U., Sigala, M., Xiang, Z., & Koo, C. (2015). Smart tourism: foundations and developments. Electronic markets, 25(3), 179-188.

with applications in a variety of fields such as mobility, living, people, governance, economy and environment.[48] This smart approach is being applied also to tourism destinations.[49]

Indeed, considering the importance of tourism in urban contexts, the complementarity between services for tourists and residents, as well as the potential of emerging technologies for the tourism ecosystem, smart solutions have been widely introduced in the tourism sector.[50] According to the European Commission, smart tourism "responds to new challenges and demands in a fast-changing sector, including the evolution of digital tools, products and services, equal opportunity and access for all visitors, sustainable development of the local area, and support to creative industries, local talent and heritage".[51]

Smart tourism definition

Although the academic literature has produced many definitions of smart tourism.[52] for the purposes of this study, a smart tourism destination is defined as a destination facilitating access to tourism and hospitality products, services, spaces and experiences through ICT-based innovative solutions, making tourism sustainable and accessible, and fully leveraging their cultural heritage and creativity.[53]

Drawing from this definition, the report adopts a focus on data management in tourism, and of how the use of data support the smart and digital transformation of the sector. The view taken in the report fits into the framework for improved data sharing and re-use set out in the EU Data Strategy, and in the main legislative initiatives directly related to data such as the Data Act. By adopting a focus on tourism, the report enables a better understanding about the opportunities linked to the availability and productive use of data and digital technologies for the sustainability, resilience, and competitiveness of the tourism ecosystem. The opportunities created by digital innovation in tourism destinations have been well documented and they can lead to:[54]

- New business opportunities, through the implementation of innovative business models and ecosystems, new services exchanged by consumers and producers as peers, and new ways to bring together demand and supply.
- Better destination management, in terms of increased management capacity of flows, infrastructures, transport systems and services using data and information.
- Better visitor experiences, through the provision of customised experiences, the development of new tourism products and services also based on visitors' feedback.

Some of these opportunities are popular in smart tourism destinations and have already proved their capacity to boost the sector's attractiveness and sustainability. For instance, virtual and augmented reality technologies can now be found in many European cities, as they provide immersive cultural heritage experiences, while making less well-known resources more attractive. However, there is still much to do to overcome key barriers to unlock the full potential of smart tourism, such as the low level of digitisation of public authorities and small-

[48] Giffinger, R., Fertner, C., Kramar, H., Kalasek, R., Pichler-Milanovic, N., & Meijers, E. (2007). Smart cities. Vienna: Ranking of European medium-sized cities.
[49] In this respect, Spain is considered to be an international pioneer of smart tourism, where the tourism policy established with the Plan Nacional e Integral de Turismo (National and Comprehensive Tourism Plan) 2012-2015 identified smart destinations as one of the priority actions under the coordination of Segittur – the state company for the management of tourism of the Spanish Ministry of tourism. See Ivars-Baidal, J. A., Celdrán-Bernabeu, M. A., Mazón, J. N., & Perles-Ivars, Á. F. (2017). Smart destinations and the evolution of ICTs: A new scenario for destination management? Current Issues in Tourism, 3500(October), 1–20. For a more detailed account of Segittur's activities, please refer to good practice #2 in the present report.
[50] Kontogianni, A., & Alepis, E. (2020). Smart tourism: State of the art and literature review for the last six years. Array, 100020.
[51] More information is available on the European Commission's website, available at https://smart-tourism-capital.ec.europa.eu/about_en
[52] See e.g. Shafiee, S., Rajabzadeh Ghatari, A., Hasanzadeh, A., & Jahanyan, S. (2019). Developing a model for sustainable smart tourism destinations: A systematic review. Tourism Management Perspectives, 31, 287–300.
[53] The definition is adapted from European Union (2021). Competition for the European Capital of Smart Tourism 2022 – Guide for applicants all you need to know.
[54] European Commission (2021). Scenarios towards co-creation of transition pathway for tourism for a more resilient, innovative and sustainable ecosystem. Brussels, 21.6.2021 SWD(2021) 164 final.

and medium-sized enterprises (SMEs).[55] In this regard, governments play a pivotal role in the creation of the right conditions for the digital transformation of the tourism ecosystem. According to the Organisation for Economic Co-operation and Development (OECD), this support should move along the following three trajectories:

- Create regulatory frameworks that encourage innovation and strengthen SMEs' capacity development through accelerators and mentoring opportunities.
- Encourage uptake and investments in new digital technologies by tourism businesses, making them more accessible to SMEs, and supporting investments in human resources for the management of smart initiatives.
- Encourage digital business model and ecosystems, supporting access to digital infrastructure, public-private partnerships and knowledge sharing mechanisms.

1.4.1. Key EU policies and initiatives on smart tourism

Over the years, the European Commission launched several initiatives to create a supportive framework for the development of smart tourism destinations, as part of a wider strategy to support the digital transformation of the EU tourism and to maintain the leading role of Europe's tourist destinations in the world.

The 2010 European Commission Communication "Europe, the world's No. 1 tourist destination - a new political framework for tourism in Europe" can be considered as a key starting point, as it sets out a comprehensive strategy and action plan for EU tourism, including actions in support to innovation and new information technologies as a key competitive factor[56].More recently, the EU has launched an ambitious strategy for the Europe's digital transformation, as an integral part of the EU twin green and digital transition approach set out in the 2020 Communication "A New Industrial Strategy for Europe". The strong impetus on the digital transition is reflected in the Commission priorities for 2019-24, and in the Commission's "Strategy on Shaping Europe's Digital Future", which established a programme of policy reforms accompanied by a legislative framework for data access and use. The digital transformation and the better use of data also fits into the European Green Deal, since they represent a key enabler to reach the transition's objectives to a climate neutral, circular and more resilient EU economy. This new political impetus shows concrete implications for the tourism sector.

At the beginning of the 2020, the Communication 'A European strategy for data" highlighted the need to boost the European data economy through a single market for data and to capture the benefit of data-informed decision making. The strategy announced the development of common European sector-specific data spaces, bringing together relevant data, data infrastructures and governance structures to pool, access, share, process and use data. A common tourism data space creates a framework for improved data access, sharing and re-use in the tourism ecosystem, contributing to the competitiveness and sustainability of the sector, the emergence of innovative business models and opportunities, as well as the upskilling of tourism workers[57]. The initiative also constitutes a significant contribution to support tourism in achieving the digital targets outlined in the communication "2030 Digital Compass: the European way for the Digital Decade"[58], which are focused on digital education and skills, sustainable digital infrastructures, digital transformation of business – with a focus on SMEs as they represent the backbone of the EU economy - and public services.

The support to the SMEs transition towards digitalization, sustainability, access to market and financing is at the heart of the Commission's communication "An SME Strategy for a

[55] European Commission (2021). Scenarios towards co-creation of transition pathway for tourism for a more resilient, innovative and sustainable ecosystem. Brussels, 21.6.2021 SWD(2021) 164 final.
[56] European Commission (2010). Europe, the world's No 1 tourist destination – a new political framework for tourism in Europe. Available online: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52010DC0352&from=EN
[57] European Commission (2021) Pact for Skills Roundtable with Commissioners Schmit and Breton for the Tourism Ecosystem.
[58] More information on the 2030 Digital Compass: the European way for the Digital Decade is available at: https://eur-lex.europa.eu/resource.html?uri=cellar:12e835e2-81af-11eb-9ac9-01aa75ed71a1.0001.02/DOC_1&format=PDF

sustainable and digital Europe". The strategy has a significant relevance for the tourism ecosystem's companies, which is almost totally composed by small and medium enterprises (SMEs) employing most than the 80% of its workers.[59] The strategy announced the deployment of a network of Digital Innovation Hubs across the EU, offering access to technology and accelerating the digital transformation of SMEs.[60] A further step to reinforce the role of these hubs came from the recently created Digital Europe Programme, which will support the deployment of a network of European Digital Innovation Hubs. They will provide access to technical expertise and experimentation, helping companies to adopt digital technologies to improve business and production processes, products, and services. They will also provide financing advice, training, and skills development opportunities.[61]

The outbreak of the COVID-19 pandemic has further highlighted the need to accelerate the green and digital transitions and increase the resilience of the EU industrial ecosystems, which was reflected in the update of the EU Industrial Strategy, where tourism was included among one of the 14 EU industrial ecosystems.[62;63] In this context, the European Commission proposed to co-create with relevant stakeholders so-called transition pathways, namely a set of measures and outputs to enable a transition towards a more resilient, sustainable and innovative industrial ecosystems. Because of its high economic value for the EU, the challenges it is now facing to meet environmental and digital goals, and the fact that it was heavily hit by the Covid-19 pandemic, the tourism ecosystem was the first where a co-creation process was launched to develop a transition pathway, leading to the Transition Pathway for Tourism – published in February 2022. It has identified 27 areas of actions for the green, digital and resilient transition of the tourism ecosystem, grouped into 7 key building blocks: sustainable competitiveness; regulation and public governance; research and innovation, techniques and technological solutions; infrastructure; skills; social dimension; investments and funding. The area of action #9 – within the building block of green and digital transition – recommends fostering the creation of data-driven tourism services.

The role of digital technologies and data was also directly associated to the pandemic contrast within the Communication "Tourism and transport in 2020 and beyond". This Communication - which was released in May 2020 - set the first tourism focused coordinated framework following the COVID outbreak. It was accompanied by a package of three sets of guidelines and a recommendation to help Member States gradually lift travel restrictions and allow tourism and transport businesses to safely reopen during the forthcoming summer season and the following months. Mobile applications were seen as valuable tools to support contact-tracing strategies by public health authorities, while artificial intelligence and robotics was associated to the monitoring of physical distancing and to the facilitation of disinfection. The use of digital solutions was also linked to the management of tourists' flows and carrying capacity of destinations' points of interests. The Communication also encouraged the deployment of the Digital Innovation Hubs as providers of technical expertise to local tourism businesses,[64] such as robots for disinfecting and cleaning, smart booking systems and crowd management tools. It also announced the new EU-funded support action for interregional

[59] European Commission (2021) Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. Brussels 5.5.2021 SWD(2021) 351 final.
[60] For an overview of the support mechanisms focused on SME, including also those focused in tourism, please see: European Commission (2022). Transition Pathway for Tourism. Publications Office of the European Union, Luxembourg.
[61] Detailed information on European Digital Innovation Hubs is available at: https://digital-strategy.ec.europa.eu/en/activities/edihs
[62] European Commission (2021). Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions Updating the 2020 New Industrial Strategy: Building a stronger Single Market for Europe's recovery. Brussels, 5.5.2021. COM(2021) 350 final.
[63] EU ecosystems were selected on based on their economic and technological relevance, and for their expected contribution to the EU economy decarbonisation, digitalisation and resilience. For more information about the tourism ecosystem, please visit: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52021SC0351&from=EN
[64] European Commission (2020). Communication from the commission to the European Parliament, the Council, the European economic and social committee and the committee of the regions. An SME Strategy for a sustainable and digital Europe. Brussels, 10.3.2020 COM (2020) 103 final.

partnerships on sustainable and digital tourism[65], and the launch of the European Tourism Convention which was held in October 2020 to engage stakeholders in a dialogue on digital transition, data and innovation.

As concerns specific on-the-ground smart tourism initiatives, the annual European Capital of Smart Tourism competition aims at identifying and supporting European smart tourism excellences, also establishing a framework for networking and the exchange of best practices between cities.[66]

Among other initiatives to support digitalisation, it is worth mentioning:

- the Tourism Business Portal[67], which provides SMEs with guidance and up to date information to SMEs on a variety of tourism industry topics, including issues linked to digitisation and smart tourism.
- the Intelligent Cities Challenge (ICC) [68], supporting selected cities and smart tourism destinations to achieve sustainable growth. The project also focuses on green and digital transition in tourism, which is one of the overarching thematic tracks.
- the Digital Tourism Network[69], a forum gathering relevant stakeholders to discuss challenges and opportunities linked to EU tourism industry's digital transformation.

Moreover, it is worth noting that many initiatives in other sectors – such as mobility or the environment – have an impact on the tourism value chains as well.

1.4.2. The Smart Tourism Destinations project

The "Smart Tourism Destinations"[70] project was launched in 2021 by the Directorate-General Internal Market, Industry, Entrepreneurship and SMEs (DG GROW) of the European Commission to support EU tourism destinations to adopt data-driven approaches to become or improve as smart tourism destinations. The project has four main objectives:

- Support EU destinations in the adoption of new technologies and data-driven approaches, with a view to promote new high-quality tourism products and services.
- Foster EU smart, responsible and sustainable tourism, and enhance the comprehension of tourism impacts.
- Understand and address current and future challenges of EU tourism through data management and unlock the potential of EU destinations as smart tourism destinations.
- Foster collaboration among EU tourism destinations on data management and re-use, promoting capacity building and a knowledge base to inform urban tourism policies and strategies.

The project is structured around three main pillars:

Pillar 1: A "Mastering data for tourism by EU destinations" study, namely the present report, which assesses the state-of-the-art of smart tourism in Europe, analysing its key features and challenges, presenting notable good practices, analysing future trends, and describing fruitful cases of cooperation between destinations.

Pillar 2: Developing tools for urban tourism destinations for mastering data and to strengthen cooperation on smart tourism at EU level, which is going to provide a wide

[65] European Commission (2020). Communication from the commission to the European Parliament, the Council, the European economic and social committee and the committee of the regions. An SME Strategy for a sustainable and digital Europe. Brussels, 10.3.2020 COM (2020) 103 final.
[66] European Union (2021), Competition for the European Capital of Smart Tourism 2022. Guide for applicants, available at: https://smart-tourism-capital.ec.europa.eu/system/files/2021-04/SmartCapitals_GuideforApplicants_2022.pdf
[67] Information on the Tourism Business Portal to advice SMEs in the tourism industry available on the European Commission's website: https://ec.europa.eu/growth/sectors/tourism/business-portal_en
[68] More information on the Intelligent Cities Challenge initiative is available at: https://www.intelligentcitieschallenge.eu/
[69] More information on the Digital Tourism Network is available at: https://ec.europa.eu/growth/sectors/tourism/support-business/digital_en
[70] More information and details on the initiative are available at: https://smarttourismdestinations.eu/

range of services to a selected pool of EU destinations to improve how they make use of data for tourism. This pillar also aims at setting-up a community of practice to foster cooperation within the smart tourism ecosystem.

Pillar 3: Recommendations for follow-up actions on mastering data for tourism by EU destinations, i.e. developing a set of recommendations with concrete proposals for action planning at EU, national, regional, and local levels to guide further work on mastering data for tourism.

1.5. Structure of the study

The remainder of the study is structured into 7 sections. Section 2 analyses how EU destinations and companies are nowadays exploiting data to improve tourism services, also describing the key challenges they are encountering. Section 3 showcases a selection of smart tourism good practices. Section 4 assesses future trends of the use of data for tourism, also assessing the key implications of such trends for destinations and businesses. Section 5 analyses how destinations are cooperating to exploit the value of data for tourism and presents notable cases of cooperation. Section 6 provides a set of recommendations for destinations wanting to become or improve as smart tourism destinations, and draws the conclusions of the study. Finally the Annexes A and B complement the report with additional good practices (integrating those already presented in Section 3) and cases of cooperation (integrating those already presented in Section 5).

In addition to this, a separate appendix offers a detailed account of the methodology adopted.

2. Data for tourism: features and challenges

2.1. How does tourism make use of data?

The exploitation of data is a key enabler for the smart growth of tourism.[71] Indeed, the effective and efficient use of data offers a myriad of opportunities to improve tourism services of both destinations and companies.[72] For instance, a destination may use information shared in location-based social media to create personalised marketing campaigns, or a company may use historical data on visits to predict tourist demand and plan operations more effectively.[73]

In order to gather an updated picture of how destinations and companies are making use of data to enhance the experiences of tourists, the study team assessed 200 cases of data use for tourism in over 50 countries across the world. As presented in detail in the methodological appendix, these cases were collected through desk-based research (e.g. academic papers, publications, etc.) and interviews with experts, and have an ample time coverage as they include both recent cases implemented in the past few years, but also more dated ones, going back to a couple of decades.

30 cases of particular interest have been selected as good practices, and are presented in detail in Section 3.3 and in Annex A. Moreover, 10 notable cases of successful cooperation between different destinations in the use of data have also been identified and are presented in Section 5 and in Annex B.

Cases of data use for tourism

In this report, a case of data use for tourism consists of a real-world instance in which data was put to use for tourism purposes.

For example, Airbnb recommends to individual accommodation providers the prices at which they should rent out their accommodation by analysing data on the characteristics of the accommodation (size of the accommodation, equipment, number of rooms), the environment of the accommodation (number of attractions nearby, distance from the centre), booking time and planned events (season, public holidays, festivals, etc.), weather forecasts, availability and pricing of nearby accommodations, and user activity (searches, filtering preferences, ratings, and reviews).

The remainder of this section presents the key insights from the analysis of the 200 cases of data use for tourism, and allows to understand how destinations and companies – both in Europe and across the world – are making use of data to become more competitive and improve the experiences of their tourists.

Three main dimensions of analysis are taken into consideration:

[71] Alcántara-Pilar, J. M., del Barrio-García, S., Crespo-Almendros, E., & Porcu, L. (2017). Toward an understanding of online information processing in e-tourism: Does national culture matter? Journal of Travel & Tourism Marketing, 34(8), 1128–1142 and Fuchs, M., Höpken, W., & Lexhagen, M. (2014). Big data analytics for knowledge generation in tourism destinations–A case from Sweden. Journal of Destination Marketing & Management, 3(4), 198–209 and Gretzel, U., Sigala, M., Xiang, Z., & Koo, C. (2015). Smart tourism: Foundations and developments. Electronic Markets, 25(3), 179–188.

[72] Jackson, S. (2016). Prediction, explanation and big(ger) data: A middle way to measuring and modelling the perceived success of a volunteer tourism sustainability campaign based on 'nudging'. Current Issues in Tourism, 19, 643–658.

[73] Ardito L., Cerchione R., Del Vecchio P., Raguseo E. (2019). Big data in smart tourism: challenges, issues and opportunities, Current Issues in Tourism, 22:15, 1805-1809.

Dimension 1 - Purpose areas of data use

Purpose areas consist of the objective for making use of data. Four key purpose areas have been identified in the framework of the study:




Improve interaction and engagement with the tourist	Conduct market analyses and inform decision-making	Improve planning and operations of tourism services	Increase destination sustainability and accessibility

Dimension 2 – Type of data users

The type of data user distinguishes the subject making use of data, including both public and private actors. Three main types of data users have been identified:



Tourism destinations and public authorities	Private sector - Tourism industry	Private sector – Other

Dimension 3 – Source of data

Finally, the dimension on the source of data defines the origin of the data being used. Building upon the relevant literature[74], 4 main types of data sources have been identified, further divided into 10 sub-types:


User-generated data		Transaction data		
Textual	Photo	Web search and webpage visiting	Online booking and purchasing	Consumer card transactions


Device data		Other data		
GPS, mobile roaming, RFID, bluetooth, meteorological, Wi-Fi	Smart city (pollution, traffic, waste, etc.)	Business information (restaurants, hotels, etc.)	Statistics	Context-specific information

[74] Including in particular: Li, J., Xu, L., Tang, L., Wang, S., & Li, L. (2018). Big data in tourism research: A literature review. Tourism Management, 68, 301–323; Xiang, Z., Du, Q., Ma, Y., & Fan, W. (2017). A comparative analysis of major online review platforms: Implications for social media analytics in hospitality and tourism. Tourism Management, 58, 51e65; and: Shoval, N., & Ahas, R. (2016). The use of tracking technologies in tourism research: The first decade. Tourism Geographies, 18(5), 587-606.

The sections 2.1.1, 2.1.2, and 2.1.3 present a detailed analysis for each of the three dimensions respectively.

2.1.1. Insights on the main purposes of data use

What are the purposes of making use of data for tourism? What goals do destinations and companies set when they exploit data? All the different cases of data use for tourism collected by the study team can be grouped into four main purpose areas.

What are the purposes of making use of data for tourism? What goals do destinations and companies set when they exploit data? All the different cases of data use for tourism collected by the study team can be grouped into four main purpose areas.

Purpose area 1 - Improvement of the interaction with and engagement of the tourist

The first purpose of data use relates to the development of **tourism services increasingly personalised and based on a higher degree of interaction with the customer/end-user**. This is the result of a generalised trend enabled by new technologies[75] and data analytics techniques that allow optimisation and offers tailored to the customer. Personalisation is an established trend, and also works as benchmark for the quality of the experience[76].

Notable examples of cases of data use for the improvement of the interaction with and engagement of the tourist:

***Country:* Ireland** ***Destination*: Belfast** ***Main actor:* Belfast City Council** ***Solution:* Interactive landmarks** ***Implemented:* 2019**	The Belfast city council – in partnership with other stakeholders – launched a pilot project allowing residents and tourists to engage with historical landmarks in the Titanic Quarter with their phones. The solution consists in 'digitally priming' the landmarks so that when tourists pass by them, they are sent a text messages and can start to chat with those landmarks, learning fun and cultural facts. This solution allowed to collect passive insights on tourists' behaviours, collecting their suggestions, while encouraging self-guided walking tours.[77]
***Country:* Spain** ***Destination:* Ibiza** ***Main actor:* Palladium Hotel Group** ***Solution:* Smart bracelets** ***Implemented:* 2014**	The Palladium Hotel Group introduced the VIB (Very Important Bracelet) smart wristbands so guests can do everything from one device. The VIB kit is available to those staying at the new Hard Rock Hotel Ibiza and Ushuaïa Ibiza Beach Hotel. Guests do not have to carry a wallet, phone and room key as it is all be accessible from the smart bracelet. Users are able to open their rooms, access different establishments around the hotel, pay for any product using a pin code and get exclusive discounts.

[75] "In the last years, destinations have started to redefine their role and their entrepreneurial logics, involving tourists as active co-creators of their own experiences and considering new technologies as the main tools for defining tourism products." Buonincontri, P., & Micera, R. (2016). The experience co-creation in smart tourism destinations: A multiple case analysis of European destinations. Information Technology and Tourism, 16(3), 285–315. For a more detailed assessment of the trends in tourism – including the growing preferences of tourists for personalised experiences, please refer to the following Section 4.

[76] Digital transformation in the travel & tourism sector: 3 trends that travel marketers need to know' – Doxee Blog – Digital Marketing: https://www.doxee.com/blog/digital-marketing/digital-transformation-in-travel-sector-3-trends/ [Last accessed: 14 March 2022]

[77] More information on the What is Hello Maritime Mile pilot project is available at: https://smartbelfast.city/story/hello/

Purpose area 2 – Conduct market analyses and inform decision-making

The second data purpose area pertains to the **improvements in market analysis and decision-making** linked to higher availability of data and improved data analytics capabilities by tourism destinations.

Both private companies and public entities work as data collectors, but also as data users in order to define their business strategies and manage the destination territory and tourism flows, respectively. Public authorities often have information on visitors' interactions with local services – for instance local mobility (e.g. airports, ports, etc.) or data on accesses to heritage sites – while private actors collect large amounts of commercial (purchases on websites or by credit cards) and even behavioural data.

The combination and interoperability of the many available data sources, supported by increasingly affordable Big Data analytics and machine learning technologies, can help destinations in extracting meaningful insights[78], improving their strategies and the way priorities are defined and budget allocated. In this sense, the establishment of synergies based on data sharing or technology implementation can be mutually beneficial and improve value propositions and increase the appeal of destinations towards prospect visitors.

The following represent notable examples on how destinations improved their ability to master the data available to **conduct market analyses and inform decision-making**.

***Destination*: Buenos Aires (Argentina)** ***Main actor*: Buenos Aires Tourism Board (BATB)** ***Solution*: Big Data analytics** ***Implemented*: Presented at the 1st UNWTO World Conference on smart destinations in 2017**	Buenos Aires has implemented a Tourism Intelligence System, which generates insights to support public and private sector decision-making. The system provides information on tourism flows across the different city neighbourhoods, based on GPS data from telecommunication companies. The analysis of such data makes it possible to understand the behaviours and preferences of different tourists segments as well as to better monitor and the flow of visitors between districts and attractions.[79]
***Country*: Spain** ***Destination*: Costa del Sol - Màlaga (Spain)** ***Main actor*: Costa del Sol Tourism** ***Solution*: Big Data analytics** ***Implemented*: 2021**	A powerful Tourism Intelligence tool has been adopted in Costa del Sol, allowing local tourism stakeholders to freely consult data useful to develop business strategies, tailor their offering and anticipate trends. Data gathered from the entire tourism ecosystem has been collated and presented under 11 macro-indicators, each one including a number of sub-indicators. The data visualisations are provided in the form of dynamic dashboards easily accessible on a dedicated portal.

Purpose area 3 – Improvement of planning and operations of tourism services

Data allowing to better understand (and possibly predict) tourism patterns can also help **improve the overall efficiency and competitiveness of the tourism ecosystem**, through accurate planning and resources allocation.

[78] Gustavo, N., Pronto, J., Carvalho, L., Belo, M., (2022), Optimizing Digital Solutions for Hyper-Personalization in Tourism and Hospitality. Advances in Hospitality, Tourism, and the Services Industry, IGI Global.
[79] More information on the Tourism Intelligence System in Buenos Aires is available on the Global Report on Smart Tourism in Cities:https://prefeitura.pbh.gov.br/sites/default/files/estrutura-de-governo/belotur/2020/wtcf-global-report-on-smart-tourism-in-cities.pdf

Depending on the type of destination and the characteristics of its attractions, tourism flows can present more or less clear or recurring patterns - such as in relation to seasonal attractions or specific landmarks/sites. In both cases, specific events or changes in tourists' preferences and behaviours can impact these flows, even abruptly, diverging from initial plans of destination managers and tourism-related companies.

Increasing the number of tourism data sources that provide relevant insights on tourists' flows and choices can help identify promptly the changes that require re-scheduling of activities (e.g. timing of events, special offers/promotions, free access to museums, etc.), or amendments in the planning of material or human resources deployment (e.g. personnel needed in info points, airports, shops, etc.).

The following provide examples on how the planning and operations of tourism services can be improved through data analysis and management:

 ***Destination*: United States** ***Main actor:* Red Roof Inn** ***Solution:* Big Data analytics** ***Implemented:* 2014**	The hotel chain Red Roof Inn uses data analytics since 2014 to foresee tourists flows and customise its marketing strategy. Red Roof analysed patterns in last-minute hotel cancellations and bookings caused by the impact of bad weather on flight traffic. They combined weather datasets with flight cancellations/delays frequency to develop tailored marketing campaigns in locations likely to be hit by harsh weather, where Red Roof had a hotel near the airport. The effect was an optimisation in their offer across different locations and destinations and an overall increase in revenues.[80]
 ***Destination:* Amsterdam (Netherlands)** ***Main actor:* Amsterdam Schipol Airport** ***Solution:* Big Data analytics** ***Implemented:* 2018**	Amsterdam Airport adopted data-driven forecasting, and passenger predictability model. The system combines information on passengers flows with data from wi-fi and cameras, giving a real-time picture of travellers' journeys from airport entrances to gates. The solution has been enriched with many functionalities, such as predicted wait time information, displayed on screens at passenger processing points. Removing data and operational silos the solution to improves airport operations and contingency planning as well as the overall passenger experience.[81]

Purpose area 4 - Increase of destination sustainability and accessibility

Mastering data can also put destinations in a position to improve the sustainability and accessibility of the tourism ecosystem. For instance, technological solutions can unlock and enable better tourism experiences for vulnerable or disadvantaged groups by developing specific services or making existing services easier to use, or they can allow a more effective management of tourism flows, increasing locals' wellbeing and reducing the strain on the urban and natural environments.

Among the many efforts conducted by destinations worldwide to **increase sustainability and accessibility**, the following represent inspirational examples, useful to clarify this concept:

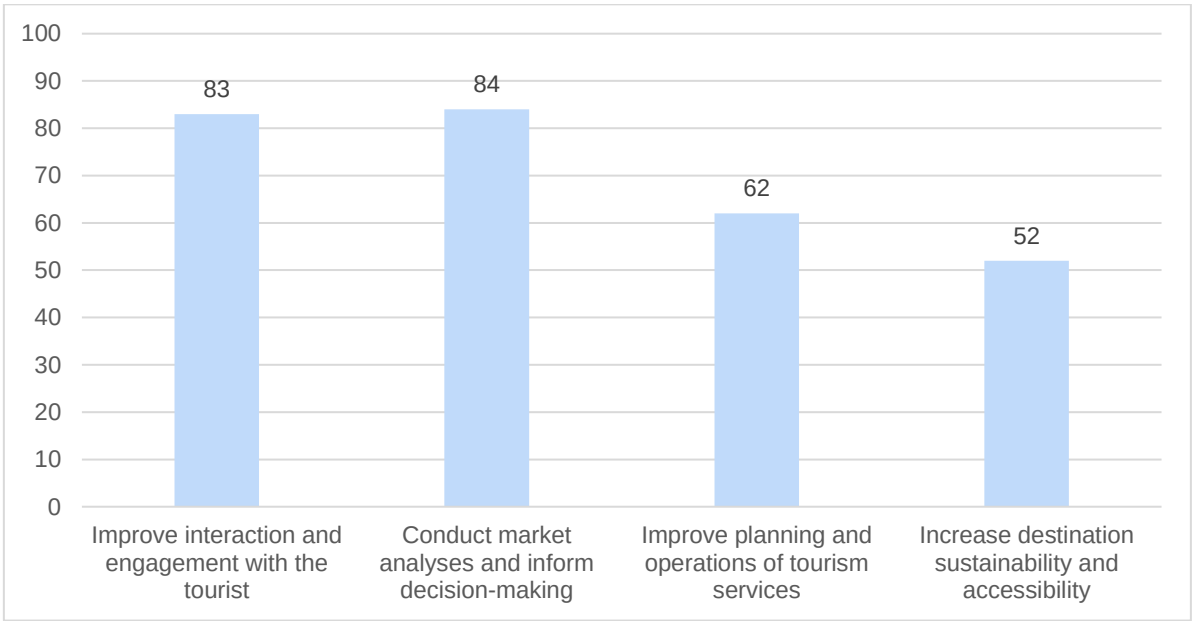
[80] Mobile Marketing Association (2014). Red Roof Inn Turns Flight Cancellations into Customers.
[81] More information on Amsterdam Airport Schiphol´s investment in the Veovo BlipTrack Guest Predictability solution is available at: https://amsterdamsmartcity.com/updates/news/schiphol-to-expand-predictability-technology-to-ma

Destination: ***Granada (Spain)*** ***Main actor:*** ***Granada Human Smart City initiative*** ***Solution:*** ***Mobile and web app*** ***Implemented:*** ***2016-2017***	Granada Human Smart City initiative decided to improve accessibility to? the historical district of Albaicín. To this end, a specific mobile and web app has been developed to calculate optimal routes in the Albaicín neighbourhood depending on the mobility profile of the user (e.g. people in wheelchairs, families with baby strollers). Business Intelligence and Customer Relationship Management systems have also been developed to analyse the needs of residents and tourists and continuously improve accessibility over time.[82]
Destination: ***Valencia (Spain)*** ***Main actor:*** ***Visit Valencia*** ***Solution:*** ***Smart monitoring system*** ***Implemented:*** ***2021***	Supported by a private tech-provider, Visit Valencia adopted GO2, a blockchain-based tool which allows to calculate the carbon footprint of tourism activity. The system relies on smart labels/smart tags assigned to different types of tourism activities. Each activity is broken down and evaluated according to a 5-level calculus scheme allowing real-time information on the carbon footprint of any of them. Supporting data-driven decision-making, this tool allows Valencia to work toward carbon neutrality and increase tourism sustainability.

Analysis of cases of data use for tourism according to purpose areas

The following figure illustrates how the different cases of data use analysed by the study team distribute across the four purpose areas.

Figure 1 – Number of cases of data use, by purpose of use



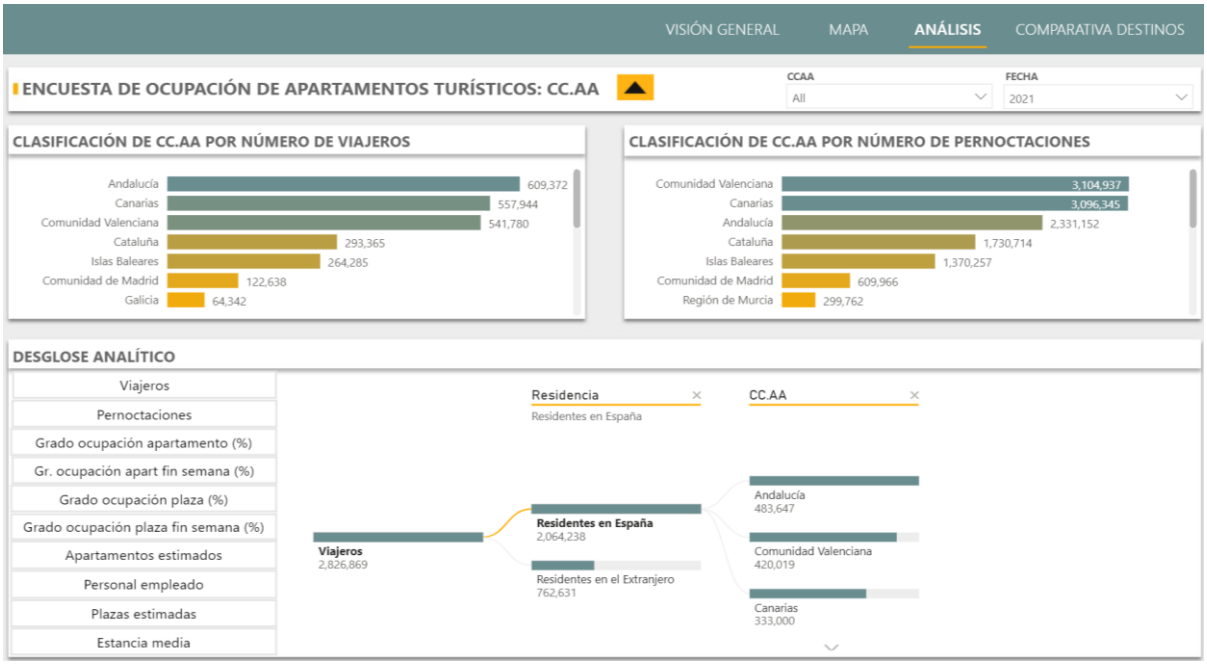
Note: A total of 200 cases of data use were analysed. Each case of data use may be linked to more than one purpose area, therefore the sum of the cases of data use by purpose area exceeds the total number of cases.

Source: Author's elaboration

[82] The European Commission's 100 Intelligent Cities Challenge – Granada Human Smart City. More information available at: https://www.digitallytransformyourregion.eu/good-practices/granada-human-smart-city

It emerges that data are mostly used for the purpose of conducting market analyses and inform decision-making (44% of the 200 cases), in line with the widespread belief that data can aid the improvement of forecasts and predictions through the discovery of hidden patterns.[83] Indeed, the possibility of making decisions on the basis of numbers and analysis rather than anecdotes and intuition is considered a key opportunity offered by data in the tourism sector.[84] In this respect, the results of data analyses are frequently visualised through dashboards. For instance, Segittur – the state company for the management of tourism of the Spanish Ministry of tourism – has developed Dataestur, a platform for the visualisation of different types and breakdowns of tourism data.[85]

Figure 2 – An exemplificatory screenshot from the Segittur dashboard



Source: Dataestur, Survey on Touristic apartment occupancy

Data is also frequently used to improve customer interaction and engagement (43% of the 200 cases). This may be partly explained by the fact that a successful relationship with customers translates quite rapidly into increased revenues, and for this reason, destinations and companies have an immediate interest in making use of data for that purpose. Indeed, in the literature the increase of destination competitiveness is considered to be one of the key drivers for the management of data.[86]

In a lesser number of cases, data is used to improve planning and operations of tourism services (32% of the 200 cases). This result may stem from the fact that – while the tourism industry is becoming smarter – it may still be lagging behind other industries as it is characterised by a high number of small-size companies with limited capabilities for investing in the extraction of value from data.[87]

Finally, the study team also recorded a relatively low, yet still quite significant number of cases of data use with the purpose of increasing the sustainability and accessibility of a destination

[83] Shi, Y. (2014). Big data: History, current status, and challenges going forward. Bridge, 44(4), 6–11.
[84] Song, H., & Liu, H. (2017). Predicting tourist demand using big data. In Z. Xiang & D. Fesenmaier (Eds.), Analytics in Smart Tourism Design, Tourism on the Verge (pp. 13–29). Cham: Springer International Publishing Switzerland.
[85] More information on the *Survey on Touristic apartment occupancy* is available at: https://www.dataestur.es/alojamientos/eoap/
[86] Gretzel, U., Zhong, L., Koo, C., Morrison, A., & Morrison, A. (2016). Application of smart tourism to cities. International Journal of Tourism Cities, 2(2), 216–233.
[87] Gajdošík T. (2019) Big Data Analytics in Smart Tourism Destinations. A New Tool for Destination Management Organizations? In: Katsoni V., Segarra-Oña M. (eds) Smart Tourism as a Driver for Culture and Sustainability. Springer Proceedings in Business and Economics. Springer, Cham.

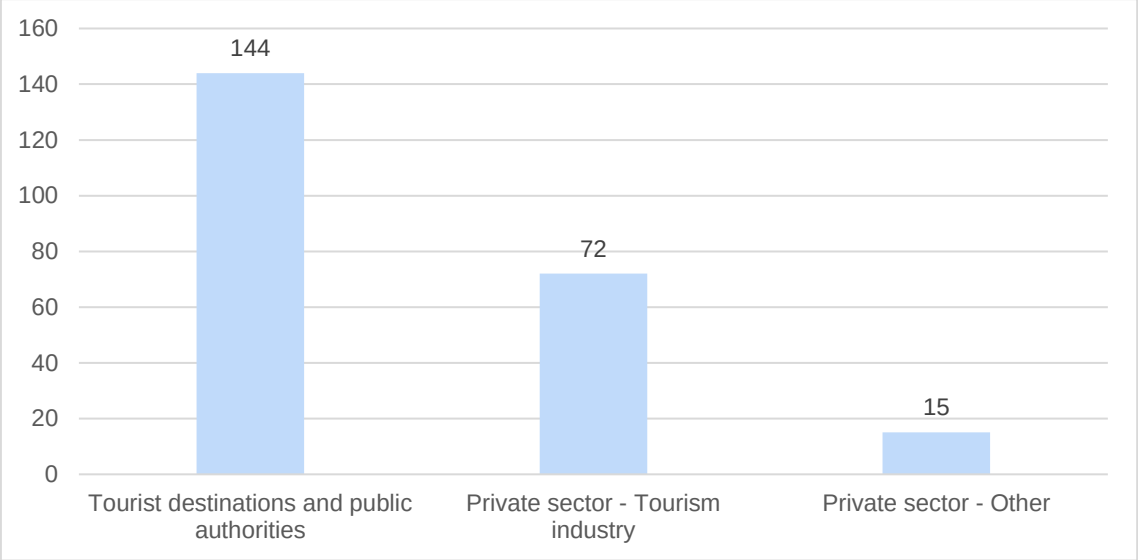
(27% of the 200 cases), designed to improve tourism experiences and quality of life for residents.[88]

2.1.2. Insights on the key data users

It is a widely held belief that public sector institutions are somewhat slower at embracing innovative solutions and at seizing the opportunities offered by data than private companies. In line with this assumption, researchers in the field of smart tourism have found that data is mainly exploited by tourism companies and that, to the contrary, destinations are hardly making use of it at the moment.[89]

However, as illustrated in the following chart, the analysis of the cases of data use collected in the framework of the study highlights that the public sector is very well aware of the value of data and already seeking to exploit its value on a number of cases. Indeed, in 75% of the 200 cases of data use, the data user consists of a destination or a public authority. The empirical evidence of the study therefore complements the existing knowledge base, pointing to the fact that – while the private sector is certainly at the forefront of data mastering for tourism – the public sector also displays a distinct awareness of the value generated by data.

Figure 3 - Number of cases of data use, by data user



Note: A total of 200 cases of data use were analysed. Each case of data use may be linked to more than one data user, therefore the sum of the cases of data use by data user exceeds the total number of cases.

Source: Author's elaboration

Data users - Tourism destinations and public authorities

This category of data user includes a wide variety of different entities, from multi-level public administrations to education institutions and cultural heritage sites. The former often include city councils and municipalities as main adopters of new digital solutions such as the Municipality of Berlin, which offers tour services linking real places to virtual content through QR codes, or the above-mentioned municipality of Malaga collecting real-time tourist information in the Costa del Sol through a tourist intelligence tool. It has been observed that in some cases, destinations mutualise the effort working in groups of municipalities such as in the case of Maidstone, Breda, Lille, Vlissingen, Bruges which collaborated in the development

[88] Lee, P., Hunter, W. C., & Chung, N. (2020). Smart tourism city: Developments and transformations. Sustainability, 12(10), 3958.
[89] Celdrán Bernabeu, M.A., Mazón, J., Giner, D., Baidal, J. (2016). Big Data and Smart Tourism Destinations: Challenges and opportunities from an industry perspective, 9.

of a dedicated strategic plan to support the tourism industry of the 2 Seas area (Southern North Sea and the Channel area), through. In larger countries presenting regional administrations, these sometimes launch strategies involving the entire regional tourism sector, such as the Lombardy Region in Northern Italy where a digital tourism ecosystem has been set up to connect tourists, tourism operators and local authorities.

As mentioned above, not only public administrations, but also other types of public institutions act as direct investors and promoters of smart tourism solutions. The Louvre museum, for instance, adopted Bluetooth-based sensoring to collect data on visitors' habits and potentially personalising visits[90], while universities, like the University of Aveiro (Portugal), are actively involved in tourism data analysis to support policy-making (e.g. on main tourist groups preferences, such as British tourists visiting Portugal).

Destination: Nice (France)

Main actor: Nice Côte d'Azur metropolitan authority

Solution: Smart monitoring system

Implemented: 2012

The Nice Côte d'Azur metropolitan authority, in collaboration with private tech-providers, developed the Urban Environmental Monitoring (UEM). The latter is a programme that collects environmental data thanks to 3,000 sensors rolled out over 160 hectares around the city. This monitoring system allows environmental data to be processed (air and sound pollution, water and energy, waste management, etc.) to test new services for the benefit of local residents, companies and authorities.[91]

Data users – Private sector - tourism industry

In the mapping and analysis of smart tourism data uses in tourism destinations, the study team also recorded – as expected – a significant number of cases of data use by private companies (35% of the 200 cases).

A more granular analysis of these cases highlights that the majority of companies making use of data are big vacation rental sites and touristic metasearch engines (such as renowned Airbnb, Booking, TripAdvisor, Kayak, Skyscanner) and big hotel groups, as emerges in the example below.

Destination: Any (Global)

Main actor: Booking.com

Solution: Analysis of users' online activity

Implemented: n/a

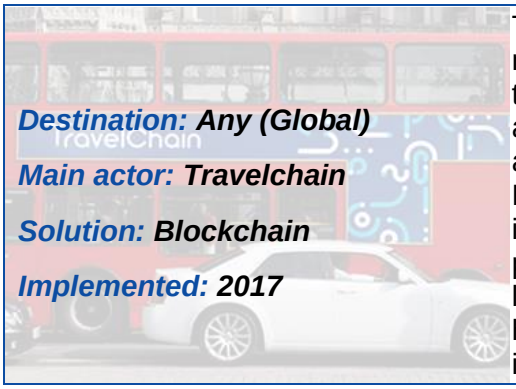
Booking.com analyses the online activity of registered and anonymous users, and then dynamically personalises the accommodation results list based on these. In addition to traditional search parameters (e.g. location, time, type of accommodation), it also examines behavioural data, such as users' clicks and times spent on any given page, thus creating an even more accurate picture of the user's preference.

[90] Alepis, E., Kabassi, K., & Virvou, M. (2017, November). Personalized museum exploration by mobile devices. In Interactive Mobile Communication, Technologies and Learning (pp. 353-360). Springer, Cham.

[91] Philippe Maillard and Pierre Brunet, « Urban Environmental Monitoring (UEM): a demonstration project pooling corporate expertise for smarter cities implemented in Nice Plaine du Var », Field Actions Science Reports, Special Issue 16 | 2017, 24-29. http://journals.openedition.org/factsreports/4297

Data users – Other private sector entities

A small number of cases of data use by private companies not directly related to the tourism sector was also recorded. These mostly include telecommunications companies that collect and analyse data from the sim cards of their users. This data is usually sold to operators in a variety of sectors, including tourism.



Travelchain runs an app for advertisement and marketing based on blockchain technology in tourism. After subscribing, users can choose when to activate the service and receive targeted advertisement based in their profile and geolocation. By doing so, they earn virtual tokens (TravelToken), issued by the Travelchain app, which can be used to purchase tourism-related products and services. The large amounts of users' data (e.g. transactions history, reviews/feedback, locations, interests, etc.) is made available to the industry.[92]

2.1.3. Insights on the key data sources

What are the sources of data used for tourism? Based on the literature, the 200 cases of data use can be grouped into four main categories:

Data sources – User-generated data

First, user-generated content (UGC), namely data that comes from tourists themselves, who generate it and make it available.

UGC can be divided into two main sub-categories: textual information and photos. Textual information consists of the feedback that tourists share about their experiences, such as reviews, posts, blog articles, or contributions to surveys. Photos are usually uploaded by tourists on social media,[93] and come together with a variety of additional information, such as locations, time and tags.[94] User-generated data gathered through social media interactions is becoming crucial to intercept and predict tourists' choices and preferences. These platforms offer large volumes of reviews and first-hand feedback, and power predictive algorithms.

Tourism Ireland analyses the comments left by tourists in various platforms, such as the Tourism Ireland website, Twitter and Facebook. The aim is to find out the motivations and opinions of tourists coming to the country by monitoring their online content. The software allows to listen to social media, get a more accurate picture of the movement and preference of tourists, and ultimately to improve the efficiency and effectiveness of marketing communication activities.

[92] Introducing TravelChain.io, Medium. [Last accessed: 18/03/2022] https://medium.com/hackernoon/introducing-travelchain-io-81c5236fe447
[93] Figueredo, M., Cacho, N., Thome, A., Cacho, A., Lopes, F., & Araujo, M. (2017). Using social media photos to identify tourism preferences in smart tourism destination. 2017 IEEE International Conference on Big Data (Big Data).
[94] Xiang, Z., Du, Q., Ma, Y., & Fan, W. (2017). Op. cit.

Data sources – Transaction data

Second, data generated through transactions, namely operations and activities that take place in the tourist market.

This source of data is divided into three sub-categories: data from the web searches and the webpage visits of tourists, data from the online bookings and purchases, and data from consumer cards (including credit cards, reward cards, payment cards, etc.).[95]

Destination: ***New Zealand***

Main actor: ***Ministry of Business, Innovation and Employment of New Zealand***

Solution: ***Electronic payments analysis***

Implemented: ***2012 and 2013***

In 2012 and 2013, the Ministry of Business, Innovation and Employment in New Zealand purchased data on electronic card transactions from a private company, which in turn sourced it from Paymark (one of two major credit card clearing houses within New Zealand, with approximately 70 per cent market share of New Zealand merchants with electronic funds transfer at point-of-sale facilities) and from the Bank of New Zealand (which holds approximately 20% of domestic household bank accounts). The datasets include average monthly spending rate, number of transactions, the location of purchases, origin of the cardholders. This allowed to filter out foreign and domestic tourists to identify tourism-related expenditure patterns at the national and local level, as well as in relation to different products and services (e.g. accommodation, travel, restaurant).[96]

Data sources – Device data

Third, data collected by devices and sensors,[97] including satellites.

This category can also be divided into two sub-categories: data collected by devices and sensors that allow the tracking of movements (including GPS data, mobile roaming data, Bluetooth data, RFID data, WIFI data and meteorological data), and data collected by smart city devices and sensors, which are usually used for broader purposes but can also be put to use for tourism purposes (e.g. data from sensors traffic, air quality and pollution, public transportation, internet access, waste management, etc.).[98]

[95] Sobolevsky, S., Sitko, I., Des Combes, R. T., Hawelka, B., Arias, J. M., et al. (2014). Money on the move: Big data of bank card transactions as the new proxy for human mobility patterns and regional delineation. the case of residents and foreign visitors in Spain. In 2014 IEEE international congress on big data, Anchorage, USA.

[96] Using electronic card transaction data to measure and monitor regional tourism in New Zealand. Ministry of Business, Innovation and Employment. https://www.mlit.go.jp/kankocho/naratourismstatisticsweek/global/pdf/full_paper/3-3.pdf

[97] Shoval, N., & Ahas, R. (2016). Op. cit.

[98] As far as geospatial data is concerned, it is noted that this category includes not only privately held data – including for instance geographic and navigation data from the main geo-localisers such as Google Maps, Street View, Waze – but also public geospatial data, e.g. the Infrastructure for Spatial Information in Europe (INSPIRE) Geoportal.

Destination: ***Paris (France)***

Main actor: ***Louvre Museum***

Solution: ***Bluetooth-based sensors***

Implemented: ***2017***

The Louvre Museum uses Bluetooth-based sensors to analyse visitors' habits and visit patterns. The sensors detect nearby mobile phones (when Bluetooth is on), tracking visitors' movements in the museum, collecting data on the art works they have seen, how much time they have spent in front of each of them (and in the museum overall), and what route they have taken during the visit. Data analysis reveals the most popular attractions and allows to segment visitors based on visit duration, determining optimal detours for each visitor segment. It is also possible to run various simulations, improving crowd management and optimising resources.[99]

Data sources – Other data types

Fourth, data from other sources, including in particular private businesses datasets (e.g. data on the number of passengers held by airlines, data on vacancies of hotels, data on restaurants reservations, etc.), statistics (such as the datasets published by public authorities), and context-specific information, namely all the pieces of information regarding a certain destination that can be used for a touristic service (e.g. the information on the history of a place, which can be used to develop a virtual reality experience in which the tourist can explore a destination as it was in the past).

Country: ***Spain***

Destination: ***Andalusia***

Main actor: ***Turismo Andaluz***

Solution: ***Portal***

Implemented: ***2017***

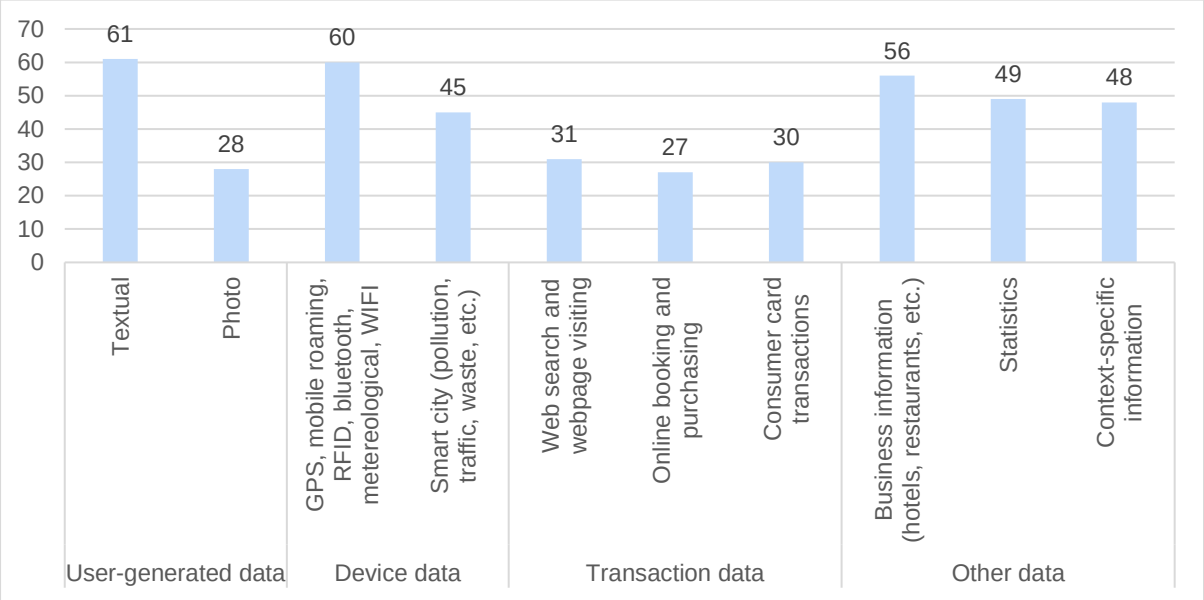
Turismo Andaluz supported the development of a portal that publishes a wide variety of tourism data from different sources, open to all interested stakeholders. These include, for instance, information on tourists (number, nationality, place of visit, etc.) from the regional statistics authority.

Analysis of key data sources

The following figure illustrates the distribution of the 200 data uses analysed by the study team, across the different types of data sources:

[99] Yoshimura, Y., Krebs, A., Ratti, C. (2017). Noninvasive Bluetooth Monitoring of Visitors' Length of Stay at the Louvre. IEEE Pervasive Computing, 16 (2), 26-34.

Figure 4 - Number of cases of data use, by type of source



Note: A total of 200 cases of data use were analysed. Each case of data use may be linked to more than one source, therefore the sum of the cases of data use by source exceeds the total number of cases.

Source: Author's elaboration

As illustrated in the above chart, it emerges that one of the most common sources of data for tourism consists of "GPS, mobile roaming, RFID, Bluetooth, meteorological and Wi-Fi" data (31% of cases), which is used to understand the spatial and temporal behaviour of tourists, including travel distances,[100] repeated visiting,[101] tourist flows[102] and destination loyalty.[103] Such understanding is then useful to estimate and predict tourist movements, and to make itinerary recommendations. Similarly, data from smart city sensors – on pollution, traffic, parking, mobility, waste, etc. – is also frequently used (in 24% of the cases), although their application is usually not strictly for the development and improvement of tourism services, but rather more broadly for urban services that have an impact on all city dwellers, including both residents and tourists.

User-generated textual information is another important data source among the cases of data use analysed within the scope of the study, as it is found in 32% of the cases. This data is always available in volumes and through many different platforms, including renowned social media (such as Facebook, YouTube, Instagram and TikTok), tourism review and ratings platforms (such as TripAdvisor and Yelp), and travel pages and web spaces managed by bloggers and recommenders.[104] It is used to explore tourist satisfaction and understand how to improve guest experience, competitive positioning and marketing activities.[105]

Although less common (15% of the cases), user-generated photos are also an important data source, especially when geo-tagged. Their analysis allows to understand tourist behaviour in

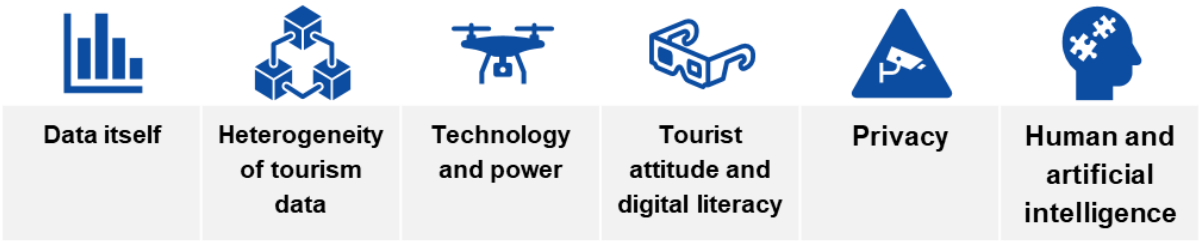
[100] Nilbe, K., Ahas, R., & Silm, S. (2014). Evaluating the travel distances of events visitors and regular visitors using mobile positioning data: The case of Estonia. Journal of Urban Technology, 21(2), 91-107.
[101] Kuusik, A., Tiru, M., Ahas, R., & Varblane, U. (2011). Innovation in destination marketing: The use of passive mobile positioning for the segmentation of repeat visitors in Estonia. Baltic Journal of Management, 6(3), 378-399.
[102] Raun, J., Ahas, R., & Tiru, M. (2016). Measuring tourism destinations using mobile tracking data. Tourism Management, 57, 202-212.
[103] Tiru, M., Kuusik, A., Lamp, M. L., & Ahas, R. (2010). LBS in marketing and tourism management: Measuring destination loyalty with mobile positioning data. Journal of Location Based Services, 4(2), 120-140.
[104] Brandt, T., Bendler, J., & Neumann, D. (2017). Social media analytics and value creation in urban smart tourism ecosystems. Information & Management, 54(6), 703–713.
[105] Crotts, J. C., Mason, P. R., & Davis, B. (2009). Measuring guest satisfaction and competitive position in the hospitality and tourism industry: An application of stance-shift analysis to travel blog narratives. Journal of Travel Research, 48(2), 139-151.

terms of country of origin[106], points of interest, travel routes and holiday duration, in a view to developing travel recommendation systems and improve marketing activities.

In comparison with UGC, transaction data is usually privately-owned (e.g. by the companies operating the search engines, such as Skyscanner, Kayak, Trivago and Booking to name the most renowned). This may partially explain why – out of the 200 cases of data uses assessed by the study – this data source tends to be less common (Web search and webpage visiting data are used in 16% of the cases; Online booking and purchasing data in 14% of the cases, and Consumer card transactions data in 16% of the cases). Despite their relatively limited use, transaction data are widely considered to excellent to understand and predict tourism behaviour, and consequently improve search engine optimisation (SEO) and marketing activities.[107]

2.2. The challenges in using data for tourism

The assessment of the 200 cases of data use for tourism – combined by literature review and a series of interviews with experts – allowed to identify six main challenges that are usually encountered when making use of data for tourism.



Key Challenge 1 – Data itself

The main challenges encountered when making use of data for tourism consist of the well-known challenges posed by data itself, regardless of the sector of application.[108] When characterising data – and big data in particular – reference is frequently made to the so-called "Vs":[109]

- To be valuable, data needs to have a large **volume**. However, big datasets are usually expensive and require a lot of time to build;
- Data also needs **velocity**, in the sense that it has to be quickly generated and processed, which are however once again expensive processes;
- Data usually comes from a **variety** of sources and in heterogeneous formats, requiring considerable effort to standardise and harmonise;
- Data requires **veracity**, as it obviously has to be accurate and meaningful.[110]

Guaranteeing all the different Vs requires specialised competencies and advanced technologies. Within a fragmented industry like tourism – which is mostly based on micro-businesses – the significant investments required to harness data and generate value may be particularly difficult to implement.

[106] Da Rugna, J., Chareyron, G., & Branchet, B. (2012). Tourist behavior analysis through geotagged photographies: A method to identify the country of origin. In 2012 IEEE 13th international symposium on Computational Intelligence and Informatics (CINTI), Budapest, Hungary.
[107] Li, X., Wu, Q., Peng, G., & LV B. (2016). Tourism forecasting by search engine data with noise-processing. African Journal of Business Management, 10(6), 114.
[108] Celdrán Bernabeu, Marco A., Mazón, J., Giner, D., Baidal, J. (2016). Op. cit.
[109] Furht, B., & Villanustre, F. (2016). Introduction to big data. In Big Data Technologies and Applications (pp. 3–11). Cham: Springer International Publishing.
[110] For the famous 3 Vs characterisation of big data, refer to Laney, D. (2001). 3D data management: Controlling data volume, velocity and variety. META Group Research Note, 6, 70. For the addition of the fourth V, refer to Gantz, J., & Reinsel, D. (2011). Extracting value from chaos. IDC iView, 1e12.

Key Challenge 2 – Heterogeneity of tourism data

The well-known issues in connection with using (big) data appear to have been encountered also in the framework of recent initiatives aimed at creating tourism platforms and data sharing spaces at international, national and local levels.[111] These are indeed characterised by an overall lack of interconnection, common formats, standards (e.g. semantic) and interoperability protocols. This limits the full exploitation of the data value to support destination management and sustainable tourism development approaches, as well as the possibility for stakeholders to combine data from different sources and obtain insights to feed into policy and business decision-making processes. As highlighted in Section 1.4.1, the fragmentation of tourism datasets is also one of the key reasons behind the European Commission's recent investments in common European data spaces in various strategic areas, including tourism.

Key Challenge 3 – Technology and power

Another key challenge is that all smart solutions require an ecosystem of information and communication infrastructures, systems and devices to function. The development of this info-structure requires significant investments on the part of destinations and companies. While these may have already taken place in bigger destinations – where public administrations have usually already funded a number of relevant smart city projects – there is a risk of digital exclusion for smaller destinations. This challenge is closely linked with the issue of access to power: for the info-structure to function, all stakeholders – including destinations, companies, and tourists themselves – have to be ensured constant access to power, which is challenging both in terms of technical feasibility and also in light of sustainability goals.[112]

Key Challenge 4 – Tourist attitude and digital literacy

Smart tourism solutions certainly offer enormous potential to offer more and more personalised and co-created experiences to tourists.[113] At the same time, however, not all tourists may actually prefer such smart experiences over more traditional ones. Indeed, smart tourism solutions require a high degree of effort to interact and be engaged with, and pose the risk of cognitive overload.[114] In other words, in an ever more connected world, tourists may be precisely looking for a window of opportunity to disconnect, unplug and rediscover the authentic through travel.[115] For this reason, another important challenge consists of ensuring that smart tourism can accommodate for different levels of tourists' eagerness to make use of technologies[116], and to avoid any negative consequences of ICT on the tourist experience, a phenomenon sometimes referred to as "e-lienation".[117] Similarly, a strong reliance on technology also poses issues when considering that tourists can have different levels of digital literacy, and that therefore tourists without the necessary competencies or devices may be left out of particularly smart experiences.

Key Challenge 5 – Privacy

The continuous capture and exploitation of tourists' personal data lie at the core of many smart tourism solutions to enable the creation of enriched experiences. Indeed, personal data allows to tailor tourism services to personal preferences (e.g. suggesting meal options in accordance

[111] There are few tourism-focused initiatives at international level, including the UNWTO Tourism Data Dashboard and the OECD Tourism Statistics Database. At EU level, in addition to the cross-sectoral portal for European data developed by the European Union, it is worth to mention the EU (Council/Commission) initiative for the development of the EU Tourism Dashboard developed by the JRC under the policy ownership of DG GROW. At Member States level, the Spanish Dataestur and the French DATAtourisme initiatives - which are analysed in greater detail among the good practices in the following Section 3 of this study - are the only examples. On the other hand, there is a wide availability of national, regional and local data platforms providing access to and reuse of public sector information, including about tourism.
[112] Gretzel, U., Reino, S., Kopera, S., & Koo, C. (2015). Smart tourism challenges. Journal of Tourism, 16(1), 41-47.
[113] Neuhofer, B., Buhalis, D., & Ladkin, A. (2015). Smart technologies for personalized experiences: a case study in the hospitality domain. Electronic Markets, 25(3), 243–254.
[114] Kontogianni, A., & Alepis, E. (2020). Op. cit.
[115] MacCannell, D. (2013). The tourist: A new theory of the leisure class. University of California Press, as cited in Tribe, J., & Mkono, M. (2017). Not such smart tourism? The concept of e-lienation. Annals of Tourism Research, 66, 105-115.
[116] Gretzel, U., Reino, S., Kopera, S., & Koo, C. (2015). Op. cit.
[117] Tribe, J., & Mkono, M. (2017). Not such smart tourism? The concept of e-lienation. Annals of Tourism Research, 66, 105-115.

with dietary requirements), location (e.g. alerting of important landmarks in the vicinity), and time (e.g. suggesting alternative routes based on real-time weather conditions). While caution regarding privacy is certainly on the rise among European citizens, especially after the entry into force of the General Data Protection Regulation (GDPR)[118], tourists tend to be more easily persuaded to share their personal data when compared to people in their usual context of life. For instance, a tourist may yield up her/his data to an application if that comes as a necessary condition to have access to the internet, or a tourist may suspend her/his privacy concerns when using an app that offers an entertaining and interactive experience.[119] The extensive collection and processing of personal data in tourism – combined with the fact that data subjects are frequently unaware of the value of their personal data and are therefore unable to negotiate their exchange – generates significant privacy concerns, especially in connection with the issues of electronic surveillance and profiling for micro-targeting.[120]

Key Challenge 6 – Human and artificial intelligence

Tourism workers are, on average, less qualified than the overall EU working population, with up to 25% possessing low-level qualifications.[121] The sector is also affected by structural innovation deficiencies,[122] despite the fact that ICT is ubiquitous in tourism and that tourism experiences are more and more mediated by smart gadgetry.[123] Due to the COVID-19 pandemic, the skills gap was further worsened, as a large number of employees that could not be hired in 2020 and 2021 moved to other sectors and new workers from other sectors were often not equally qualified. Moreover, the pandemic generated new competencies needs – such as the need to use digital tools for sanitary reasons.[124]

In addition to the average low qualification level of the tourism worker, specialised human intelligence is also needed to reap the benefits of technology and data in order to improve tourism experiences, especially in the form of skilled data experts. The need to attract knowledgeable workers becomes clearer when considering that the technological advances, such as artificial intelligence, are going to unlock an even greater potential from the exploitation of data.[125] Indeed, artificial intelligence is expected to be a particularly disruptive and challenging technology, as it will require significant technological investments, change management actions to address possible adverse attitudes towards AI by tourists and tourism workers, and the already-mentioned need to secure the necessary skilled workforce.[126]

[118] Beinat, E. (2001). Privacy and location-based services: Stating the policies clearly. Geoinformatics, 4, 14–17 and Narayanan, A., & Shmatikov, V. (2009). De-anonymizing social networks. In Proceedings of the 30th IEEE Symposium on Security and Privacy (pp. 173–187). Berkeley, CA: IEEE.
[119] Masseno, M. D., & Santos, C. T. (2018). Assuring Privacy and Data Protection within the Framework of Smart Tourism Destinations. MediaLaws-Rivista di Diritto dei Media, (2), 251-266.
[120] Masseno, M. D. (2016). Personal data circulation from the EU to USA and now what for the American Tourism Industry with business in Europe. In 23rd International Tourism Safety Conference, Las Vegas.
[121] European Commission (2021). The EU Pact for Skills – Skills Partnership for the Tourism Ecosystem.
[122] Hjalager, A. M. (2002). Repairing innovation defectiveness in tourism. Tourism Management, 23(5), 465–474.
[123] Janet E. Dickinson, Karen Ghali, Thomas Cherrett, Chris Speed, Nigel Davies & Sarah Norgate (2014). Tourism and the smartphone app: capabilities, emerging practice and scope in the travel domain, Current Issues in Tourism, 17:1, 84-101.
[124] European Commission (2021). Op. cit.
[125] Gretzel, U., Sigala, M., Xiang, Z., & Koo, C. (2015). Smart tourism: foundations and developments. Electronic markets, 25(3), 179-188.
[126] Geisler R. (2018). Artificial Intelligence in the Travel & Tourism industry Adoption and impact. NOVA – School of Business and Economics.

3. Good practices

3.1. Selection of good practices

Out of the 200 cases of data use analysed in the previous section, 30 good practices have then been selected and assessed in greater detail. The selection was based on a set of 8 evaluation criteria, as illustrated in the following table. Each of the 200 cases of data use was evaluated against each criterion, on a low-medium-high scale.[127] A low score corresponded to one point, a medium score to 2 points, and a high score to 3 points. By summing up all the scores, a ranking highlighted the top scoring 30 good practices.

Table 1 – Overview of evaluation criteria

	Evaluation scale		
Evaluation criteria	**Low (1 point)**	**Medium (2 points)**	**High (3 points)**
Sustainability	The project does not aim at improving the sustainability of the destination	The project does not focus on sustainability, but it has positive effects on it nonetheless	The improvement of the sustainability of the destination is one of the key aims of the project
Accessibility and inclusivity	The project does not aim at improving the accessibility and inclusivity of the destination	The project does not focus on accessibility and inclusivity, but it has positive effects on it nonetheless	The improvement of the accessibility and inclusivity of the destination is one of the key aims of the project
Cultural heritage	The project does not aim at enhancing the cultural heritage of the destination	The project does not focus on cultural heritage, but it has positive effects on it nonetheless	The enhancement of the cultural heritage of the destination is one of the key aims of the project
Data usage	Data is used by one actor only	Some sort of data exchange between different actors takes place	Data-driven insights and results are openly available to any interested actors
Innovativeness of the solution	The technological solution is already widely available on the market	The technological solution has already been piloted, but it is not yet widely available on the market	The technological solution is completely experimental requires research and development activities
Relevance of technology	The technological solution is not essential for the implementation of the project	The technological solution adopted contributed to the effectiveness and efficiency of the project	The project would not exist without the technological solution adopted
Tourists-residents relationship	The project does not aim at improving the relationship between tourists and residents	The project does not focus on the relationship between tourists and residents, but it has a positive impact on it nonetheless	The improvement of the relationship between tourists and residents is one of the key aims of the project
Stakeholder involvement	The project does not involve any stakeholders beyond the implementing organisation	The project is characterised by the involvement of 2-3 stakeholders	The project is characterised by the involvement of more than 3 stakeholders

Source: Author's elaboration

In addition to the 8 evaluation criteria, the selection of the 30 good practices was refined by taking into consideration 3 secondary criteria:

Secondary criteria	
Location	The selection of good practices paid attention to geographical balance, ensuring to cover many different countries, and also to select a few good practices from outside the EU

[127] For a detailed account of the methodology for the selection of the good practices, please refer to the methodological appendix.

Size	The size of the destinations where the cases of data use took place was factored in the selection, with the aim of including destinations of many sizes (metropolitan areas, regions, big cities, small municipalities, etc.)
Duplication	Attention was finally paid to select good practices not previously included in other collections and compendia of good practices

Source: Author's elaboration

The following table presents the evaluations of the 30 good practices selected.

Table 2 – Good practices evaluation grid

Rank	Case of data use	Points per evaluation criterion (1=low, 2=medium, 3=high)								Total Score
		Sustainability	Accessibility and inclusivity	Cultural heritage	Data usage	Innovativeness of the solution	Relevance of technology	Tourists-residents relationship	Stakeholder involvement	
1	**Italy**, Venice - Smart Monitoring System	2	3	3	3	2	3	3	2	21
2	**Spain -** DATAESTUR	2	3	3	3	2	3	2	2	20
3	**Finland**, Helsinki - MyHelsinki Open API	1	2	3	3	3	3	3	2	20
4	**The Netherlands**, Amsterdam - iBeaconMile	2	2	1	2	3	3	3	3	19
5	**Sweden**, Gothenburg - Event Impact Calculator	3	3	2	2	1	3	3	2	19
6	**Norway**, Stavanger - KvikktestNordic Innovation	2	2	1	3	3	3	1	3	18
7	**Italy**, Florence - Silfi Smart City Control Room	2	2	2	2	3	2	3	2	18
8	**Ireland**, Dublin - Smart Dublin Programme	2	2	3	3	2	2	2	2	18
9	**Portugal**, Lisbon - Shops with History	1	3	2	2	2	2	3	3	18
10	**France**, Grand Chambéry - Open data for eco-tourism	2	3	2	2	2	2	2	3	18
11	**The Netherlands**, Aruba – Biometric authentication	1	2	1	2	3	3	3	3	18
12	**UK**, London - Digital LITH	2	3	2	3	2	2	2	2	18
13	**Japan**, Kyoto Sightseeing Comfort Map	2	2	1	3	3	3	1	2	17
14	**France** – DATAtourisme	2	2	2	2	2	2	2	3	17
15	**Spain,** Valencia – Intelligent Tourism Destinations	3	2	2	2	2	2	2	2	17
16	**Belgium**, Brussels - Neighborhood walks	2	3	3	2	1	1	3	2	17
17	**Argentina**, Buenos Aires - City Smartvel's technology	2	2	2	1	1	3	3	3	17
18	**International** – Tur4All	1	2	1	2	2	2	3	3	16
19	**Vietnam,** Ho Chi Minh City – Go!Bus application	2	3	2	2	1	1	3	2	16
20	**Spain,** Seville – City Past View	1	1	3	2	2	3	3	1	16
21	**Sweden,** Gothenburg - The Knowledge Hub	2	3	2	2	1	2	2	2	16
22	**Finland**, Helsinki – Real Time Crowding heatmap	1	2	1	3	3	3	2	1	16

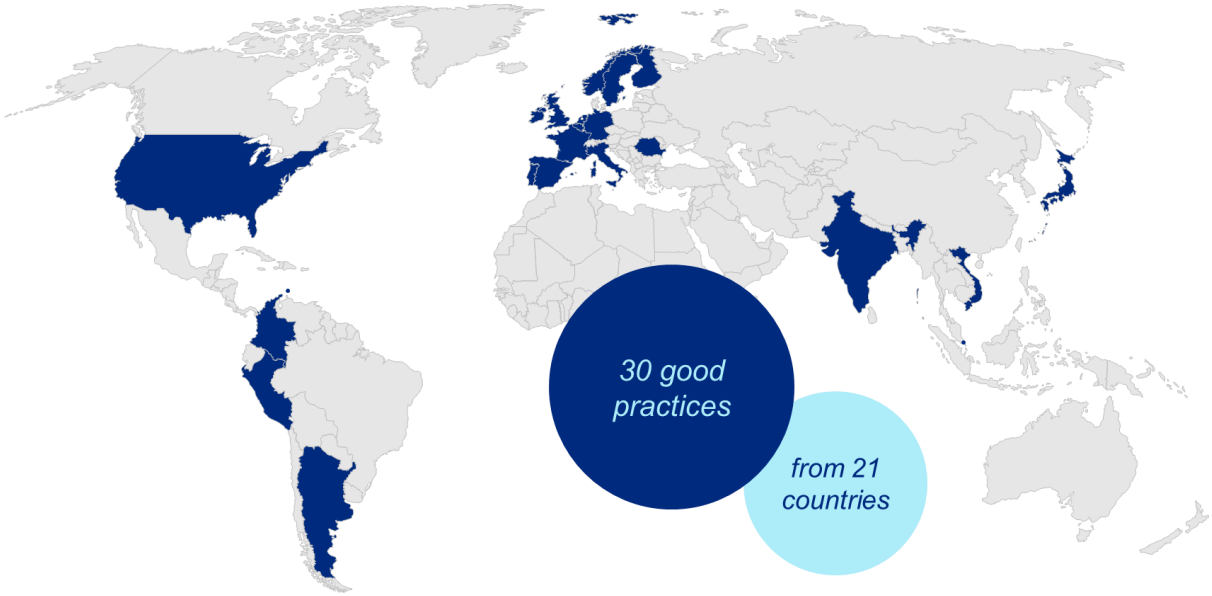
Rank	Case of data use	Points per evaluation criterion (1=low, 2=medium, 3=high)								Total Score
		Sustainability	Accessibility and inclusivity	Cultural heritage	Data usage	Innovativeness of the solution	Relevance of technology	Tourists-residents relationship	Stakeholder involvement	
23	**Italy,** Lombardy Region – Digital Tourism Ecosystem	1	2	2	3	1	2	2	3	16
24	**Germany,** Berlin - Virtual Experiences	1	1	3	2	1	3	3	2	16
25	**Romania,** Brasov - Augmented Reality Application	1	2	3	2	1	3	3	1	16
26	**Singapore**, Singapore - Virtual City Platform	2	2	2	2	2	2	2	2	16
27	**The Netherlands**, Nijmegen - Smart Tourism Management	2	2	2	2	1	2	2	3	16
28	**Belgium,** Antwerp **-** Crowd Monitoring	2	2	1	2	2	2	2	3	16
29	**Spain,** Gipuzkoa Region – Big Data Solution	2	2	2	2	2	2	2	2	16
30	**United States of America,** New York City - Link NYC	2	3	1	2	2	2	2	2	16

Source: Author's elaboration

3.2. Overview of the 30 good practices

As illustrated in the following figure, the 30 good practices selected have been identified across 21 countries: 11 EU Member States (Belgium, Finland, France, Germany, Ireland, Italy, Netherlands, Romania, Portugal, Spain, Sweden) and 10 non-EU countries (Argentina, Colombia, India, Japan, Norway, Peru, Singapore, Vietnam, UK, USA).[128]

Figure 5 – Overview of the countries of the 30 good practice

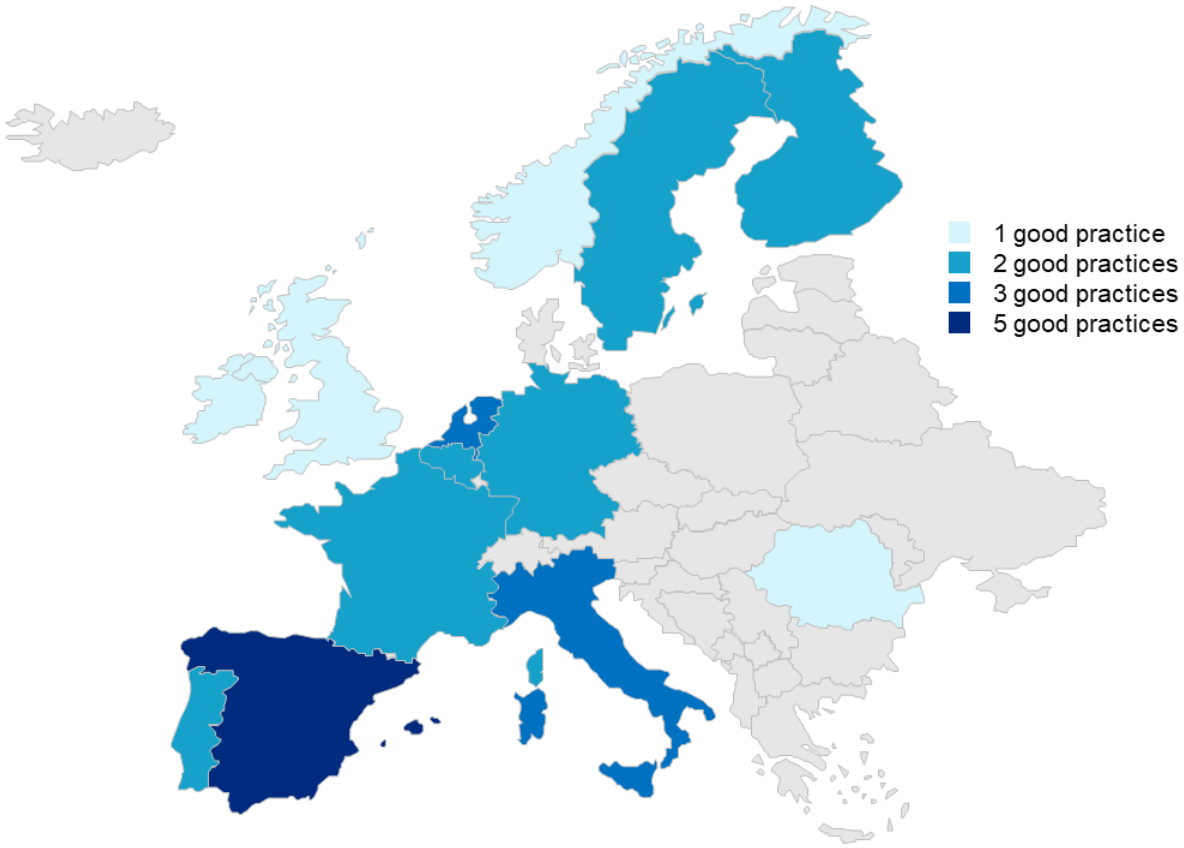


Source: Author's elaboration

24 good practices have been identified in Europe, including 22 from EU Member States, 2 from non-EU countries (1 in Norway and 1 in the UK), and 1 from Aruba. The following figure presents the distribution of good practices across the different countries: 5 in Spain, 3 in Italy and the Netherlands (including the previously mentioned Aruba good practice), 2 in Belgium, France, Finland, Germany, Portugal, Sweden, and 1 in Ireland, Norway, Romania and the UK respectively.

[128] One of the good practices was implemented across multiple countries including mainly Spain and Portugal but also Germany, Colombia, India and Peru.

Figure 6 – Number of good practices per European country

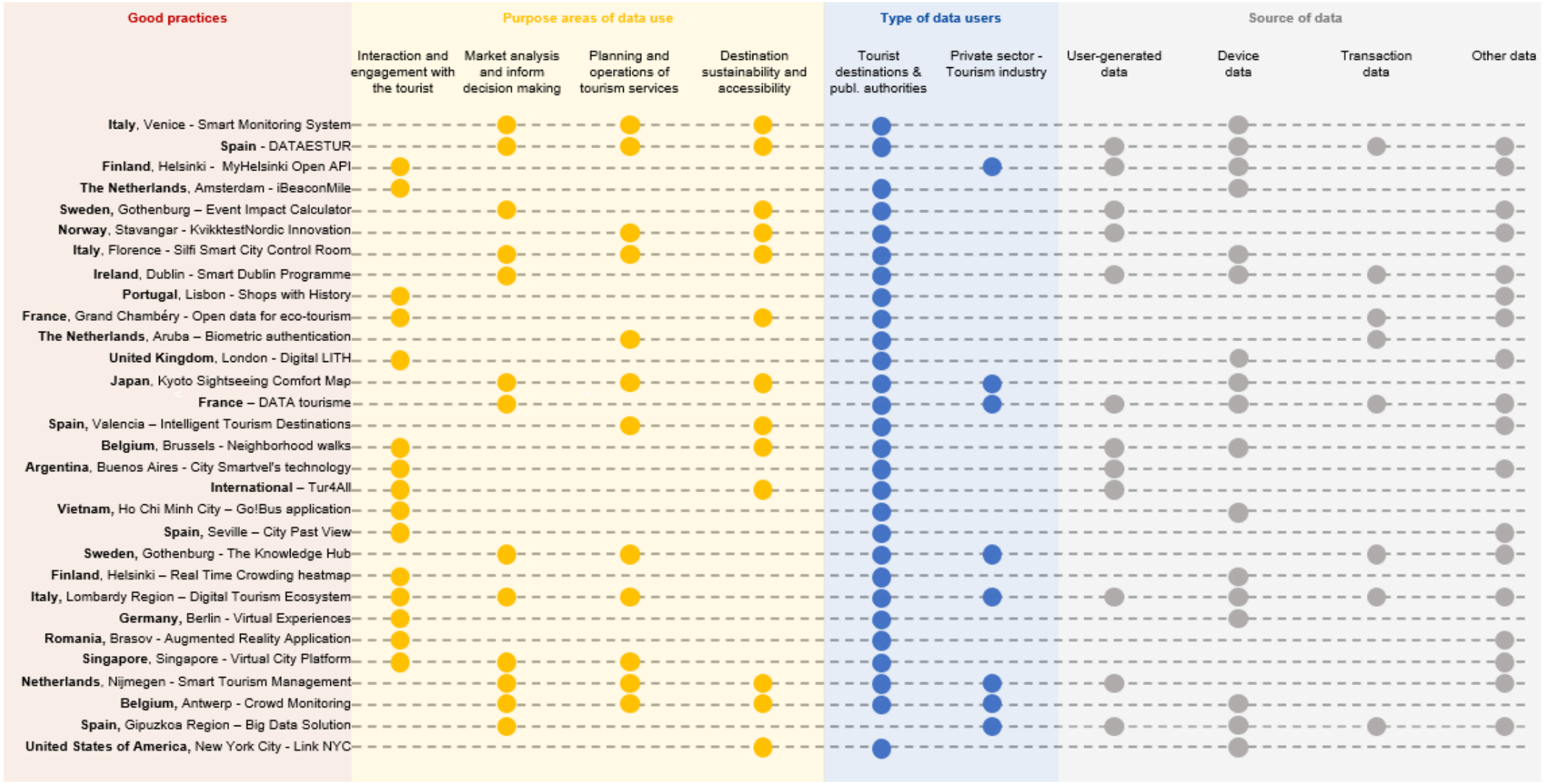


Source: Author's elaboration

Such a comprehensive selection from different regions ensured an equally broad coverage of the dimensions of analysis of the study, as illustrated in the following figure. The 30 good practices are characterised by:

- **Purpose of data use**. The 30 good practices display a wide variety of cases of data use for different purposes, such as: to improve the interaction and engagement of the tourist (see e.g. good practice #3 about Helsinki's app for Chinese tourists), to conduct market analyses and inform decision-making (see e.g. good practice #1 about Venice's system for the monitoring of tourist flows), to improve the planning and operations of tourism services (see e.g. good practice #11 on Aruba's automated passport checks at the airport), and to increase sustainability and accessibility (see e.g. good practice #5 on Gothenburg's forecasting tool to estimate the socio-economic and environmental impact of events).
- **Type of data user**. In the majority of cases, data users are destinations and public authorities. At the same time, various good practices also include private companies from the tourism sector making use of the data, e.g. good practice #6 on Stavanger's pilot projects with 5 private companies.
- **Source of data**. The 30 good practices cover all the 4 main types (User-generated data, Device data, Transaction data, Other data) and their 10 sub-types of data sources. For instance, good practice #4 focuses on Amsterdam's iBeaconMile, built on the capability of understanding tourists' location via Bluetooth technology. It is noted that 5 good practices consist of wide-ranging initiatives that comprise many of the data sources under analysis, such as for instance good practice #8 on Dublin's smart tourism database, which collates information from all the 10 sub-types of data sources.

Figure 7 – Overview of good practices



Source: Author's elaboration

3.3. Good practices

This section presents the first 5 good practices selected. The other 25 are available as part of Annex A.

Good practice 1:

Venice – Smart monitoring system

Geographical area	*Venice (Italy)*
Purpose areas of data use	*Conduct market analyses and inform decision-making* *Improve planning and operations of tourism services* *Increase destination sustainability and accessibility*
Type of data users	*Tourist destinations and public authorities*
Source of data	*Device data – GPS, mobile roaming, RFID, Bluetooth, meteorological, Wi-Fi; Smart city*
Implementation period	*2017 - 2020*
Actors involved	***Venis SpA**, the in-house information systems and telecommunications network provider of the Municipality of Venice* ***Insula SpA**, another in-house company of the Municipality of Venice, responsible for building maintenance works* ***TIM**, the largest Italian telecommunications services provider and former state monopoly telephone operator*

Context and background

Venice is one of the most fascinating and peculiar destinations in the world. Its historical palaces sitting on a lagoon, its traditional gondolas slowly navigating through canals and its warren of narrow alleys are renowned landmarks in every tourist's imagination. Prior to Covid-19, the city would attract over 30,000 tourists per day, despite a population within the historical city centre of just above 50,000.[129] Such a significant influx of tourists – while certainly representing the main income source for the city – poses at the same time the typical challenges associated with touristification and gentrification processes.[130] Indeed, in the literature Venice is frequently considered as the "overwhelmed city",[131] and the population of the historical city centre has been constantly falling (-70% from its peak in the 1950s), as residents move to the mainland to escape the nuisances of tourists and to conveniently make their homes available to online vacation rentals operators, such as most notably Airbnb. Moreover, overtourism also generates a set of other challenges, including of the effectiveness of public services, conservation of the cultural heritage (tangible and intangible), and management of security risks. For these reasons, the city needed a solution to better manage the flows of tourists.

[129] This peculiarity motivates the extensive literature focused on the Venice's social and physical tourism carrying capacity. See e.g. Bertocchi D., Camatti N., Giove S., Van der Borg J., (2020). Venice and Overtourism: Simulating Sustainable Development Scenarios through a Tourism Carrying Capacity Model, Sustainability 2020, 12, 512.

[130] Such touristification and gentrification processes appear to have taken place not only in Venice but also in surrounding areas. Bertocchi D., Ferri C., (2021). Far from gentrification and touristification? Residents' perceptions of displacement on Murano Island.

[131] Bertocchi D., Visentin F., (2019). "The Overwhelmed City": Physical and Social Over-Capacities of Global Tourism in Venice, Sustainability 2019, 11, 6937.

Solutions adopted

Venice developed a smart system to monitor the influx of individuals based on sensors, cameras and mobile phone data. Sensors – strategically placed at the key intersections and squares – allow to detect the transit of pedestrians. Similarly, cameras provide real-time images of crowds and flows. Finally, mobile phone data allows to track the movements – and other pieces of information such as the region of origin – of individuals. Such a comprehensive monitoring system allows the city to assess both historical and real-time flows, and also enables the modelling of physical phenomena such as crowds in specific areas at specific times. All the data are visualised in a dedicated smart control room, together with the data from other monitoring systems, such as the sensors checking water levels to anticipate the so-called "acqua alta" – namely "high-water" – phenomenon, or the cameras that detect and fine speeding vessels. The smart control room project was launched in 2018 thanks to a public-private partnership for innovation, funded partly by the EU and partly by the Municipality itself.

Figure 8 – The predictive modelling to anticipate flows and crowds

Key challenges

Such a comprehensive monitoring system – including in particular the use of mobile phone data – raised significant privacy concerns. Despite the anonymisation of all data collected, the issue remains contentious, especially after the entry into force of the General Data Protection Regulation and the growing awareness among EU citizens on the use of their personal data. Another key challenge encountered, especially during the implementation phase of the various technical solutions, consisted of the governance of the different actors involved in the public-private partnership.

Impacts

The smart monitoring system aims at addressing the overtourism issue by increasing the knowledge on the flows of tourists across the city and informing real-time decision-making, such as for instance the re-routing of flows to less-crowded areas. Moreover, the system also enables short-term predictive modelling, in a view not only to address security issues – such as an overcrowded square – but to anticipate them. In addition to the smart monitoring system, the city administration has also been planning for some time the introduction of city gates, in a view to limit the influx – possibly through the payment of a ticket – when needed.

Replicability potential[132]

The replicability potential is high. The smart monitoring system employs technological solutions that are readily available on the market and similarly utilised in other cities, such as Florence. In addition to this, the number of stakeholders involved for the implementation of the smart monitoring system is limited. At the same time, however, it is to be noted that Venice presents extremely peculiar physical characteristics that can hardly be found elsewhere. Consisting of a group of islands, Venice has a limited number of access points that can be monitored with relative ease in comparison to mainland cities, and the many bridges above the canals offer strategic monitoring spots. Therefore, a similar solution appears to be more easily replicable in delimited areas – such as for instance city centres – that have a relatively low number of access routes and that are for this reason more easily monitorable.

[132] For a detailed account of how the replicability potential is assessed, please refer to the methodological appendix.

Good practice 2:

Spain – DATAESTUR

Geographical area	*Spain*
Purpose areas of data use	*Conduct market analyses and inform decision-making* *Improve planning and operations of tourism services* *Increase destination sustainability and accessibility*
Type of data users	*Tourist destinations and public authorities*
Source of data	*User-generated data – Textual; Photo* *Transaction data – Web search and webpage visiting; Online booking and purchasing; Consumer card transactions* *Device data – GPS, mobile roaming, RFID, Bluetooth, meteorological, Wi-Fi; Smart city* *Other data – Business information; Statistics; Context-specific information*
Implementation period	*Launched in 2020*
Actors involved	***SEGITTUR** (Sociedad Mercantil Estatal para la Gestión de la Innovación y las Tecnologías Turísticas, namely State Company for the Management of Tourism Innovation and Technologies), the governmental Agency responsible for the promotion of innovation in the public and private Spanish tourism sector*

Context and background

In 2019, Spain was the second world's most popular global tourism destination, registering 83 million international tourist arrivals.[133] In the same year, the country registered the EU highest number of nights spent in tourist accommodation establishments by international tourists (almost 300 million, which represents the 22% of the EU total), which were heavily concentrated in three regions: Canary Islands, Balearic Islands, and Catalonia.[134] Tourism contributes substantially to the national economy. In 2019, it accounted for 12.4% of GDP, and generated the 12.7% of total national employment, which correspond to almost 2.7 million jobs.[135] COVID-19 heavily impacted the Spanish tourism sector. In 2020, the country registered almost 19 million international tourist arrivals, which increased to 31 million arrivals in 2021.[136] In order to address the reactivation of the industry and to support its development in the long term, Spain has recently launched an ambitious digital transformation process of the tourism sector to maintain its competitiveness in the global market. The main objective has been the redesign of the tourism knowledge and intelligence system to strengthen the model of production and collection of statistical information, ensuring the availability of a common digital platform at national level for the dissemination of data and analyses. In particular, the strategy Digital Spain 2025 promoted a focus on smart tourism to accelerate the digitalization of tourist destinations and companies, which included actions linked to the development of digital platforms and the increase of digital skills. The development of a tourism intelligence model based on data was also identified in the "General guidelines of the Sustainable Tourism Strategy of Spain 2030", which highlighted the need to provide tourism market intelligence services to support public and private decision-making processes[137]. Innovation and technology to support sustainable

[133] World Tourism Organization (2021). International Tourism Highlights, 2020 Edition, UNWTO, Madrid. Data are provisional.
[134] Eurostat tourism statistics, available at https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Tourism_statistics&oldid=553979
[135] OECD (2020), OECD Tourism Trends and Policies 2020, OECD Publishing, Paris, https://doi.org/10.1787/6b47b985-en
[136] Authors' own elaboration based on data from the Italian National Institute of Statistics, available at: https://www.ine.es/dyngs/INEbase/en/operacion.htm?c=Estadistica_C&cid=1254736176996&menu=ultiDatos&idp=1254735576863#:~:text=Spain%20received%202.9%20million%20international,the%20same%20month%20of%202020. Data for 2021 are provisional.
[137] For more information about the "Sustainable tourism strategy of Spain 2030", visit https://turismo.gob.es/en-us/estrategia-turismo-sostenible/Paginas/Index.aspx

tourism development are also at the core of the model "Destino Turístico Inteligente", which is supporting the transition of Spanish destinations into smart tourism destination.[138]

Solutions adopted

SEGITTUR, a Spanish Agency under the Ministry of Industry, Trade and Tourism, has released in 2020 the DATAESTUR website. The initiative is part of the actions to create a new national observatory of tourism intelligence envisaged in the "Promotion plan of the tourism sector", which was released in June 2020 to provide an immediate response to the impact of COVID-19.[139] DATAESTUR collects the most significant Spanish national tourism data from different public and private sources, including the National Statistics Institute, the Bank of Spain, Turespaña, UNWTO, Telefónica and Mabrian Technologies SL. Data is freely available for consultation and structured into five categories: general data (e.g. international tourist arrivals and visits to museums), economic data (tourism expenditure, contribution to GDP, and employment), transport statistics, accommodation occupancy and prices, and tourism research reports and analyses. The understanding of the behaviour of the tourist is also addressed by the dissemination of active listening reports based on information collected through social media and online media. DATAESTUR includes several Application Programming Interface (API) to foster data dissemination and reuse.

Key challenges

DATAESTUR is an aggregator of existing datasets, therefore it isn't affected by the typical challenges linked to the development of data sharing platforms (e.g. adoption of common standards and interoperability protocols). On the other hand, it addresses the fragmentation of public and private data and associated sources, providing a one-stop shop to support the comprehension of market phenomenon. This fits into the national strategic challenge linked to the digitalisation of the sector and the redesign of the national tourist intelligence system, which seeks to promote the adoption of data-driven decision-making mechanisms by destinations and companies, especially SMEs.

Impacts

Data availability is a key tool to address the sustainability, competitiveness and commercialisation of the tourism offer. It also increases the ability to manage key issues such as seasonality and tourist flows, while providing insights to develop new tourism products and services that meets consumers' needs. Moreover, it is expected that the initiative can encourage the use of data and the development of skills of public and private stakeholders, also laying the foundation for the adoption of tourism-related emerging technologies.

Replicability potential

The replicability potential is medium. One the one hand, the solution is significantly innovative, as Spain appears to be one of the very few countries having implemented a national portal with such a diverse wealth of tourism data. Other similar initiatives – such as most notably the European Commission's tourism data space – are still in their infancy.[140] On the other hand, the launch of such a platform – at least in the early stages when only a limited set of data is published – is envisaged to require the involvement of a limited number of stakeholders (e.g. the ministry of tourism and the national institute of statistics).

[138] For more information about the model, visit: https://www.destinosinteligentes.es/

[139] Gobierno de España (2020), Plan de impulso para el sector turístico: hacia un turismo seguto y sostenible, available at: https://www.lamoncloa.gob.es/serviciosdeprensa/notasprensa/industria/Documents/2020/20062020_PlanTurismo.pdf

[140] The European Commission has launched a call for proposals running from November 17, 2021, to February 22, 2022 for a coordination and support action aimed at exploring the governance of a future data space for tourism. More information available at: https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/topic-details/digital-2021-prepacts-ds-01-tourism;callCode=DIGITAL-2021-PREPACTS-DS-01;freeTextSearchKeyword=;matchWholeText=true;typeCodes=1;statusCodes=31094501,31094502,31094503;programmePeriod=null;programCcm2Id=null;programDivisionCode=null;focusAreaCode=null;destination=null;mission=null;geographicalZonesCode=null;programmeDivisionProspect=null;startDateLte=null;startDateGte=null;crossCuttingPriorityCode=null;cpvCode=null;performanceOfDelivery=null;sortQuery=sortStatus;orderBy=asc;onlyTenders=false;topicListKey=callTopicSearchTableState

Good practice 3:

Helsinki – MyHelsinki Open API

Geographical area	*Helsinki (Finland)*
Purpose areas of data use	*Improve interaction and engagement with the tourist*
Type of data users	*Private sector - Tourism industry*
Source of data	*User-generated data – Textual; Photo* *Device data – GPS, mobile roaming, RFID, Bluetooth, meteorological, Wi-Fi; Smart city* *Other data – Business information; Statistics; Context-specific information*
Implementation period	*2017 - ongoing*
Actors involved	***Helsinki Marketing**, marketing company owned by the City of Helsinki, responsible for marketing activities and business partnerships* ***City of Helsinki***

Context and background

Helsinki's fascinating location on the shore of the Gulf of Finland, its imponent Market Square (Kauppatori) and its characteristic Uspenki Cathedral along with its natural reserve make the city an ambitious touristic destination. In the past years, considerable investments have been made on smart city and smart mobility projects, boosting city public transports – especially the metro connections – and launching programmes to enhance urban sustainability such as research labs dedicated to developing new environmental solutions.[141] The economic and political commitment behind Helsinki's modernisation and the development of smart city projects has generated a positive impact on tourism, also confirmed by the award of the European Capital of Smart Tourism title in 2019. Despite its historic relevance, Helsinki's cultural patrimony has never been the primary driving motif that attracted tourists to the city. On the other hand, Helsinki was mostly seen as a landing point for visitors interested in nature and outdoor sport tourism activities, such as skiing, fishing, hiking or cycling. For this reason, the city administration was looking into developing digital solutions to promote the city's cultural heritage.

Solutions adopted

The MyHelsinki Open API is an application programming interface for accessing three databases (one about places, one regarding events and one about activities)[142] maintained by Helsinki Marketing. Based on a series of queries and filters selected by the user, the interface offers location, event and activity information related to Helsinki and the surrounding region as open data.[143] In order to be published, contents need to meet a series of standards and quality criteria. The interface is constantly updated and edited by the content experts of Helsinki Marketing. Moreover, data is made available in four different languages (Finnish, Swedish, English and Chinese) in order to facilitate and encourage its reuse by national and foreign users.

For example, in 2017 Helsinki Marketing, Tencent, Idean, MaaS Global, Finnair and Avaintec jointly developed the We-Chat-MyHelsinki app,[144] which allows Chinese visitors to discover personalised experiences, events, restaurants based on suggestions from local residents. In addition, the app enables visitors to make electronic payments through We Chat Pay, a very user-friendly and popular payment method in China.

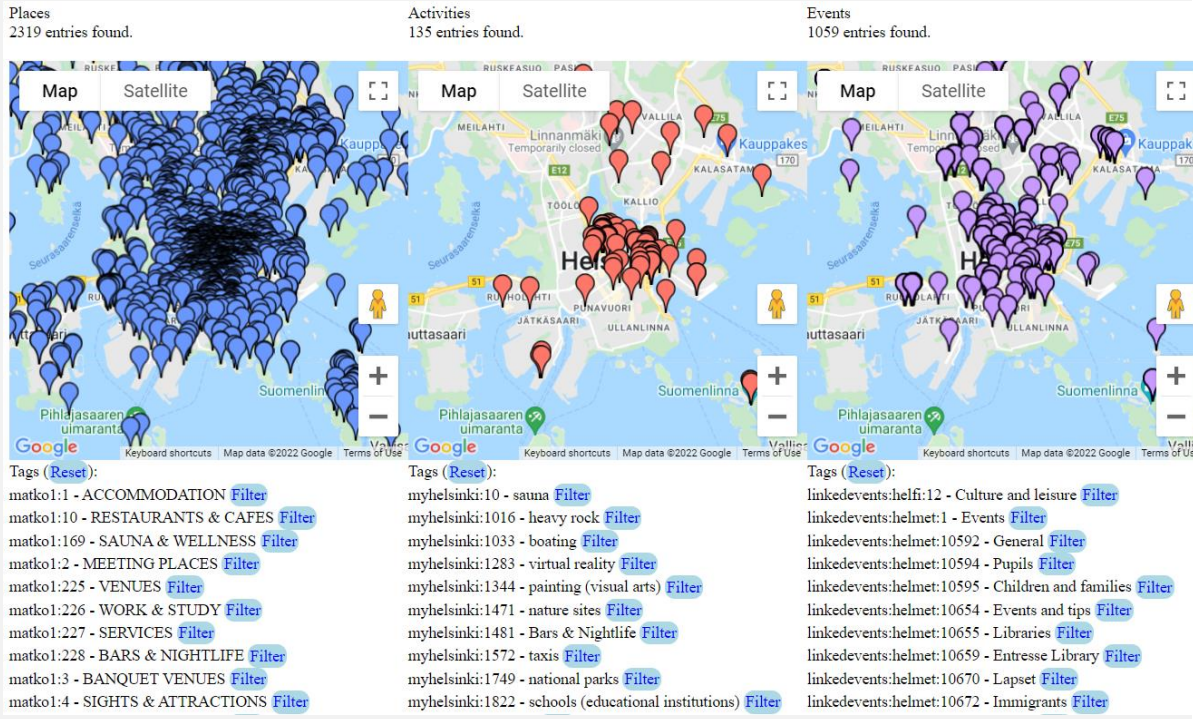
[141] Smart Cities Connect. (2021, May 6). Urban Tech Helsinki Incubator to bring New Business. Smart Cities Connect. Retrieved February 17, 2022, from https://smartcitiesconnect.org/urban-tech-helsinki-incubator-to-bring-new-business/

[142] The MyHelsinki Open API gathers information from three data sources: Kaupunkialusta database of places maintained by the City of Helsinki, the Linked Events database maintained by the City of Helsinki, and Travel Data Hub database maintained by Visit Finland.

[143] More information on the MyHelsinki Open API was released by the City of Helsinki and is available at: https://open-api.myhelsinki.fi/

[144] More information on the WeChat MyHelsinki project is available at: https://www.idean.com/micro/myhelsinki-miniprogram

Figure 9 - A screenshot of the MyHelsinki Open API, showing 2.319 available places, 135 available activities and 1.059 available events



Key challenges

As the interface combines data from different sources, the main challenges concern the need to ensure data quality and standardisation. To guarantee continuous updates and checks of the contents, a significant human resources effort is required.

Impacts

MyHelsinki Open API increases the potential market of the city, while at the same time maintaining development costs low. Indeed, cities do not usually create web or mobile applications directly for sharing data-driven services with tourists, as it tends to be too costly. To the contrary, making data available to third parties appears to be more cost-effective, as the city provides access to data, and then developers and programmers bear the costs and risk by integrating data and creating new applications, with the prospect of creating applications that tourists are going to use and consequently make profit out of it.[145]

By publishing data openly, Helsinki therefore contributed to local economic growth by aiding in the creation of businesses activities exploiting this data, and ultimately benefitting tourists by offering better and cheaper applications.[146]

Replicability potential

The replicability potential is medium. On the one hand, the origins of the open data movement can be traced back to the 1990s and the technological solutions behind it have been tried and tested, and are widely available.[147] On the other hand, the development of the interface – and of applications based on the open data – requires the involvement of many different actors, which make it less easily replicable.

[145] Pereira, R. L., Sousa, P. C., Barata, R., Oliveira, A., & Monsieur, G. (2015). CitySDK Tourism API - building value around open data. Journal of Internet Services and Applications, 6(1).
[146] Vilajosana I., Llosa J., Martinez B., Domingo-Prieto M., Angles A., Vilajosana X. (2013). Bootstrapping smart cities through a self-sustainable model based on big data flows. Commun Mag IEEE 51(6):128–134.
[147] Zuiderwijk, A.; Helbig, N.; Gil-García, J.R.; Janssen, M. (2014). Special Issue on Innovation through Open Data - A Review of the State-of-the-Art and an Emerging Research Agenda: Guest Editors' Introduction. J. Theor. Appl. Electron. Commer. Res., 9, I-XIII.

Good practice 4:

Amsterdam – iBeaconMile

Geographical area	*Amsterdam (Netherlands)*
Purpose areas of data use	*Improve interaction and engagement with the tourist*
Type of data users	*Tourist destinations and public authorities*
Source of data	*Device data – GPS, mobile roaming, RFID, Bluetooth, meteorological, Wi-Fi; Smart city*
Implementation period	*Completed in 2015*
Actors involved	***City of Amsterdam*** ***KPN**, Landline and telecommunications company (former government run telephone service)* ***Glimworm and Yenlo**, two ICT firms*

Context and background

Amsterdam's fascinating canals, its characteristic alleys, and its rich cultural heritage make the Dutch capital a world-level destination, especially for the younger generations, attracted by the city's beauty but also by its thriving nightlife, including countless bars, coffee shops and the notorious red-light district. The city recorded more than 22 million tourists in 2019, highlighting the importance of tourism for the local economy.[148]

Amsterdam has been steadily working towards becoming a European digital and innovation centre. The City Council has been investing on digital hubs and innovation labs, aiming to consolidate its position as a smart city and smart destination. In particular, the City Council was especially looking at promoting digital solutions and innovative ideas directly targeted at the tourism ecosystem such as: monitoring crowds, promote the city's cultural heritage, promote local businesses, etc[149].

[148] Boztas, S. (2021, April 23). Best case scenario: Tourists to Amsterdam around half of 2019 peak this year. DutchNews.nl. Retrieved February 17, 2022, from https://www.dutchnews.nl/news/2021/04/best-case-scenario-tourists-to-amsterdam-around-half-of-2019-peak-this-year/#:~:text=In%202019%2C%20the%20peak%20of,overnight%20visitors%20came%20to%20Amsterdam.&text=But%20after%20the%20coronavirus%20pandemic,61%25%20on%20the%20year%20before.

[149] IBeacon testing ground uses First Lora Network in the world. Yenlo. (2021, December 14). Retrieved March 11, 2022, from https://www.yenlo.com/blogs/ibeacon-testing-ground-first-lora-network/

Solutions adopted

Amsterdam developed a smart system of beacons, namely devices that transmit a radio signal that can be picked up by smartphones through Bluetooth low energy (BLE) technology. The beacons are therefore able to detect the location of nearby smartphones. Location data is then made available through APIs to enable the development of location-enhanced applications and services.

Figure 10 - A map of the iBeaconMile route

Designed to serve as an open-test environment for the developers, the iBeaconMile is a route with nearly a hundred beacons overs approximately 3 kilometres stretching from Amsterdam Central Station to Marineterrein, a district east from the city centre. The transmitters are able to detect and connect to other devices – such as nearby iPhones – provided that they have enabled Bluetooth and installed the specific application for the service.[150] Movements of tourists and residents can therefore be therefore detected, thus allowing to measure and study the flows of individuals moving along the route. The beacons can also transmit messages to the users, who can receive information and live suggestions regarding discounts, activities, events, or new routes for visitors, directly on their smartphones.

Key challenges

The main challenge consists of the large network of sensors to be installed. Moreover, another challenge concerns the necessary prerequisite to have users open the app on their phones and enable Bluetooth for the transmitters to connect with their devices.

Impacts

The idea of the administration is to stimulate innovation throughout the city, providing the testing ground for new location-enhanced applications and services, also in the field of tourism. For instance, data on tourist flows can enable the development predictive models.

Replicability potential

The replicability potential is low, since the iBeaconMile is considered as the first open living lab in the entire world.[151] Moreover, its implementation required the participation of many different parties, including inter alia the City of Amsterdam, which directed the initiative, KPN, the telecommunications company that owns the infrastructure, Glimworm, the ICT firm that produced the beacons, and Yenlo, that ICT firm responsible for the development of the APIs.

[150] Gretzel, U. & Koo, C. (2021). Smart Tourism Cities: A Duality of Place Where Technology Supports the Convergence of Touristic and Residential Experiences. Asia Pacific Journal of Tourism Research, 26(4), 1-13.
[151] IBeacon testing ground uses First Lora Network in the world. Yenlo. (2021, December 14). Retrieved March 11, 2022, from https://www.yenlo.com/blogs/ibeacon-testing-ground-first-lora-network/

Good practice 5:

Gothenburg – Event Impact Calculator

Geographical area	*Gothenburg (Sweden)*
Purpose areas of data use	*Conduct market analyses and inform decision-making* *Increase destination sustainability and accessibility*
Type of data users	*Tourist destinations and public authorities*
Source of data	*User-generated data – Textual; Photo* *Other data – Business information; Statistics; Context-specific information*
Implementation period	*Completed in 2016*
Actors involved	***Riksidrottsförbundet**, the Swedish Sports Confederation, an umbrella organisation representing various sports national federations* ***Go:teborg&co**, a company controlled by the City of Gothenburg, responsible for marketing and tourism development activities*

Context and background

Gothenburg is one of the largest cities in Sweden and is establishing itself as a major tourist destination. The city is one of the main economic centres of the country and home to start-ups, innovation labs and a high-ranked university. In the last few years Gothenburg has invested in innovative solutions for traffic, transport, open data, as well as sustainability, leading to the overall award of the title of European Capital of Smart Tourism in 2020, and also of the special award for sustainability.[152] Indeed, the city has been promoting digital and green investments, tying the development of green policies with the development of the tourism sector, and increasing the social awareness towards environmentally friendly digital solutions.

Solutions adopted

Within this framework of increasing attractiveness of the city combined with growing attention towards sustainability, the Swedish Sports Confederation and Go:teborg&co – a marketing company controlled by the city – developed the Event Impact Calculator, a tool to estimate the socio-economic and environmental impact of an event. The tool is free to use for all relevant stakeholders, such as event organisers, regions, municipalities, destinations, property owners, tour operators, the hotel and restaurant industry, students, etc.

The tool is characterised by its user-friendliness, as users are simply required to input a series of figures, they have knowledge of, or can make educated guesses about. These include key figures about the magnitude of the event (such as on the expected number of participants or the expected number of foreign participants), information on participants' expected accommodation and means of transportation, costs of tickets, sponsorships, and even the residents' attitude towards the event.

After receiving the data, the tool compiles a report estimating economic, environmental and social impacts, to be potentially used by organisers to inform negotiations with destination managers, motivate grant applications, attract sponsors, or any other activity in connection with the event. Therefore, the tool allows tourism stakeholders to organise events with greater professionalism thanks to the possibility of informing discussions and decisions through data.[153]

[152] More information on Gothenburg's European Capital of Smart Tourism is available at: https://smart-tourism-capital.ec.europa.eu/cities/competition-winners-2020/gothenburg/gothenburg-2020-eutourismcapital_en

[153] More information available at the Event Impact Calculator website: https://www.eventimpactcalculator.com

Key challenges
The main challenge behind the Event Impact Calculator consists of the limited commensurability between the three types of impacts: economic, social and environmental.[154] For instance, what would be the right amount of profit to offset the inconveniences for residents during a festival? So-called Triple-Bottom-Line frameworks aim precisely at measuring and comparing non-monetary impacts,[155] but the issue of commensurability still requires particular attention, especially considering that – even if it were possible to monetise social and environmental impacts – not all would agree that negative social and environmental externalities can be offset by profits.[156] Despite this challenge, the Event Impact Calculator is considered a good practice as it is meant as a tool that provides data-driven estimates on expected impacts, which – albeit leaving considerable room for subjective interpretation – can be used by stakeholders to inform discussions and support decision-making.
Impacts
As previously mentioned, the Event Impact Calculator allows all the stakeholders gravitating around events – including in particular sport events – to build a data-driven basis for discussion and decision-making. Throughout the years, a number of trainings have been organised with the aim of providing users of the tool with a better understanding of its functioning and greater confidence in how to interpret its results. Anecdotally, it is reported that the U2 held concerts in Gothenburg, Stockholm and Copenhagen, and the one in Gothenburg turned out to be by far the most profitable.[157]
Replicability potential
The replicability potential is high: the technological solution is fairly available on the market, as similar tools for the calculation of events impacts appear to be quite common.[158] Moreover, the tool was developed through the collaboration of only two stakeholders – the Swedish Sports Confederation and Go:teborg&co – and for this reason appears to be rather easily replicable in other cities without the need to mobilise and involve many stakeholders.

[154] Brown, S., Getz, D., Pettersson, R., & Wallstam, M. (2015). Event evaluation: Definitions, concepts and a state-of-the-art review. International Journal of Event and Festival Management, 6(2), 135-157.
[155] Wallstam, M., & Kronenberg, K. (2021). The Role of Major Sports Events in Regional Communities: A Spatial Approach to the Analysis of Social Impacts. Event Management.
[156] Lohmann, L. (2009). Neoliberalism and the calculable world: The rise of carbon trading. In S. Böhm, & S. Dabhi (Eds.), Upsetting the offset: The political economy of carbon markets (pp. 25–40). Mayfly Books.
[157] Based on Josefine Aspenstrad's interview of Ossian Stiernstrand available at: https://www.eventimpactcalculator.com/bakgrund/
[158] See e.g. the tool eventIMPACTS created by UK's Department for Culture, Media and Sport, Discover Northern Ireland, EventScotland, London & Partners, UK Sport and Welsh Government, available at: https://www.eventimpacts.com/the-project

4. Future smart tourism trends

4.1. Predictions on the evolution of data use for tourism

Smart destinations are continuously evolving in their provision of services to tourists, following societal, cultural and technological trends that affect all areas of society. For example, Project 1 (Venice) provides evidence on how the increasing size of touristic flows since the early '60s have forced downtown inhabitants to move out, leaving the city center buildings empy.This has allowed to provide more quality space for tourists and, in recent years, to create revenue opportunities for house-owners by using Airbnb for renting their houses. In more recent years, the availability of low-cost and high-performance digital technologies have allowed to increase the touristic flow monitoring, providing a more effective management of their pathways, so to increase quality and sustainable services for tourists and residents.These trends can act both as drivers and/or obstacles to digital innovation (including both digital technologies and data), just as they can hinder or boost the digital transformation of the touristic services more specifically.

The following analysis tackles three overarching typologies of megatrends, which represent a specific set of drivers for social, demographic, environmental and technological change on a global scale, stemming from the combination of trends of a more contained scope. The megatrends have been identified and aggregated in three time windows according to the possibility of their occurrence: short-term (until 2024); mid-term (until 2030); long-term (2050). They are: (1) socio-demographic changes, (2) technological enhancements, and (3) sustainable development and environmental neutrality.

4.1.1. Megatrend 1 – Socio-demographic changes

Ageing populations and higher rates of digital literacy represent two defining demographic trends for the next 30 years. Regarding ageing populations, the share of older individuals in the total global population is expected to increase significantly in the coming decades. For example, the five primary generations alive today are the following: Baby Boomers, born in the period 1946-1964; Generation X, born in the period 1965-1980; Millennials, born in the period 1981-1996; and finally, Generation Z, which includes the individuals born in the period 1997-2012. The Baby Boomer generation will become the oldest target group in the coming decades, with the highest spending capability, but with lower digital skills than the other groups of interest. They will progressively require a set of personalised touristic services based on a combination of health and cultural tourism, in line with both their health needs and cultural habits. Generations Z and Y will become young adults before 2050, with lower spending capability than their parents. For what concerns digital literacy, however, individuals belonging to Generations Z and Y will be fully engaged with digital technologies throughout their lives. Millennials, who are collectively considered "digital natives", will become the main smart tourism consumers, but with greater need for low spending solutions. The purchasing process of touristic products and services is also changing, as more and more individuals are using online services rather than travel agencies.[159]

[159] See for instance Batista Sánchez, Ernesto. (2020). How Ageing Population will Affect Tourism? Challenges and Opportunities; Carlisle, S., Ivanov, S. and Dijkmans, C. (2021), "The digital skills divide: evidence from the European tourism industry", Journal of Tourism Futures; Dijkmans, C., Kerkhof, P. and Beukeboom, C. (2020), "Adapting to an emerging social media landscape: the rise of informalization of company communication in tourism", in Neidhardt, J. and Wörndl, W. (Eds), Information and Communication Technologies in Tourism 2020, Springer International Publishing, pp. 3-14; Buhalis, D. and Law, R. (2008), "Progress in information technology and tourism management: 20 years on and 10 years after the internet – the state of eTourism research", Tourism Management, Vol. 29 No. 4, pp. 609-623.

Table 3 – Socio-demographic megatrend across the period of analysis

Short-term (until 2024)	Medium-term (until 2030)	Long-term (2050)
• Propensity to remain connected • Lifelong learning for developing, maintaining and upgrading digital skills • Ageing population	• Changes in the purchasing process • Increased propensity for heath tourism • Digital natives start becoming smart tourists (behavioural shift with demands of more inclusive and interconnected virtual services)	• Digital natives (millennials and alpha generation) become the main smart tourism consumers • Generations Z and Y become young adults who are highly digitally skilled, but with lower spending capabilities than their parents • Baby boomers become older adults with accompanying requests of smart tourist services that combine healthy and cultural tourism

4.1.1.1. Increase in the propensity to remain online

In the short term (until 2024), one of the megatrends detected among tourists that already affects the current touristic services, and that will also impact the development of new ones, especially among the youngest (Generations Y and Z), is the propensity to remain online to gather information and inform their contacts about their touristic experience. These generations are tech-savvy, presenting specific needs for communication, consumption, and experiences. There is evidence that a growing number of tourists are prone to staying connected a high proportion of the time they travel. Hence, this behaviour has to be considered by Destination Management Organisations (DMOs) because this time spent connected may be approached as an opportunity to engage consumers of touristic offers. This engagement is normally achieved through activities recommended online or highlighting destination events that might interest the tourist. Moreover, this is also a chance for gathering new information and data if properly managed with apps, challenges, contests, or other gaming actions.

4.1.1.2. Boost in lifelong learning

DMOs organise their strategies to satisfy the future demand with new services that increasingly require digital technologies and data, as well as digital capabilities to develop and manage such technological offers. This is a great opportunity for employment and innovation in the tourist sector, but, as in all other industries, it requires new skills and a paradigm shift to a more digitally skilled labour force. Therefore, to remain competitive on the labour market, workers will need to develop digital capabilities and knowledge either to design innovative digital services or to manage them for the benefit of users. Under this perspective, lifelong learning capabilities for developing, maintaining, and upgrading digital skills will become a fundamental requirement both to increase the digital competences of workers in the tourism industry and to leverage digital entrepreneurship. The importance of integrating large sets of data, extracting valuable knowledge, and creating digital services leveraging such data to be made accessible through apps is evident in all industries, including that of cultural tourism, which can leverage on images of archaeological sites and digitalization of artworks. Training centres, schools for tourism services and other types of learning organisations should adapt their curricula to this end, just as policy makers should include these needs in their policy agenda. By doing so, regulations, technical tools, and new procedures will put forward the need for lifelong learning programmes, which will bridge the gap between the current outdated knowledge and the skills an employee needs to have at any time. This megatrend will continue in the mid-to-long-term perspective, evolving along with the market.

4.1.1.3. Ageing population

An ageing population is another key issue within the socio-demographic megatrend that will potentially impact the tourism sector. The average age of tourists is likely to increase (“silver

hair tourists"[160]), and therefore, it is arguable that future tourists will be more reluctant to travel to destinations that do not provide services for their age[161]. These expectations may involve specific desires and needs regarding customisation, security and service consumption. For this population (which, in the short term, is mainly composed by Baby Boomers and earlier generations), health and wellness services availability is an important choice factor for touristic destinations. Importantly, most tourists in this category have sufficient income to grant them access to such services. To address these needs, touristic destinations are progressively integrating such services into their tourism supply chain. However, future visitors are expected to be better informed and more digitally connected than today's elderly travellers, because they will have already experienced the digital transition[162]. Hence, competition among tourist destinations will take place on the basis of the knowledge about *what* these more connected, new elderly tourists need, *which* features of the destination are worth highlighting through communication, and *how* to effectively attach these tourists.

This will become more evident in the mid-term (until 2030) when digital natives will turn 30-40 years old, have increased their spending power, and therefore will be able to influence the touristic offer to a higher extent. These tourists will most likely ask for more inclusive and interconnected digital solutions. Such digitally focused touristic journey experiences would start from the planning stage, starting at the point of origin of the trip and continuing during all the various stages of the trip. This type of tourists is also expected to change the purchasing process of touristic services[163].

4.1.1.4. Change in the purchasing process of touristic services

The change in the purchasing process of touristic services is another trend that has emerged clearly in the literature review. It is more and more evident that individuals start reducing the use of intermediation channels if they do not provide a higher added value than an online website. In other words, there is a change in tourist behaviour, which is characterised by being able to choose, configure and assemble a highly customised journey, instead of asking for a package from a travel agent or a website. Another facet in this change of purchasing processes is a reduction in the regular use of cash in tourist exchanges, due partly to the risk of carrying high amounts of money when travelling. One of the main reasons could be the convenience of contactless payment systems or the chance of paying for the entire travel journey in advance using a dedicated payment platform. This trend may be boosting the use of *blockchain*, which enables transactions without intermediation.[164]. Consequently, this process also brought forward another kind of intermediaries — different from traditional ones — who are specialised in the new online channel, highlighting the need to compare or aggregate tourism supply. Such intermediaries (e.g. online travel agencies – or OTAs – search engines, and price comparison platforms) have progressively gained higher market shares. They will likely remain as key agents, at least in the short term. Consequently, more and more tourists engage in this modality of travel. Finally, the change in the purchasing process is also associated with a response to increasing environmental risks. A more ethical lifestyle and consumer awareness are changing the decision-patterns of younger generations in choosing touristic destinations too.

4.1.1.5. Digital natives to become the main consumers of smart tourism

In the long term (2050), digital natives will become the main consumers of smart tourism offers. Due to their propensity to use digital means to stay connected with the community, digital

[160] For a description of the "silver hair tourists" please refer to http://corporate.cms-horwathhtl.com/wp-content/uploads/sites/2/2015/12/Tourism-Mega-Trends4.pdf

[161] Glover, P., & Prideaux, B. (2009). Implications of population ageing for the development of tourism products and destinations. *Journal of Vacation Marketing*, *15*(1), 25-37.

[162] Saša, Z. K., & Mateja, Š. (2022). Does Tourism 4.0 answers the needs of baby-boomers?. *Industry 4.0*, *7*(1), 33-35.

[163] Veiga, C., Santos, M. C., Águas, P., & Santos, J. A. C. (2017). Are millennials transforming global tourism? Challenges for destinations and companies. *Worldwide Hospitality and Tourism Themes*.

[164] Nam, K., Dutt, C. S., Chathoth, P., & Khan, M. S. (2019). Blockchain technology for smart city and smart tourism: latest trends and challenges. Asia Pacific Journal of Tourism Research, 1–15.

natives will provide high volumes of data through various digital channels. Such data will, in turn, be used to feed AI-based systems and develop more personalised and interactive services. However, millennials will be more attracted to low-cost solutions, and they will have a higher propensity to share resources also due to their lower spending power with respect to Baby Boomers.

Close to 2050, the ageing population will have a different composition than it has today. Generations Y and Z will be over 55 years old, becoming the adult population of that period, with less collective spending power, yet higher digital skills than the previous generation. The Baby Boomer generation will also become older adults during this time, but in contrast to today's elderly population, they are expected to be healthier and more in demand of inclusive experiences at touristic destination, combined with cultural and health services of higher quality.

4.1.2. Megatrend 2 – Technological enhancements

As reported by the European Commission[165], a key factor to boost competitiveness in the tourism sector is to make better and more innovative use of data, so that operators are able to anticipate demand for their services, analyse customer profiles and business trends, and ultimately provide a better customer experience. The technologies already in use in the touristic sector include cloud-based and Big Data decision support systems, as well as sensor deployment. Technologies that will be more extensively adopted in the future include Internet of Things (IoT), Artificial Intelligence (AI), Augmented Reality (AR), Virtual Reality (VA), and even Facial Recognition.[166] The take-up of such digital solutions by tourism operators for improving the efficiency and sustainability of their processes, and for developing innovative and improved services to meet the changing demand, will also require better and more specific skills of the tourism workforce.

The following table outlines the technological megatrends.

Table 4 – Technological megatrends across the period of analysis

Short-term (until 2024)	Medium-term (until 2030)	Long-term (until 2050)
• High power remote communication networks (4G, 5G, 6G) diffusion • Big Data and BD analysis • Cloud computing • Internet of Things (IoT) • Voluntary data capture and Recommender Systems	• Internet of Things combined with systems for acquiring and processing data (e.g. gateways, edge computing or data centres), and higher geographical scalability, reliability and maintenance of security and privacy • Artificial Intelligence (AI) • Augmented Reality (AR) • Virtual reality (VR) • System and Data Interoperability • Data privacy and security	• Robots • Facial and speech recognition • Fingerprints scanning • Biometrics • Accessibility and inclusivity standards

In the short term (2024), remote communication networks will be a component of the core infrastructure required for implementing all technologies adopted so far.

[165] European Commission (2022). Transition Pathway for Tourism. Publications Office of the European Union, Luxembourg.
[166] Tsaih, Rua-Huan and Hsu, Chih Chun (2018) "Artificial Intelligence in Smart Tourism: A Conceptual Framework". ICEB 2018 Proceedings (Guilin, China). P. 89; W. Wang et al. (November/December 2020), "Realizing the Potential of the Internet of Things for Smart Tourism with 5G and AI," in IEEE Network, vol. 34, no. 6, pp. 295-301; Badidi, E., & Maheswaran, M. (2018). Towards a Platform for Urban Data Management, Integration and Processing. IoTBDS; M. Knudsen and J. Kaivo-Oja, "Collaborative Robots: Frontiers of Current Literature".

4.1.2.1. Establishment of 5G and 6G mobile networks

5G and 6G mobile networks, able to transmit data massively, quickly and reliably, aim to address the growing demand for speed, coverage and quality in current networks. In the short term, organisations should be ready to face the upcoming challenges and a new scenario of rapid shift, whereby new ecosystems for both products and services will be commercialised, mainly through wireless or wired appliances.

4.1.2.2. Big data technologies

Big Data (BD) analysis is widely implemented for several decision-making processes in many destinations. Over the time, techniques for the analysis and use of Big Data become finer and more accurate in predicting patterns, and thus become increasingly useful to destination managers. Therefore, BD management should be developed into fast data (which is processed in real-time) or through dedicated analytical tools (for actionable data). The enablers underpinning this evolution include the increasing volume of data available, the improved technical capabilities for machine learning and data mining, and the development of more reliable techniques (e.g. natural language processing, image recognition, genetic algorithms, or sentiment analysis). The analysis of mobile data, social networks and sensor data, allowing for ethnography, predictive techniques, simulation techniques and sentiment analysis, or the establishment of city labs, can also be useful for DMOs to anticipate technological trends. Developing advanced data analytics capabilities requires investments in market research, partnerships between DMOs and smart-tech companies, as well as large-scale involvement of various stakeholders (i.e. EU institutions and policymakers, governments, hotel chains, airline companies, travel data companies, academia) to gather information about consumers in line with transparency standards and current regulations (e.g. GDPR).

4.1.2.3. Cloud computing

Another aspect of the technological megatrend that affects the tourism sector in the short term is Cloud Computing. The increasing volume of data destinations and data to be stored needs cloud providers. This evolution, along with better networks and the spreading of smartphones and other internet devices, has allowed Cloud Computing to establish itself as an enabler for smart tourism. The adoption of modular software, which is more secure, flexible, and easy-to-use, will help Cloud Computing spread even more as an alternative to storing data and software on local, private devices, leading to more cost-effective systems.

4.1.2.4. Increased connectivity of Big Data with 5G

BD analysis also takes advantage of the spreading of online sources that have quickly become central in the ecosystem compared to offline resources. Due to wider connectivity, broader and quicker networks (4G, 5G, 6G), the increasing use of smartphones and mobile devices, and the increasingly user-friendliness of apps and software, the vast majority of datasets is expected to be available in the cloud in the future. Another key factor in the technological evolution megatrend is the increase in connectivity, especially with 5G. The improvement of connectivity and related infrastructure is pivotal to keep the pace of digital services and content development to allow tourists to have a seamless experience. Despite some niche tourism segments that rely on the concept of being technologically ‘disconnected’, an overall trend based on tourist demand for progressively better and more reliable connectivity services, can be clearly observed. Consequently, this has become an increasingly influential element on opinions and perceptions of the overall quality of the touristic offer.

4.1.2.5. Voluntary data capture and recommendation systems

One of the most effective ways of obtaining information and data of citizens or tourists for the purposes of making predictions about their behaviours and designing “user profiles” is through leads capture forms. These are forms that the user fills in, which ask information relevant to the destination and which automatically become part of the destination's database. Some

examples are newsletters, citizen sensing[167], tourist app with beacons. This information is also used by DMOs to make more personalized recommendations for tourists. Recommendation systems are also fed by online reviews, which provide further data for analysis.

4.1.2.6. Evolution of the Internet of Things (IoT)

In the short term (2024), as the Internet of Things (IoT) gains momentum and the need for data expands, destinations and companies will require sensors that register and measure variables to feed systems. Currently, sensors are developed to be more accurate, intelligent, safe, and easier to install. The cost of sensors is also decreasing rapidly, so that they will become more affordable to a wider range of businesses and destinations. Sensor data fusion, which aims to include different sensor technologies in single compact devices, will also help produce new data for the applications to be developed. This will also improve the reception and processing of information in the short term. Moreover, wireless communication will allow sensors to be autonomous, and their maintenance will be less demanding across their entire lifespan. In the medium term (2030), the IoT will evolve rapidly, with smartphones and other appliances further incorporating internet connectivity. However, the promising developments of the IoT in the medium term are conditional upon the quality of the supporting architecture. IoT technology is highly dependent on other complementary technologies that enable the system to acquire and process data, such as sensors, gateways, edge computing or data centres. The IoT will be a valuable technology for destinations if several current issues are properly addressed, like the standardisation of protocols, its geographical scalability, its reliability, or the maintenance of proper security and privacy levels.

4.1.2.7. Combination of AI and Augmented Reality

AI and Augmented Reality (AR) are strongly interrelated, since AR relies primarily on AI for its development. Hence, machine learning and neural networks can help AR software in developing to unprecedented levels. Its applications today are mainly focused on videogames — an application which may be extended to the tourism sector by augmenting the human perception and information collection, for instance, through special glasses. In this regard, although the existing way of taking advantage of AR is through the use of smartphones or tablets, there is a growing demand for new devices for more immersive and “all-surrounding” experiences. These appliances are expected to become cheaper and more reliable, which would likely lead to an increase in the uptake of AR in the tourism sector.

4.1.2.8. Data interoperability and re-use

In order to transmit data and make operations work efficiently, the systems need to talk to one another. Payment systems depend on the exchange of data by multiple organisations. Destinations can also benefit from data collected by service providers (e.g. hotels, cruise lines, museums, or travel agencies) in the course of their daily operations. Hence, there is an increasing demand for datasets to be shared and interoperable. Several technical challenges are linked to this objective, such as the standards to be used for regulating data transfer, the enforcement of agreements that allow communication between systems owned by different companies, and the principles to govern data transfer when entities are based in countries with different legal regulations. In the tourism sector, destination managers’ and businesses' data largely remain on-site on machines instead of being stored in the cloud, which would facilitate information exchange. Hence, a first step for increasing the interoperability of systems is to bring data over the ecosystem that best suits each destination or enable the agreements that allow machine communication. In order for this to be achieved, several actions must be adopted in advance, such as increasing the human resources skills on IT, updating operational procedures, and improving respective organisations’ privacy policy. An interesting element to consider is the re-use of different data generated by tourists through

[167] Citizen Sensing, a correlative of Citizen Science, employs low-cost sensors to evidence local environmental issues and empowers citizens to use the data they collect. For more information please refer to Coulson S, Woods M and Making Sense EU (2021) Citizen Sensing: An Action-Orientated Framework for Citizen Science. Front. Commun. 6:629700.

credit card and phone usage, as well as other behavioural data related to choices of transport and amenities, upon which new business opportunities can be generated.

4.1.2.9. Increase in the awareness of data ownership

A key trend, cross-sectional to every technology and policy, is data privacy. Users and consumers are increasingly aware of the ownership of their data, which includes who records it, where it is stored, and to whom it is transferred. Users are also increasingly concerned with how to access their information and how to request it is erased if they wish so. Every agent in the tourism industry who hosts private data should comply with regulations issued about this topic, such as those derived from General Data Protection Regulation in the EU. This aspect will face several challenges in the future, as companies store more and more data, and the systems need to exchange it more safely and efficiently. Hence, several initiatives are expected to mature in the medium term, like data exchange agreements between governments and organisations, open platforms to display relevant pieces of information, or trusted statistics agreements to run analysis on one machine – which hosts the data – and transfer the results aggregated and anonymised to another one – which requests the information.

4.1.2.10. Use of robots in the tourism industry

In long term (2050), robots will still presumably be far from being implemented to their full capacity in the tourism industry[168; 169]. Despite some interesting initiatives concerning chat-bots, drones, or even robots performing concierge or reception tasks, experts agree that robots have a long way to go until they are capable of delivering the services they are expected to provide. There are several issues to be tackled before their full implementation is to be realized, mainly related to their cost, installation or maintenance, and interaction with customers. Robots' designers acknowledge that humans prefer to be served by humans rather than by machines with a currently limited range of interaction. However, in the future, deep learning will allow robots to make decisions and communicate with humans using advanced interfaces (e.g. face and speech recognition). Those communication devices are still under development and not yet sufficiently reliable and safe to be put into commercial use. Nonetheless, so long as a robot is able to execute a set of tasks, it is becoming more and more evident that the machine will need to collect, store or download a considerable amount of data concerning each particular user to provide a customised experience. The required information might be, for instance, invoicing data, health conditions, biometrics, wishes, expectations or preferences. Moreover, the future design of collaborative robots – those working safely together with human – the definition of common standards for their design (e.g. regulating their ability to learn from their environment beyond their programming), and issues concerning cybersecurity are still open challenges.

4.1.2.11. Use of biometric for personal identification

Tourism is also highly dependent on personal identification. Since it entails mobility of individuals and groups, and given the current security and safety constraints in transportation, housing, or leisure activities, the access to restricted areas (e.g. an airport's boarding hall) need to be controlled. However, traditional methods for granting access, such as desk officers and turnstiles, are being replaced by a set of increasingly accurate technological alternatives, which rely on biometrics. Face recognition or fingerprint scanning are now being extended to other biometric data such as ear or eye traits, which may be used not only for granting access to restricted areas, but also for tracking visitors and users, as well as storing data about their path through the destination. This will allow companies to anticipate their expectations and trigger the most convenient commercial push. In spite of the potential, there are still technical

[168] Ivanov, S. H., Webster, C., & Berezina, K. (2017). Adoption of robots and service automation by tourism and hospitality companies. *Revista Turismo & Desenvolvimento*, *27*(28), 1501-1517.
[169] Ivanov, S., & Webster, C. (2020). Robots in tourism: A research agenda for tourism economics. *Tourism Economics*, *26*(7), 1065-1085.

and policy aspects to be solved. For instance, recognition can still be faked using pictures, and fingerprints security measures can be breached. Biometrics hacking is an issue that must be properly addressed before implementing this technology in sectors such as tourism, as biometrics have become a major technology application for user authentication in premises such as hotels and airports[170].

4.1.3. Megatrend 3 – Sustainable development and environmental neutrality

A final megatrend is related to the sustainable development and environmental neutrality of solutions for tourists that will be increasingly engaged with local communities and destinations stakeholders in developing more inclusive and environmentally neutral social innovations for both residents and tourists.[171]

Short-term (until 2024)	Medium-term (until 2030)	Long-term (until 2050)
• Changes of traveller behaviours due to the COVID-19 pandemic becoming a structural trend together with more sustainable travelling options • Burst of low-cost business models for travels • Growth of green tourism • Increase in the number of digital nomads and remote workers • New business models aiming to create peer-to-peer relationships	• More sustainable and environmentally neutral solutions and services • Growth of digital nomads and free lancers asking for good quality, low-cost accommodations and services • More stable and innovative business models which are based on resource sharing and holiday rental solutions	• Previous trends will continue to evolve into a more inclusive and sustainable sharing economy in tourism

With regard to short term (2024), it must be noted that the traveller behaviour was already changing before the COVID-19 crisis, due mainly to environmental awareness, which drove demand for more sustainable travelling options.

4.1.3.1. New business models

Moreover, new business models will also strongly enter into the tourism market, taking full advantage of new information and communication technologies. They facilitate end-users' exchange of products and services outside the regular, traditional models by creating peer-to-peer relationships. This trend stems from the expansion of internet access in 2008, which, combined with a strong economic recession, drove many entrepreneurs to focus on very specific needs of the users. The regular business models implemented in the destinations soon had to leave ample room for mobility, room-sharing, or holiday rental applications. Thus, regulation, quality control and taxation remain open points of conflict between those peer-to-peer, "*ad hoc*" services and the traditional establishments which remain to be addressed.

In the mid-term (2030), digital nomads[172] and free lancers will represent a significant share of the consumers' market for touristic services. Such travellers seek low-fare and good-quality accommodations and services, and they want to combine working time (that always requires

[170] Neo HF., Teo CC. (2021) Biometrics in Tourism: Issues and Challenges. In: Xiang Z., Fuchs M., Gretzel U., Höpken W. (eds) Handbook of e-Tourism. Springer, Cham.
[171] European Parliament resolution of 25 March 2021 on establishing an EU strategy for sustainable tourism (2020/2038(INI)). 2021, pp. 107–119; Gretzel, U. & Scarpino-Johns, M. (2018). Destination Resilience and Smart Tourism Destinations. Tourism Review International; Reinhold, S., Zach, F.J. and Krizaj, D. (2017), Business models in tourism: a review and research agenda, Tourism Review, Vol. 72 No. 4, pp. 462-482.
[172] They are a category of visitors changing their residences temporarily as they work (being mainly freelancers or remote workers); they another facet of the phenomenon.

powerful digital connectivity) with high-quality spare time. More innovative business models based on sharing/renting resources are foreseen not only for them, but also for the other consumers of touristic services. However, as already experimented in some smart tourist destinations, new tourists are more willing to be engaged with the resident population in less environmentally impactful solutions (e.g. separate waste collection or visiting a touristic attraction when it is less crowded). Interestingly, during the pandemic, several destinations have focused on these digital nomads, featuring themselves as comfortable and convenient destinations for the so-called "bleisure"[173].

In the long term (2050), all the above trends are expected to evolve into a more inclusive, economically and environmentally sustainable sharing economy. This is in line with the current behaviours that millennials generation are showing, as described above in the socio-demographic megatrends.

4.2. Key implications of future smart tourism trends on the sector

The tourism industry will be impacted by environmental awareness. Both DMOs and businesses will have to compete in a context where ambitious environmental goals are expected to be met. For instance, the current commitments related to the Sustainable Development Goals (SDGs), enforced in 2015, drove the EU to set up an ambitious Green Deal and, in turn, to plan to be climate-neutral[174] by 2050. Therefore, in the mid-term (that is, by 2030), the goal is to cut Greenhouse Gas (GHG) emissions by 55% within the European Union.[175] Among other things, this will have an enormous impact on aviation,[176] which will need to invest in new clean technologies for achieving the goals stated in these policies.

According to the aforementioned megatrends, tourism destinations and operations will have to adapt their working models to adopt more flexible, interconnected and safe data systems. This will enable them to work in a challenging environment within growing policy constraints and higher competition among destinations or businesses.

4.2.1. Key implications for tourism businesses

Tourism enterprises are facing growing uncertainty, especially after the COVID-19 crisis. They will need to collect as much data as possible to cover the gaps in the decision-making process. The increasing availability of several sources of information on different scales and in different units will heighten the need for skilled analysts capable of designing and taking advantage of Big Data, open data, cloud computing, deep learning or sensor systems. On the commercial side, recommender systems, and subsequently, the Internet of Things, will lead the changes to anticipate customer behaviour, market trends, and competitor actions. New payment systems will also be important for companies that need to remove constraints when monetising their operations. In that regard, the correct implementation of items such as contactless payment, e-payment platforms, codes generated by applications, and mobile wallet compatibility will be crucial in a context where e-payments replace cash.

Business operations will need to adopt a more data-driven approach, shifting from the current Customer Relationships Management (CRM) to integrated systems where CRM is integrated with Channel Management System (CMS) and Property Management Systems (PMS), as concerns the hospitality and leisure industry. All such systems will be fed by databases that gather information from sources progressively more reliable and diverse. The resulting information composite will enable developed algorithms to assemble a more customised,

[173] A number of EU countries is offering VISAs (more info is available at this link) or tax breaks (more info is available at this link) for digital nomads.
[174] For more information on the EU Green Deal and sustainable objectives, please refer to: https://www.roadmap2050.eu/
[175] More information on the EU Green Deal short, mid- and long-term objectives is available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32021R1119.
[176] More information on the route to Net Zero Aviation in Europe is available at: https://www.destination2050.eu/.

seamless tourist experience. A good example of this is the increasing use of chatbots in corporate websites, which help users obtain the information for which they search and provide support for organising trips. Moreover, as such systems collect information and learn over time, they become increasingly more helpful and useful.

In the transportation sector, tracking and identifying tourists will become increasingly important. The technologies for controlling mobility and access will be key in this aspect. For business purposes, knowledge about the size of customer groups, the activities in which they participate, the expenditure in each tourism attraction, or their preferences in terms of calendar or schedule are extremely valuable in building a competitive, non-standard service.

One of the relevant markets within the tourism industry is MICE (meetings, incentives, conferences, and exhibitions) and business travel. In this aspect, the former is recovering well post-COVID-19, depending, of course, on regulations governing mass events and physical distancing. On the contrary, the latter will need more time to regain the momentum reached before the COVID crisis. Video meetings and remote teamwork have been implemented so quickly and deeply in companies that they may replace part of the travelling that used to be organised. Some underlying reasons for which companies are choosing to remain with hybrid work modalities could be the need to preserve employees' health and the costs associated with business travel.

There is also a need to provide much more valuable information to users of touristic services. This implies more measurable impact indicators and monitoring systems made available for both users and stakeholders. Also, in this case, digital technologies can play a relevant role for both gathering data and producing valuable impact score carding systems.

More inclusive strategies for touristic destinations would increase the engagement of citizens and enterprises. This engagement should be regarded as a valuable resource that could bring more experiences and expertise in digital transformation processes via-à-vis touristic destinations.

Making tourism more accessible and inclusive is also linked to various demographic phenomena, such as the ageing population across the EU. The tourism industry will need to respond to the trend to target this market segment in the future. Granting access to tourism resources for everyone, regardless of personal health conditions or family composition (which may entail travelling with children) will become a key issue in the future.

4.2.2. Key implications for Destination Management Organisations

From the point of view of destinations and DMOs, the tourism ecosystem will undergo key changes in the forthcoming years. Regarding technology, information will be more available than ever. If adequately collected and analysed, it has the potential to generate the basis for one destination’s competitive advantage vis-à-vis other destinations. Nevertheless, DMOs should first establish clear, realistic objectives concerning the goals they wish to achieve. Plans must be co-designed and agreed upon by all stakeholders in the territory (inhabitants, tourists, businesses, institutions), who should be not only aware of, but also aligned with the goals to be achieved at the destination level. In fact, businesses and institutions must agree on the model of tourism proposed and on the data sharing practices, in order to fully exploit the potential; the local population must buy the tourism model proposed so as to get along with tourists and avoid issues in their daily life. For instance, in a context where the average age of the population is rising and the market is splitting into various segments, destinations will likely specialise in meeting the demands of one or more customer typologies, aiming to become leaders on these specific clusters through the definition of specific value propositions stemming from a through market and analysis of needs. Technology will facilitate specialisation, but DMOs will also need to adopt *ad-hoc* strategies and policies in order to harness the potential linked to transitions.

Since tourism involves international mobility, the enforcement of dedicated agreements and standards for interoperability and data exchange will undoubtedly become a relevant

challenge between countries. Border controls will benefit from data exchanges and from shared regulatory standards. Furthermore, information about popular itineraries of tourists within a given country will be valuable for operators if collected and displayed with enough granularity. This would be possible if DMOs were to take all necessary steps to remove barriers to continuous tourist connectivity to the Internet – enabling not only tourists to access online resources at any time and from any place, but also DMOs to collect more extensive and comprehensive data. It would entail, for example, setting up public networks or promoting roaming agreements, as well as facilitating the purchase of SIM-cards for travellers anywhere in the destination.

Privacy policies will be of utmost relevance, and every effort should be dedicated to preserving tourists' data privacy and ownership. However, the right of tourists to keep their information private will have to be balanced with the growing need of both businesses and destinations for disaggregated data. International policy agreements and specific regulations work towards the need to balance both interests. Collecting and opening privately owned data (through anonymization) is another important action that DMOs may undertake to anticipate the effects of such trends, ensuring sectoral resilience by staying "ahead of the curve". Establishing stronger and wider public-private partnerships to open and share data is pivotal to have a stable inflow providing a clear picture of tourists' flows and perceptions. Examples include the practices of Expedia, Booking.com, TripAdvisor and Airbnb, who transmit monthly and yearly aggregated re-usable booking data with EUROSTAT.

Moreover, DMOs will develop more sophisticated and thorough monitoring systems. At present, DMOs are monitored through simple variables such as the number of visitors, the number of marketing actions organised, or the number of overnight stays, sometimes in a rather qualitative manner. In the future, hard, quantitative data will play an important role in the way DMOs' activities and results are measured. It will be progressively easier and cheaper to measure the impact of DMOs' commercial activities, as well as the extent to which those activities are able to attract a given tourist type to the destination. Analytics will enable DMOs to assess their efficiency, gathering data about tourism expectations, tourism expenditure, online reputation, e-Word of Mouth (e-WOM) spread, perceived quality, and travel decisions.

In order to make sure that policies and services for tourism destinations are in line with the needs of potential customers and are to be taken up by stakeholders and local population, it will be necessary to involve citizens and enterprises in co-creation activities, in particular through co-creation workshops and public consultations.

Moreover, the future of smart destinations will be focused on connecting smart city and smart destination services and data management/analysis activities. For instance, any platform showcasing touristic destination services should contain dynamic data (for instance, from traffic) and be continuously improved by incorporating new databases as their usefulness and availability is assured. Similarly, DMOs should develop an Open Data strategy to share the information managed in the field of Geographic Information Systems (GIS), generating valuable information in real time (crowdsourcing or citizen sensing).

Finally, in the future, DMOs will have to shift from a decision-making model whereby the destination is conceptualised as a set of resources leveraged for maximising the number of tourists to a tailored approach whereby the destination focuses on its competitive advantages and acts accordingly. This implies acknowledging that DMOs might use data for assessing the most interesting segments of visitors that providers could serve in the destination.

4.2.3. Key implications for existing data use cases

At present, the tourism industry uses data for a wide range of objectives, from logistics to marketing. The amount of information stored and available for tourism decision-makers is gathered mainly from public sources, social media or private databases shared or disclosed through specific agreements. If properly filtered and analysed, this data can provide valuable insights about expected tourist behaviour, market research, or corporate reputation. Analytics is expected to evolve from current models, which first gather and store data before being able

to analyse it, to real-time, predictive analytics, whereby patterns and trends are displayed in real time as new information is fed into the analytical models. Disciplines such as Revenue Management or Community Management benefit from this kind of analysis, since they entail the prediction of competitors' prices, customer demand, business opportunities for specific customer segments, or optimal pricing of special offers.

Another set of data currently in use is the tracking of tourists' location. If stakeholders are able to track tourists by GPS or any other means, then they can use this information to describe the behaviour for every visitor's profile in terms of sites visited, time used to eat and rest, and general travel habits. The expense involved in accessing this information would be more justified if linked to a specific tourist profile, so that the model could cross-reference their geographical tracking with elements like age, point of origin of the trip, size of the travellers' group, travel motivations, and average expenditure.

Similarly, social media platforms provide a vast amount of information for decision-makers, such as "likes", posts, ratings, evaluations, and comments, enabling those skilled in its analysis to predict with sufficient accuracy not only tourist preferences, but also the sentiments associated with specific items concerning the destination or the operator analysed. Therefore, this data – though very expensive to collect – will be highly relevant for sentiment analysis and tailored marketing interventions.

Regarding the ownership of information, private data will be more exchangeable due to higher interconnection and interoperability of storage systems, the adoption of standards, and the use of cloud computing. On the other hand, Open Data sources will spread throughout the tourism sector, becoming a recurrent asset for data-driven decision making in tourism destinations, as well as for the creation of new products and services. This is in alignment with policies implemented by the European Commission, i.e. the Data Act and the Data Governance Regulation; while the Data Act clarifies *who* can create value from data and under which conditions, the Data Governance Regulation creates the *processes and structures* to facilitate data creation and exchange. Specifically, the Data Act encourages wider re-use of data held by the public sector bodies (including personal data), provides a licensing regime for "data intermediaries", encourages data sharing, and contains the first steps towards restriction of transfers of non-personal data.

4.2.4. Key implications for new data use cases

In the future, biometric techniques to identify travellers and/or improve safety in payments are likely to gain strong relevance for the tourism sector. Currently, these techniques are being slowly adopted to store information about face traits or fingerprints. In the coming decades, more detailed information will be included (such as behavioural patterns stemming from signature, gait, typing patterns, and voice recognition)[177]. Biometrics will advance at the same pace of interconnectivity and work, to produce seamless travel experiences, supporting crowd management and public security, border control, smart ticketing, local mobility, and contactless payments. In this regard, privacy and safety are crucial.

Social media will remain another important source of information in the years to come. Specifically, tools for gathering and analysing sentiment stemming from posts, comments and reviews publicly available will be increasingly accurate in predicting tourists' preferences and in displaying the appropriate triggers for a transaction. Recommender systems will become much more insightful and will consequently propose mainly those recommendations with a high possibility of acceptance by tourists.

Augmented reality will also benefit from new data usage, and lodging CRM systems will be capable of customising guest experiences in their entirety. In that regard, interconnecting DMOs with other providers' databases will generate more insightful insights and possibilities.

[177] See for instance https://ati.ec.europa.eu/reports/technology-watch/biometrics-technologies-key-enabler-future-digital-services.

Moreover, DMOs will be able to set up common databases containing valuable information based on customer profiles and recommendations provided in other stages of the touristic value chain. For instance, a concierge could recommend a local event based on TV contents that the tourist selected in the plane when arriving, if this information were to be available to every actor involved in the tourist experience.

5. Opportunities and possible areas for cooperation on data management for tourism

This Section provides a snapshot of the state-of-the-art of cooperation on data management in the tourism sector. The aim is to highlight areas where cooperation among destinations has already been established and is currently producing positive impacts, but also areas where cooperation is lacking or should be strengthened. To this end, the study team selected 10 notable cases of cooperation and analysed them in-depth, in order to identify key features of successful joint smart tourism initiatives. The cases of cooperation selected serve as a proxy to depict the current status of cooperation in data tourism management and draw a number of recommendations.

5.1. Overview of the 10 case studies of cooperation

About 50 cases have been analysed to better understand opportunities and potential areas of cooperation, collecting details from the websites of the initiatives and supplemented by information deriving from secondary sources. Ten out of the total number – mainly EC projects or continuation of formerly EC funded initiatives – have been selected for a more detailed analysis concerning their potential area for cooperation on data management. The selection criteria was based on a ranking following the same methdology adopted for scoring and assessing the 30 projects, as described in Section 3.

The following table provides an overview of the 10 selected case studies of cooperation, grouping them according to the number of countries involved in each case.

Table 5 – Case studies of cooperation grouped according the number of countries involved

Number of countries involved	List of countries involved	Total number of case studies of cooperation per country grouping
6 countries	Bosnia and Herzegovina, Croatia, France, Greece, Italy, Spain	**3 cases of cooperation**
	Cyprus, Greece, Italy, Malta, Portugal, Spain	
	Belgium, Croatia, Finland, Italy, Netherlands Spain	
4 countries	Croatia, Greece, Italy, Spain	**1 case of cooperation**
3 countries	France, Ireland, Spain	**1 case of cooperation**
2 countries	France, Italy	**2 cases of cooperation**
	Croatia, Italy	
1 country*	Finland	**3 cases of cooperation**
	Italy	
	Slovenia	
Total number of cases of cooperation		***10***

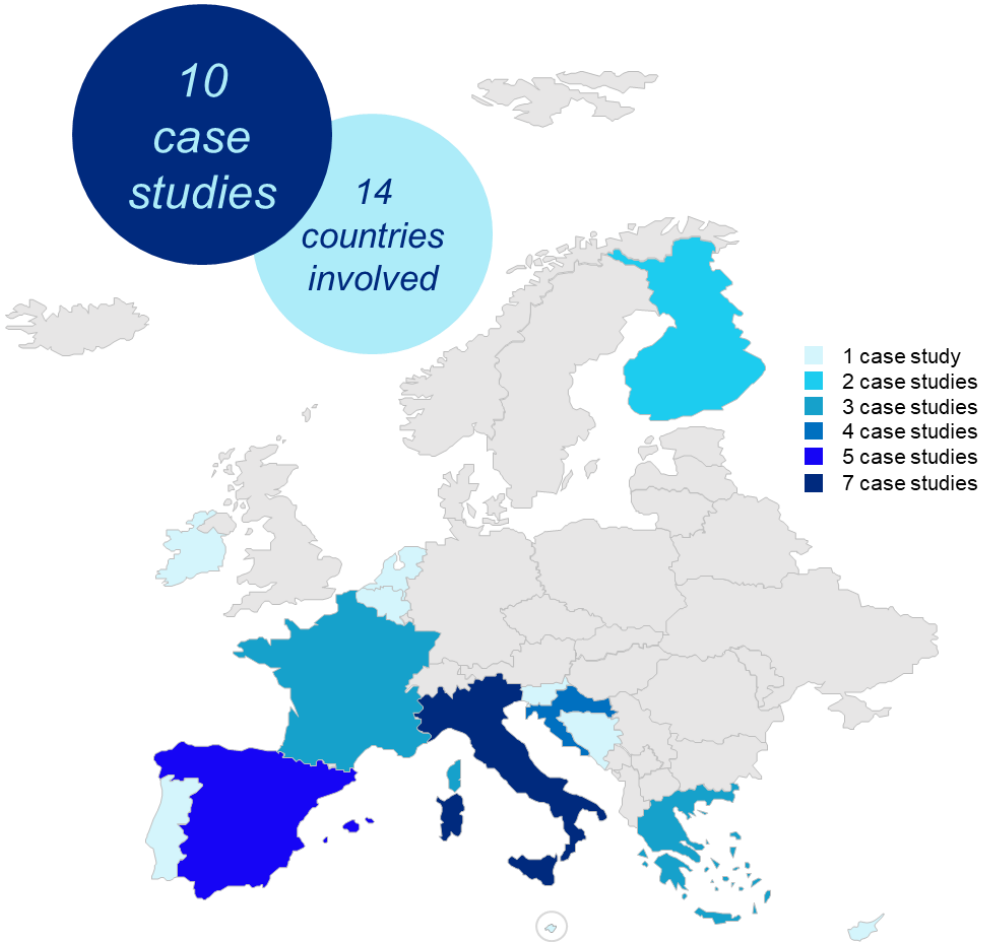
**Cases involving only one country relate to cooperation taking place between actors at sub-national level, such as regions, communities of municipalities and cities.*

Source: Author's elaboration

The information presented in the previous table is illustrated by the following figure, which provides an overview of the countries involved in the 10 selected case studies of cooperation.

A total of 14 countries participated in the initiatives analysed, including 13 EU Member States (Belgium, Croatia, Cyprus, Finland, France, Greece, Ireland, Italy, Malta, the Netherlands, Portugal, Slovenia, Spain) and one non-EU country (Bosnia and Herzegovina).

Figure 11 – Number of case studies of cooperation per country



Source: Author's elaboration

Figure 11 shows that the cases of cooperation entail a high involvement of countries in the Mediterranean area, many of them participating in two or more initiatives: 7 cases of cooperation involve Italy, 5 Spain, 4 Croatia, 3 Greece and France, 2 Finland, and one each involve Belgium, Bosnia and Herzegovina, Cyprus, Ireland, Malta, the Netherlands, Portugal and Slovenia.

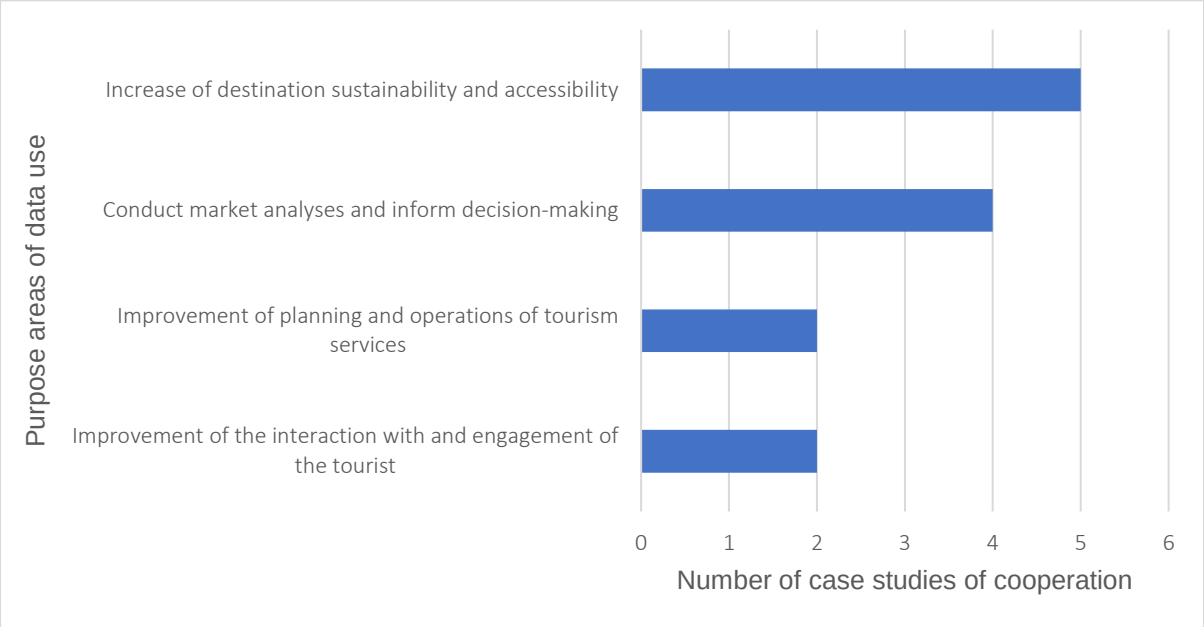
The following paragraphs report the key findings of the analysis transversally conducted by the study team, across the 10 cases of cooperation and according to multiple dimensions.

5.1.1. Purpose areas of data use

The case studies investigated and presented in this study cover all four purpose areas of data use in the tourism sector, as outlined in Section 2.1.1. Purpose area 4, *Increase destinations accessibility and sustainability* is the most recurrent in the case studies of cooperation analysed, present in half of the total. *Supporting DMOs' ability to conduct market analyses and inform decision-making* (Purpose area 2) is also particularly relevant for the data shared in the cases of cooperation. Overcoming interoperability constraints and ensuring data ownership are the most relevant objectives that motivate the collaboration among stakeholders within the scope of the initiatives analysed.

In a smaller number of cases, the analysis also involved cases of cooperation related to the development of tools and services for better interacting with tourists and residents (Purpose area 1). Thanks to technology and gamified applications, this area of cooperation is widening its scope to include behavioural analysis of tourists. The latter is an emerging area of cooperation with which recent case studies are experimenting, and it will increasingly become more central as AI technologies mature. Finally, the study team also identified case studies related to Purpose area 3, *Cooperation among destinations, aiming to improve planning and operations*. A common driver for cooperation in such cases is the intention to develop tourist services more aligned to tourist needs.

Figure 12 – Purpose areas of cooperation of the case studies



Source: Author's elaboration

5.1.2. Typology of data shared and data management/sharing approaches

Case studies entail sharing data for several purposes, and they leverage upon different technological solutions for doing so. Providing value-added data to tourists through mobile apps and/or open data portals is one of the most common aspects transversal to most of the cooperation cases identified. In most cases, this information is used by DMOs and stakeholders to plan their offer. Data to understand and improve the experiences of travellers are also widely shared. Mobile apps and interoperable and open data portals are well established technological solutions to support this kind of data sharing practice. In some cases, the IoT and smart sensors are also used to gather behavioural information from the users, just as interactions with mobile applications are used to induce behavioural changes in tourists (e.g. change for a less crowded touristic destination; collaborate in waste recycling; having more sustainable behaviours; etc.). The definitions of common KPIs and related metrics is another typology of data that has been experimented, as highlighted in the case studies. To this end, data analytics and shared databases are the most common technological solutions.

5.1.3. Key challenges and barriers

Barriers to data availability and openness characterise more than half of the cases analysed. They represent the most common challenges, together with the lack of capacity to properly and meaningfully engage stakeholders. Current practices of data collection and storage have significant limitations to the sharing potential of tourist information across departments and

institutions, leading to individual data silos. Data availability and updating are additional key challenges, particularly as they are prerequisites for the development of AI and ML algorithms. Data collection, storage, sharing, and interoperability are key elements to improve data and knowledge sharing among stakeholders. Data sharing should be encouraged by highlighting the relevant business opportunities and economic advantages that it entails. The availability of tourism open data sources, for example, can reduce private costs for buying data. The development of incentive schemes to motivate data sharing among stakeholders can thus be an effective solution to overcome this issue. Unfortunately, there is not much quantitative information on what incentives really work. From the conceptual point of view, business to government data sharing can be increased through incentives that can be direct (e.g. monetary), indirect (e.g. reputational – as part of corporate social responsibility programmes), or by making the data transfer by making the transaction mandatory, with a fair cost compensation. Other incentives include setting up public-private partnerships, or governance frameworks aimed at reducing the transaction costs and perceived risks for the provider data supplier, e.g. by setting up trusted data intermediary platforms, or appropriate contractual provisions[178]. Finally, understanding data value and their potential applications, as well as establishing a clear data exploitation strategy are key elements to foster data use. Several sectoral stakeholders still lack insights to the purpose and efficiency gains of ML and AI, so destinations exploiting these technologies are still few. Much work remains to be done to understand the added value of ML and AI for the management or real-time data or the implementation of algorithms to produce forecasts.

Budgetary constraints and lack of financial and human capital resources are key barriers for scaling up the initiatives. For half of the cases analysed, financial aspects are a major issue. For the other half, a lack of vision and coordination capabilities emerged as a significant barrier. The lack of sufficient investments limits the capacity of initiatives and projects to scale up, thus leading to a loss of larger opportunities. Moreover, the shortage of skills required for the effective use of data is another key challenge.

Technological barriers emerged in some cases, which primarily relate to the lack of fast connectivity (e.g. 5G) as well as interoperability constraints. Digital experiences are becoming increasingly important, assuming a relevance that is more and more similar to that of traditional, ‘physical’ tourism experiences. One example is today’s prominence of digital experiences in pre-visit planning, such as in the booking of tourism services, but the fruition of tourist attractions at destinations is increasingly linked to the digital sphere.

The table below shows the main challenges and barriers:

Table 6 – Challenges and barriers

Case study ID	Key challenges and barriers
A	Tourist seasonality
B	Lack of tourism-related data; lack of tools and resources, including lack of a sufficient number of sensors to measure tourism impact
C	Tourism overflow, with a direct impact on the urban environment and on the key elements that define MED culture
D	Open data and information availability; citizens and tourist participation; engagement of stakeholders regarding tourist services
E	Lack of common governance and strategy; lack of Open data
F	Fragmented supply; lack of coordination; lack of resources; 5G
G	Data availability, data privacy and data ownership; lack of capability in stakeholder engagement, common vision, and strategy
H	Stakeholder engagement: citizen, tourist and traveller participation and adoption of proposed solution; data availability; ownership privacy and security; 5G availability

[178] For a discussion, please refer to Martens, B., Duch-Brown, N., The economics of Business-to-Government data sharing, European Commission, Seville, 2020, JRC119947.

Case study ID	Key challenges and barriers
I	Open data and information availability; citizens and tourists' participation; engagement of stakeholders of tourist services
J	Data availability, privacy and security; stakeholder and user engagement; policy, decision makers commitments; 5G

Source: Author's elaboration

5.1.4. Key success factors

With regard to **success factors**, they can be summarised as follows:

- For virtually all cases, the **proper engagement of stakeholders** from the first phases of an initiative ranked on top. This can be achieved through a preparatory work consisting in scenario workshops and interviews, and it can help overcome a lack of understanding users' needs. In that regard, a primary task of DMOs is to identify and engage the stakeholders who are most interested in data, since they can act as the main drivers for the development of smart tourism destinations;
- **Awareness among stakeholders about the purposes and benefits of sharing and using data.** To increase public opportunities, DMOs must encourage and promote public discussions, workshops and social media campaigns informing stakeholders about the challenges and benefits linked to the use of data. In that regard, also the establishment of a repository of best practices and success cases can help;
- **Establishment of an open data portal**: this is a success factor in a number of cases, with many of them having relied on existing ICT infrastructures. However, the presence of a portal for data consultation does not automatically lead to the useful re-use of the data;
- **Strong policy commitments** and the consequential presence of a well-established network of partners are important success factors for the majority of the cases investigated. This can overcome the silos mentality preventing data sharing, and can enable tourism authorities to channel resources and efforts to enhance the impact of data sharing. By the same token, it is also important to support DMOs in the adoption of innovative management practices that would allow the development of sound metrics and processes to measure the impacts and outcomes of cooperation initiatives.

5.2. Cases studies of cooperation

Five case studies are reported below as significant examples (Case studies A to E), while the remaining five (cases F to J) have been included in Section 8 – Annex B: *Case studies of cooperation supplement*. With regard to the first five cases:

Case A involves six European island locations that established a cooperation aimed at enhancing the effectiveness of their market analyses to inform decision making, but also to increase destination sustainability and accessibility, adopting data-driven approaches based on relevant data such as business information and tourism statistics.

Case B is a wide tourism cooperation initiative aimed at establishing innovative ways for improving interaction and engagement with tourists. The initiative involves tourism destinations and public authorities from six countries of the Mediterranean basin ~~Med-Area~~, including city and regional public administrations, research centres and universities.

Case C has been developed among six destinations of the Mediterranean basin. It is an example of public-private collaboration for information sharing aimed at increasing the sustainability and accessibility of tourism destinations through better and more coordinated plans and operations of services provided to tourists and residents.

Case D involves several destinations on both the eastern and western shores of the Adriatic Sea, from Croatia and Italy. A mix of public and private actors launched a cooperation programme to strengthen their ability to conduct tourism market analysis and support data-driven decision making.

Case E is an example of cooperation occurring at sub-national level, across various tourist destinations of Finland. Both private and public sector actors are driving forces behind this case study and decided to cooperate in order to increase the sustainability and accessibility of tourism in their respective destinations.

Case Study: A

CIVITAS DESTINATION

Geographical area	*Elba (Italy), Madeira (Portugal), Limassol (Cyprus), Rethymo (Greece), Las Palmas de Gran Canaria (Spain), Valletta (Malta)*
Purpose areas of data use	*Conduct market analysis and inform decision making* *Increase destination sustainability and accessibility*
Type of data users	*Tourist destinations and public authorities*
Source of data	*Other data – Business information; Statistics; Context-specific information*
Actors involved	*29 actors ranging from local Public Administrations, Fleet organisations, Tourist operators, ICT providers, Universities, etc.*

Context and background

Transport systems of many European islands are affected by seasonal touristic flows, which entail large swings in population and demands. This situation requires innovative mobility patterns that improve quality of life for both habitants and tourists.

Solutions adopted

The six European Islands participating in the DESTINATION project are testing and assessing the impact of various types of mobility solutions: (a) collective passengers transport & shared mobility; (b) AVM tools on Public Transport (Elba); (c) integrated payment for mobility services (Elba); (d) SUMP observatory, fast charging EVs, safe and accessible public space at major attractions, Bus Rapid Transit, real-time mobility and tourism information services and SMART destination (Las Palmas); (e) expansion of public bike sharing systems, e-mobility promotion, awareness on the use of sustainable mobility for leisure trips, business cases for combined tourist and mobility products, PT Traveller information system and its application to smartphones to provide real time information and sustainable Mobility Tourist Action Plan (Limassol); (f) Mobility planning for tourism related companies, green credits – a business model for mobility, sustainability and tourism, promotion and uptake of EVs and sustainable regional mobility plan in touristic regions (Madeira); (g) integrating tourist mobility, uptake of EVs by fleet operators, sustainable mobility agency for tourists/visitors and improved PT for tourists and citizens (Rethymno); (h) promotion of sustainable mobility among tourists, promoting e-bike and car sharing, sustainable urban mobility plan award and SUMP for Valletta (Valletta region).

Reasons for cooperation

For almost five years, 29 partners from 6 Member States – with the strong support of local politicians – have worked together on designing, developing, and implementing more than 75 measures and actions.

Areas of cooperation

- Sustainable Urban Mobility and Logistics Plans (SUMPs and SULPS).
- Development of attractive and more accessible public space.
- Encouraging shared mobility and e-mobility (by also providing new infrastructure).

- Introducing more sustainable mobility patterns through a better management of mobility demand and a re-allocation of urban space.
- Raising awareness on the value of sustainable mobility.
- Fostering attractive, efficient, and accessible public transport.

Typology of data shared

Public transport data, traffic data, information about touristic destinations; information on touristic flows.

Approach to data management and sharing

Several data management solutions were adopted, some ICT-oriented and others non-ICT-oriented, depending on the initiative.

Key challenges

Stakeholders and citizen engagement; integration of collective and shared transport means for enabling multimodal shifts; decision makers' cost-effective evaluation capability of sustainable solutions.

Impact

- Knowledge-sharing initiatives through quarterly newsletters published within CIVITAS MOVE and SATELLITE newsletters.
- Training courses and webinars open to CIVITAS members.
- Mobility solution descriptions, multimedia content, and a knowledge bank with all the project's publications containing the DESTINATION project partners' mobility experiences for touristic islands hosted on the CIVITAS website.

Success factors

Stakeholder engagement; public active participations; open data; accessibility of active transportation means as well as low-zero impact vehicles; behavioural shift of users towards smart applications and Mobility as a Service (MaaS) solutions.

Replicability potential

DESTINATIONS showed how the tourism and transport sectors can work together, and how sustainable mobility can forge a path for other holiday destinations to follow as they attempt to "go green". Following the onset of the COVID-19 pandemic, DESTINATIONS also supported touristic cities in rethinking tourism in times of travel restrictions. Two additional, relevant initiatives of CIVITAS are CIVITAS PORTIS and CIVITAS ECCENTRIC. In total, 175 cities are involved. See also: New CIVITAS publication showcases tested and effective sustainable mobility solutions | CIVITAS.

Case Study: B

HERIT - DATA

Geographical area	*Italy, Spain, Croatia, Greece, Bosnia and Herzegovina, France*
Purpose areas of data use	*Improve interaction and engagement with the tourist*
Type of data users	*Tourist destinations and public authorities*
Source of data	*Other data – Business information; Statistics; Context-specific information*
Actors involved	*Region of Tuscany, CPMR, AVITE, Occitane Region, Tourism Center of the Valencian Community; Valenciaport Foundation, Region of Western Greece, Foundation Santa Maria la Real; Italian Foundation of Research and Innovation, Centre for Spatial Research, Nova University of Lisbon, University of Florence.*

Context and background

Whereas tourism for several locations can be considered an important economic source and a great opportunity for economic growth, it can also produce burdens which entail significant impact on the conservation of heritage, which can prove difficult to manage. The overcrowding of heritage sites creates a burden difficult to bear for local inhabitants, while impacting the local heritage. However, prior to arriving at critical situation of "Over-tourism", there are different critical phases (e.g. the incubation phase, the touristification phase, etc.) that can be monitored through SMART KPIs so that they can help defining early warnings and enable the anticipation of countermeasures aimed at correcting the possible imbalances in touristic flows management that may occur.

Solutions adopted

Data collection from the sites through smart sensors; common platform for elaborating data and extracting knowledge to support decision makers. Big Data and AI technologies are adopted to leverage knowledge from the data gathered.

Reasons for cooperation

To develop, test and transfer a series of tools to collect, generate, integrate, and analyse information and transform it into behaviour changes.

Areas of cooperation

IoT; Big Data management; decision support systems and governance.

Typology of data shared

Touristic information and behaviour of tourists.

Approach to data management and sharing

(a) a set of indicators to collect data about tourism flows (see 3.2.1_List_of_sustainability_indicators.pdf (interreg-med.eu)); (b) an on-line platform to analyse these data (see Snap4City in Snap4City).

Key challenges

Lack of openly accessible tourism-related data (i.e. only 30% of such data are publicly available, while 65% are restricted and 5% are partially public); Lack of tools and resources, including lack of a sufficient number of sensors to properly measure the impact of tourism.

Impact

- Better management of touristic flows.
- Higher preservation of touristic sites.
- Added value information and services generated on top of the proposed solution.
- All impact indicators defined in 3.2.1_List_of_sustainability_indicators.pdf (interreg-med.eu). Some of them are listed below:
    - Host citizens: Improvement of quality of life, better distribution of impact, including positive socio-economic effects.

- Tourists: Focused offers, development of alternative offers, recommendations, information, diversification.
- Public administration: Support in decision-making and planning processes.
- Tourist and Heritage managers: Information to develop sustainable tourist products, management recommendations, conservation recommendations, better management of human pressure on heritage sites.

Success factors

Stakeholder engagement, citizen and user participation and data availability; common set of impact indicators; common platform to collect, analyse and manage tourism flows; app to help visitors better organise their visits.

Replicability potential

High**.** Particularly for all cities with characteristics similar to those of the six pilot sites involved in the project. For instance, Barcelona has similar characteristics with respect to Valencia, and Ancient Olympia can be assimilated to several Greek island cities.

Case Study: C

Alter Eco

Geographical area	*Dubrovnik (Croatia), Genoa (Italy), Malaga (Spain), Comunitat Valenciana (Spain), Venice (Italy), Thessaloniki (Greece)*
Purpose areas of data use	*Improve planning and operations of tourism services*
Type of data users	*Tourist destinations and public authorities* *Private sector – Tourism Industry*
Source of data	*User-generated data: Textual; Photo* *Other data – Business information; Statistics; Context-specific information*
Actors involved	*Valencia Institute of Building, Malaga City Council, Aristotle University of Thessaloniki – Special Account for Research and Innovation; Municipality of Genoa; Ca' Foscari University of Venice; City of Dubrovnik; Larnaca-Famagusta Districts Development Agency Cyprus; South Aegean Region; The European city of Culture, Tourism and Development; Observatory on Tourism in the European Islands*

Context and background

The Mediterranean basin is under pressure due to inappropriate practices and development associated with mass tourism, which can provide environmental damage. Areas of high tourist attraction in coastal cities are reaching their capacity limits, with a direct impact not only on the urban environment, but also on key elements of the cultural heritage of Mediterranean countries.

Solutions adopted

Development of a "Carrying Capacity Limit" calculation tool. It is a solution which combines a tool and methodology to support policy decisions to absorb tourism in a given territory.

Reasons for cooperation

To promote Mediterranean Area identity, defined as a unique cultural heritage of Mediterranean countries, which comes as the result of the historical development of the civilizations that constitute the Mediterranean culture melting pot in all its expressions, both material and immaterial, through the adoption of alternative tourist strategies. Co-designing, testing and assessing the strategies in six pilot sites in collaboration with key public and private stakeholders and comparing the pilot results to leverage lessons, best practices and recommendations. Several examples are reported in: https://alterecotips.com/.

Areas of cooperation

Mobility and transport, ecological sustainability, economic and social sustainability.

Typology of data shared

Different types of data were shared among the sites. Examples are available at: https://alterecotips.com/, such as:

- Valencia and Gandia, which share information related to neighbours through gamified apps to allow tourists to select alternative destinations, in order to reduce congestion in usual touristic sites and allow touristic operators to increase their offer. Applications can geolocate all resources provided. Users can also complete special missions that involve moving around these areas, e.g. they can travel from one place to another within the city. The application takes into account the possibility of generating smart push notifications in real time or scheduled notifications to disseminate news among users.
- Málaga is developing maps of location and intensity of tourist accommodations, using plots of 200 x 200 meters to give a global image of the uses and intensities. The proposal tries to establish a new urban regulation that delimits three density zones of tourist accommodation.

Approach to data management and sharing

The six pilot sites have been organized in LIVING LABS to test both existing methodologies and tools as well as solutions proposed by stakeholders, and to assess their impact in the field of sustainable tourism. Cross-comparison of the results will help leverage holistic and realistic tourist strategies transferable throughout the Mediterranean basin.

Key challenges

Lack of stakeholders' interest in partaking in the initiatives; data ownership and availability.

Impact

- Improvement of knowledge and decision-making capacities of key stakeholders and decision making of tourist strategies.
- More informed sustainable strategies for touristic strategies in the Mediterranean Basin.
- Increased coordinated actions between public and private stakeholders for more sustainable touristic solutions for Mediterranean Areas.
- For Valencia and Gandia – there were a total of 1,029 downloads during the campaign. We also obtained information on the international presence with downloads from up to 10 different countries, not just Spain, but also Mexico, Italy, Peru, Colombia, US, India, China, Taiwan, and more. The over one-thousand App users completed a total of 1,640 objectives and collected 396 gifts.
- For Málaga, please see the three main project impacts listed above).
- Improve the conservation of the culture heritage of Mediterranean countries.

Other examples are available in https://alterecotips.com/.

Success factors

Tourists' engagement through gamified applications; stakeholder networks engagement.

Replicability potential

High. The application of the "carrying capacity limit" tool in other contexts doesn't require particular conditions or complex datasets. The tool requires basic information related to touristic flows and tourist behaviours that are commonly gathered in most touristic destinations. See other projects collected in https://alterecotips.com/

Case Study: D

S.LI.DES.

Geographical area	*Venice (Italy), Ferrara (Italy), Bari (Italy), Dubrovnik (Croatia), Sibenik (Croatia)*
Purpose areas of data use	*Conduct market analysis and inform decision making*
Type of data users	*Tourist destinations and public authorities* *Private sector – Tourism Industry*
Source of data	*Other data – Business information; Statistics; Context-specific information*
Actors involved	*11 partner, including Ciset (coordinated by the Department of Management of the Ca 'Foscari University), together with Ecipa, the Training and Services company of the manufacturing trade union of the Veneto and Friuli Venezia Giulia; the Center for Advanced Studies on Tourism of the University of Bologna; Institut za Turizam - the Croatian Tourism Institute; the Craft College based in Rijeka; the Municipality of Venice; the Municipality of Bari; S.I.PRO - the Territorial Development Agency of Ferrara; the Šibenik Tourist Office and DURA, the Dubrovnik Spatial Development Agency.*

Context and background

In many sectors, the use of open data has not yet reached its full potential. The current available Open Datasets are only a small fraction of what is available and often are of scarce interest for players (companies, governmental and non-governmental organisations, universities, and research centres). In Italy, a national programme for open data does not exist, primarily due to lack of resources for establishing a dedicated body for its governance. The low level of automation in data collection hinders the maintenance of data being updated and, at the needed quality, to be freely accessible at the national level. Furthermore, companies and organisations are often reluctant to share data as a common added value, even if they see it as a possible way of improving their performance.

Solutions adopted

Development of an “innovative dynamic knowledge system” to support decision-making processes related to tourism management, also with a view to exploit the tourism potential of less known cultural assets. Main outputs include a Smart Destination Ecosystem methodology to provide knowledge about visitors' flows and cultural heritage, a data hub to store information about the destination, and a dashboard to support the planning and implementation of pilot actions.

Reasons for cooperation

The project aims at developing, testing and assessing a set of tools that can help decision makers develop innovative strategies and policies for better management of cultural destinations of the Adriatic area, to increase sustainability and leverage local economies based on tourism.

Areas of cooperation

Sustainable cultural tourism.

Typology of data shared

Mobility flows related to tourism and other needs; impact of policy decisions and mobility plans.

Approach to data management and sharing

The project partners have adopted various solutions for data management and sharing, as well as for data analysis such as:

- The development of a set of tools to study and monitor tourist flows and to assess the impact of policies and strategic decisions concerning tourism.
- The establishment of a smart destination ecosystem in each of the pilot sites that is composed of key public and private stakeholders to test and assess the proposed solutions.

- The development of a common approach to be tested in the Smart Destination Ecosystems of the pilot sites, to leverage lessons and policy recommendations for the use of the tools.

Key challenges

Disperse datasets that are only partially public and open; heterogeneity of data; privacy and security issues; 5G availability.

Impact

- Increased awareness of local decision makers.
- Implementation of innovative policies able to better distribute visitors' flows in space and time.
- Innovative strategies to promote cultural heritage and valorise local productions.
- Create synergies between culture and tourism policies.
- Create stronger cross-border cooperation.

Success factors

Stakeholder engagement and active participation; data availability. (more information is available at this link https://www.unive.it/pag/fileadmin/user_upload/centri/CISET/documenti/SLIDES/Newsletter_SLIDES_EN.pdf).

Replicability potential

Medium. The initiative requires authorities to overcome two barriers: a) the setting up of the "Smart destination ecosystem", which requires an effective engagement and collaboration of private and public stakeholders and the adoption of a tool for local decision-making processes for tourism management; b) the availability of several sets of open data, which are not easily available at all touristic destinations.

Case Study: E

Carbon Neutral Tourism project (6Aika)

Geographical area	*Helsinki, Espoo, Vantaa, Tampere, Turku and Oulu (Finland)*
Purpose areas of data use	*Increase destination sustainability and accessibility*
Type of data users	*Private sector – Tourism Industry*
Source of data	*Other data – Business information; Statistics; Context-specific information*
Actors involved	*Experts, companies; city residents; workers and jobseekers; civil servants.*

Context and background

Tourism is an important field of business in Finland. However, the tourism industry is also a major producer of carbon dioxide emissions. Air carriage, hotels, land transport, food and the wide range of other services linked to tourism together produce a significant share of the world's total carbon dioxide emissions (*see also this link*). The six largest cities in Finland have been cooperating through the "Carbon Neutral Tourism" project to find a solution for reducing tourism-related carbon footprint in their destination sites. The project is part of the implementation of Finland's structural fund programme for sustainable growth and jobs in 2014–2020, that is characterised by an extensive cooperation across different cities, organisations and sectors, which engaged almost 4000 business. Since 2014, almost 60 projects were launched, making the cities more open, climate-wiser, and smarter. The themes of the pilot projects ranged from smart mobility, learning, health and wellbeing to the circular economy and energy efficiency.

Solutions adopted

The objective of the "Carbon Neutral Tourism" project was to develop smart solutions and operating models to reduce the travel industry's carbon dioxide emissions and increase energy efficiency. The project was mainly targeted to industry operators providing them with an understanding of the sector's carbon footprint and concrete solutions to address the reduction of emissions. A suitable set of indicators have been created, developing and combining relevant data sources, compiling these into a shared database and utilising smart solutions to transform data into useful and easily accessible information. The project also launched several calls for funding pilot projects which involved industry operators proposing the development and testing of digital tools for monitoring and assessing carbon footprint in travel and mobility domains and developing a CO2-TIS (Carbon Neutral Tourism Intelligence System) operating model for the six cities.

Reasons for cooperation

Combine data sources and technology to develop more accurate models, testing them in different contexts and applying multiple technologies to support carbon neutrality goals. Solutions are provided to the public administrations involved by private sector companies dealing with the design and provision of data-driven solutions. The companies in turn can use cities and regions as testbeds for further refining and scaling up their products and services.

Areas of cooperation

Private and public sector actors involved in the 6Aika-related projects mostly cooperate in the fields of mobility and environment to develop sustainable tourism solutions relying on data analytics to support policy-making.

Typology of data shared

The projects implemented under the 6Aika Carbon Neutral Tourism initiative mostly rely on data gathered from sensors and devices placed across the territory of the destinations. Some deal with data on tourists' mobility collected through cameras or numbers of access to transport services, others take into consideration air pollution and emissions, triangulating this data with the number and density of tourists in different areas to develop models and estimate the impacts.

Approach to data management and sharing

Regions and municipalities worked as data providers, making available their urban spaces as testbeds for new technologies and data-driven approaches. The latter mostly rely on AI and predictive algorithms to elaborate the

data mass gathered in relation to tourism mobility and carbon emissions. Data visualisation techniques were also adopted in order to draw actionable and easy-to-consult evidence to support policy-making (maps of carbon footprint, maps of environmental costs and impacts of tourism, etc.).

Key challenges

Common governance and joint strategy. Clear smart city model customer-focused, availability of open data, co-creation of data and services capability in authentic urban environment.

Impact

The different projects completed in the context of the 6Aika Carbon Neutral Tourism had the following impact:

- Several pilot projects funded under a call for pilot projects managed by the 6Aika initiative and aimed at developing tools for carbon footprint monitoring in transport and mobility services for tourists (e.g. continuous monitoring of tourists' flows and measurement of their carbon footprint impact; the development of impact indicators to assess the ratio between tourism carbon footprint and the revenues generated).
- Training courses, workshops and seminars on the ongoing results to create awareness among the key stakeholders.
- Open publications for key stakeholders and the public.
- The CO2-TIS operating model.

Several applications for carbon footprint of the touristic mobility monitoring and management tested and assessed in real urban environment, in line with the UN's SDGs of Responsible Consumption and Production and Climate Action.

Success factors

Pivotal success factor is the collaboration of the widest possible range of actors, in terms of both data providers and technology providers. Launching these projects in the context of a wider strategy aimed at supporting the tourism sector in accordance with the achievement of carbon neutrality is a key element and allows to link such programmes to wider initiatives and sources of funding at national and EU-level. Wide dissemination of results and benefits across multiple channels (websites, booklets, conferences) is crucial to raise awareness of the projects and possibly attract further interested stakeholders.

Replicability potential

To be successfully implemented, the initiative requires a very high level of commitment from local public and private stakeholders, who need to be available to openly share their datasets and make them available to developers of digital innovations for monitoring and managing carbon footprint of touristic mobility. So potential is limited.

5.3. Possible areas for stronger cooperation

Case studies offer a comprehensive understanding about the reasons for which these initiatives have been established, the choices that have been made by the actors in order to reach their objectives, and to what extent they have achieved a sustainable impact. Therefore, this analysis help outlining some key recommendations, as well as a reflection on the opportunity to establish a European Data Space for tourism. These recommendations are listed in the sub-section below.

5.3.1. Short list of recommendations

1. DMOs must be capable of leading local stakeholders towards a common strategy for the Smart Tourist Destinations. Ability to engage stakeholders is one of the most important success factors for the success of a smart tourism project.
2. DMOs must gather agreements and commitments founded upon the needs and expectations of different stakeholders (i.e. tourists, residents, local businesses, and public institutions). Lack of clear commitment is perceived as a key barrier for the successful implementation of data management solutions for tourism destinations.
3. DMOs must plan and develop continuous awareness actions to present to both decision makers and stakeholders the on-going achievements of the initiative. This is a necessary condition for earning and maintaining sustained commitment from decision makers and for leveraging upon investments for project scale-up.
4. A project control system for providing feedback to stakeholders must be established. This is extremely important as many DMOs often adopt traditional approaches without a sound, complementary project management approach as the foundation to the initiative. Such process should also include corresponding performance indicators. Each indicator should be measurable, realistic, granted the necessary resources, and consistent with the overall goal.
5. Before starting any data sharing initiative, DMOs must conduct – together with key stakeholders – a strategic diagnostic for taking stock of the context, the resources, and the potential of the touristic destinations they aim to support. A clear implementation strategy is fundamental for the success of the initiative. A possible approach could envisage the following three phases: (a) diagnosis to develop an inventory of available data, (b) publication of data in accordance with user needs, (c) identification of technological enablers needed to make the data sharing solution operational.
6. DMOs must outline the scope of the project, the relationships among people involved, and the participant roles. This is fundamental, especially when data providers are engaged.
7. Address lack of skills in public administration through the implementation of life-long training programmes.
8. DMOs must define measurable, realistic, and common objectives for the smart tourist destination. Such objectives are a necessary condition for the success of any project.
9. Measurement of impact through KPIs and prompt communication to all stakeholders are crucial to the success of the initiatives. Sharing KPIs also helps keep stakeholders engaged, while earning the commitment of decision makers in supporting the long-term development of the initiatives.
10. DMOs must set up a master data system, designing a protocol to continuously feed and consolidate it. Data availability and openness is the most important condition for the success of the initiative. Well-established networks of stakeholders previously engaged have more capability to develop significant open data portals and related digital solutions. Sharing the data is important to (a) improve the attractiveness of destinations and enhance the tourism experience, (b) help destinations in tourism management, and (c) enable businesses to re-use data for creating new products and services. To be effective in sharing data, it is very important to ensure data quality, traceability, and

interoperability, ensuring a blueprint complying with commonly agreed standards and principles such as the Minimal Interoperability Mechanisms (MIMs), SEMIC semantic interoperability, the INSPIRE and location interoperability data models, as well as the forthcoming interoperability framework for smart cities and communities (EIF4SCC). Finally, it would be valuable to integrate tourism data with other sectoral data (e.g. cultural heritage) in order to provide more information on the ecosystem. For example, data on tourist movements (including transportation means and provenience), data deriving from holiday and other short-stay accommodation booking platforms such as Airbnb, Booking, Expedia and TripAdvisor, and finally, self-reported data on preferences represent data typologies that may be of value to both the tourism and cultural heritage sectors, and should thus be integrated.

5.3.2. Further areas of collaboration and new data sharing paradigms

On top of the recommendations and possible areas for stronger cooperation listed above, more possibilities are linked to the creation of a Data Space for the European tourism sector.

Data spaces represent a new paradigm for data sharing, based on decentralisation and common standards, and in recent years the EU Commission has been encouraging their creation in multiple sectors. In some of them (e.g. mobility, agriculture or logistics), initiatives on data spaces have already reached interesting stages of maturity and also in the tourism sector some initiatives have already been launched (e.g. DATAESTUR in Spain or DATAtourisme in France, both described as projects in Annex B).

In a data space, participants make their data available – according to agreed modalities and formats – obtaining in turn access to the data made available by the other members of the data space. Data flows are governed by a 'soft infrastructure' (generally made available by specialised tech-providers) which is the sum of all the data sharing agreements and rules and determines which data can be accessed by which actor and in which specific modality.

The novelty and added value of data spaces lie in a decentralised system and a better tracking of access to and use of data. Data spaces adopt common standards for interoperability, not only at cross-border, but also at cross-sector level, unlocking synergies with other data spaces (e.g. mobility or media).

As a consequence, public administrations, tourism destinations and tourism industry players and companies would potentially have access to an unprecedented amount of information, useful to improve customer understanding, create new services and products, and feed algorithms with the necessary 'data mass' to create business models and develop better strategies. The decentralised setting of data spaces has the benefit of mutualising the computing capabilities and reducing technological burdens on individual participants, allowing actors of any size to join, as far as they share data according to the agreed standards and formats.

The establishment of a European Tourism Data Space (ETDS) could be a relevant opportunity for the entire European tourism ecosystem. It would also be an opportunity to boost smart tourism destinations, increasing sustainability and accessibility of tourism services as well as a way to anticipate the tourism trends described in Section 4.

To this end, the study team preliminarily identified some enabling factors for the successful launch of a European data space for the tourism sector[179]:

[179] It is relevant to mention that in February 2022, the EU Commission closed a call related to a Coordination and Support Actions (CSAs) for the development of data spaces in multiple sectors, including Tourism. It is therefore expected that in the context of the relevant CSA, the priority features, key components and also data sharing guidelines for a tourism data space will be further defined.

- A specific governance framework should be developed, in order to define principles and guidelines for data sharing. Whenever possible, it should include indications on data flow modalities, and data formats (e.g. accepted levels of data aggregation if possible, frequency of updates and maintenance) general and specific KPIs.
- Engaging the full spectrum of tourism sector stakeholders is crucial to generate added value and unlock new business potential through data sharing. This entails to design a data space also suitable for private companies (including SMEs). In this sense, public-private partnerships (PPPs) should be encouraged, exploiting the potential deriving from connecting private and public datasets.
- All current and past initiatives related to tourism data sharing and cooperation on data should be mapped in order to establish synergies and possibly include existing specific initiatives into the wider data space framework, progressively adding use cases.
- A system of incentives should be established in order to encourage a progressively wider range of stakeholders to join the data space and the tourism data space community participating in the data space should proactively advocate for it and work as a catalyser to continuously attract further actors. A progressively growing portfolio of use cases should be defined and made ready to be presented to possible participants, to clearly showcase the concrete benefits of data sharing.
- All aspects of data privacy and confidentiality should be thoroughly investigated and framed beforehand, to ensure smooth deployment and guarantee control and sovereignty over the data shared to each participant. To this end, the set-up of effective rules and fair contracts for data sharing should take into consideration the legislative and regulatory developments taking place at EU (e.g. GDPR, Data Act, etc.)
- The adoption of common standards should be a top priority to ensure interoperability of data and the creation of a trusted IT environment. To this end – while taking into consideration the specificities of the tourism sector – coherence and harmonisation with the other data spaces initiatives are key. The development of common standards and infrastructures should also consider the outcomes of previous experiences launched in specific contexts at national and international level (e.g. GAIA-X, IDSA, BDVA).
- Consistently with the previous item, a roadmap for scale-up should be developed and based on the overarching goal of connecting the ETDS with other sectoral data spaces. Already in the first phases of the deployment, key ‘partner dataspaces’ should be identified in order to coordinate the activities and ensure compatibility at a later stage.

Sustaining recovery and modernisation of the European tourism ecosystem, reducing data dispersion and fragmentation and promoting collaboration across the entire spectrum of stakeholders, from destinations to private sector companies, should be the goal of this initiative.

6. Recommendations and conclusions

6.1. Recommendations

Building upon the analysis of the cases of data use (see Section 2.1), the assessment of the key challenges in connection with the usage of data for tourism (see Section 2.2), the analysis of the 30 good practices (see Section 3) and the 10 cases of cooperation (see Section 5), and the predictions on future smart tourism trends (see Section 4), a series of recommendations have been developed for destinations willing to embark upon the journey of becoming or improving as smart tourism destinations. The recommendations are also the result of the insights collected during the study through the literature review and the interviews with experts.

These recommendations are meant as a preliminary form of guidance for destinations, which will be elaborated on in the upcoming phases of the "Smart Tourism Destinations" project, of which this report constitutes the first public deliverable.

The recommendations are structured into 6 key categories:

- Strategy
- Governance
- Skills
- Data
- Infrastrutcture and technology
- Entrepreneurship and business

Strategy	
Recommendation 1 - Prepare a data strategy and execution plan	
Description	In order to successfully make use of data, a destination has to ensure a variety of elements: trusted data sources have to be identified and accessed, the appropriate technological infrastructure needs to be put in place, the proper processes need to be designed and run, specific skills have to be sourced or trained. The coordination and advancement of these different elements appears to be particularly complex in the public sector area, where a lack of political and administrative continuity may shift priorities and disrupt ongoing initiatives. For this reason, destinations need to develop and agree on a smart tourism and data management plan. The strategy has to build upon an initial self-assessment aimed at understanding current strengths and areas for improvement. Its development should entail the effective participation of multiple departments of the destination (e.g. tourism, urban planning, environment, etc.), and other stakeholders, such as local businesses. Although each destination's plan will inevitably have its specificities, it is important to include a number of key elements, namely: the envisaged goals to be achieved over different time horizons, priority actions to be conducted on the short, medium and long term, a set of key performance indicators to monitor the progress of activities, an assessment of available funding sources including both EU and national programmes and opportunities, and the results of the self-assessment paired with a plan of activities to address any weaknesses therein emerged.
Challenges addressed	All
Trends anticipated	All

Recommendation 2 - Specialise on targeted groups	
Description	Thanks to data, each destination can understand who the returning or most likely travellers are. Building upon this insight, destinations need to ensure that their smart tourism efforts are geared towards the creation of personalised value propositions for their main targets. The development of a "customer journey" mapping could support destinations in the identification of tourists' needs and behavioural patterns – and related response actions to align the supply to the demand - across all key phases of interaction.
Challenges addressed	All
Trends anticipated	All
Recommendation 3 - Use data to inform the policy cycle	
Description	Make use of all available data to inform the policy cycle, including (i) policy planning (by providing an overview of the current situation with respect to a policy area); (ii) policy adoption and design (by offering evidence on the available options and the likely scenarios that can result from public intervention); (iii) policy implementation and application (by allowing to monitor the impact of policy intervention); (iv) policy evaluation and revision (by feeding into the final assessment of policies and their possible modifications).
Challenges addressed	All
Trends anticipated	All

Governance

Recommendation 4 - Create an innovation enabling environment	
Description	In order to develop innovative solutions, create a dedicated environment (e.g. innovation labs, innovation zones, etc.) where different organisations – including private businesses – can cooperate to address tourism challenges. In particular, set up sandboxes or public-private-partnerships to encourage discovery and testing of data-driven solutions which are particularly useful to solve specific data issues (e.g. on common standards or interoperability of data from different sources, or on the contractual agreements between city administrations, their in-house companies, or private data providers). Scaling up, in steps, from small-sized projects is the recommended approach.
Challenges addressed	- Data itself - Heterogeneity of tourism data - Technology and power
Trends anticipated	Technological enhancements
Recommendation 5 – Appoint a dedicated team or officer with responsibility for smart tourism	
Description	Identify a dedicated body or officer responsible for the planning and implementation of all smart tourism actions, including the definition of objectives and the measurement of their achievement. The team/officer should possess the skills and the expertise to understand and manage the technical, commercial, legal, political and social implications of dealing with data.
Challenges addressed	All

Trends anticipated	All
Recommendation 6 – Build a data sharing culture among stakeholders	
Description	The creation of a framework for improved data sharing is as important as it is difficult. Local public authorities play a critical role in encouraging and rewarding business-to-business and business-to-governments data sharing mechanisms, ensuring priority to privacy and confidentiality rules. Also, the implementation of public-private partnerships could facilitate data sharing agreements. Visibility should be provided to successful data sharing experiences, as they can increase awareness and showcase the achievements. Destinations need to encourage the set-up of data ecosystems where tourism data are shared and reused by different stakeholders. This can also be achieved by agreeing to common practices – such as adhering to the Code of Conduct for data sharing in tourism[180] – and actively sharing tourism-related data in a European Tourism Data Space.
Challenges addressed	- Data itself - Heterogeneity of tourism data
Trends anticipated	Technological enhancements
Skills	
Recommendation 7 - Ensure the involvement of a balanced mix of profiles	
Description	Making use of data requires human capital with the technical and business know-how. Moreover, subject matter experts are also required, as they are usually aware of the available data sources, they are able to quickly identify data quality issues, and they are also capable to identify appropriate actions to act upon with the insights obtained from data.
Challenges addressed	Human and artificial intelligence
Trends anticipated	Technological enhancements
Recommendation 8 - Source/train the required skills	
Description	According to the Transition Pathway for Tourism, the most needed skills in the tourism sector consist of entrepreneurship skills,[181] governance and strategic skills,[182] green skills[183] and finally digital skills[184]. The Digital

[180] At the time of writing, the Code of Conduct for data sharing in tourism is a work in progress and is expected to be agreed upon by a group of stakeholders under the coordination of the European Commission by 2022. As far as the European Tourism Data Space is concerned, a call for proposals for preparatory actions has been launched by the European Commission in the first quarter of 2022.

[181] "Entrepreneurship skills. The development of entrepreneurial capacity (marketing, budgeting, adaptability, innovation) can help tourism companies and SME owners to better develop their market segments, analyse their cultural, economic, environmental and social business contexts and their options for developing sustainable and resilient business plans." European Commission (2022). Transition Pathway for Tourism. Publications Office of the European Union, Luxembourg, p. 30.

[182] "Governance and strategic skills. […]in addition to the SMEs and all tourism industry, strategic and administrative skills should also be improved at the level of policy development and destination management. There should be awareness raising and learning opportunities on sustainability, digitalisation and strategic collaborative governance of tourism ecosystems for national and regional authorities and all levels of destination management organisations." Transition Pathway for Tourism. Publications Office of the European Union, Luxembourg, p. 30.

[183] "Green skills. Tourism actors need skills to understand the elements of environmental sustainability. These skills can help them meet the new policy requirements and recognise how addressing sustainability challenges could also provide new business opportunities with the increasingly environmentally-conscious customers. They also need skills to implement energy and resource efficiency measures, as well as how to deploy renewables on-site. These are local jobs that cannot be delocalised, and local skills development is necessary." European Commission (2022). Transition Pathway for Tourism. Publications Office of the European Union, Luxembourg, p. 25.

[184] "Digital skills. Skills for using and strategically integrating digital tools in work processes can facilitate developing and implementing more effective and better quality services to meet the changing demand and expectations of the customers. Tourism actors need both basic and advanced digital skills." European Commission (2022). Transition Pathway for Tourism. Publications Office of the European Union, Luxembourg, p. 25.

	Competence Framework for Citizens[185] unpacks digital skills into 5 key competence areas: (i) information and data literacy (browsing, searching and filtering data, information and digital content); (ii) communication and collaboration (interacting through digital technologies, sharing information and content through digital technologies, engaging in citizenship through digital technologies, collaborating through digital technologies, netiquette, managing digital identity); (iii) digital content creation (developing digital content, integrating and re-elaborating digital content, copyright and licenses, programming), (iv) safety (protecting devices, protecting personal data and privacy, protecting health and well-being, protecting the environment), (v) problem solving (solving technical problems, identifying needs and technological responses, creatively using digital technologies, identifying digital competence gaps). The technical skills required to make use of data are varied mostly fall within the first competence area. In particular, the professional profiles that are especially needed to manage data include: data managers, data architects, data algorithm specialists, IT architects, technology integration experts, data security specialists. Expertise can also be trained, borrowed, or outsourced. Collaboration across departments and organisations enables peer-learning. This approach also addresses the need for mixed technical and business skills.
Challenges addressed	- Human and artificial intelligence - Privacy
Trends anticipated	Technological enhancements
Recommendation 9 - Enhance skills through collaborations	
Description	Hiring technical experts may be problematic for public authorities, as they may offer less competitive salaries in comparison with the private sector. This may be partially overcome by establishing collaborations with other public institutions, building working groups that can share knowledge and know-how, especially at European level. Moreover, destinations should participate in collaboration platforms with companies to further catalyse the sharing of information, tools, best practices and knowledge.
Challenges addressed	Human and artificial intelligence
Trends anticipated	Technological enhancements
Recommendation 10 – Support cultural change	
Description	Assess and communicate the benefits of using data to inform the policy cycle. Indeed, by raising awareness on the benefits that evidence-based decision-making brings, a destination will promote a culture of sharing data, both internally (e.g. between different organisations or different departments within the same destination), and even externally (e.g. between public authorities and private companies).
Challenges addressed	- Tourist attitude and digital literacy - Human and artificial intelligence
Trends anticipated	Technological enhancements

[185] Vuorikari, R., Kluzer, S. and Punie, Y. (2022). DigComp 2.2: The Digital Competence Framework for Citizens - With new examples of knowledge, skills and attitudes, Publications Office of the European Union, Luxembourg.

Data	
Recommendation 11 – Improve the availability of online information	
Description	Each destination possesses context-specific information or statistics available in open data format.[186] They include information about population, economy and employment, environment, cultural institutions and heritage, transport and education. This wealth of information is freely and readily available and should be made known and exploited to the best possible extent, starting from improving the online availability of validated information on sustainable, accessible, or specifically targeted tourism offers.
Challenges addressed	- Data itself - Heterogeneity of tourism data
Trends anticipated	Socio-demographic changes
Recommendation 12 – Ensure the availability of a data sharing platform	
Description	The availability of public, accurate and up-to-date data and information should be promoted, starting from the initial data availability and then undertaking a continuous incremental and improvement process. Destinations need to ensure access to data, information and ready-to use analyses to support the identification of market trends and opportunities, the segmentation of the demand as a precondition of product development and diversification, and the effective use of resources and infrastructures. Interoperability and standardisation should be ensured to increase re-use and comparability of data and information, as well as to foster the adoption of technologies and data-based innovations.
Challenges addressed	- Data itself - Heterogeneity of tourism data
Trends anticipated	Socio-demographic changes
Recommendation 13 - Invest on metadata management	
Description	As the number and size of available data sources is growing at a fast pace, it is important to document and systematise information about data assets to facilitate the work of data scientists, promote their use in other branches of the organization, and avoid the risk losing their knowledge within the organisation in case they leave. This includes writing down semantics and definitions, documenting programmes and data quality insights.
Challenges addressed	- Data itself - Heterogeneity of tourism data
Trends anticipated	n/a
Recommendation 14 - Develop a strategy for external data acquisition and management	
Description	In order to complement the data available within the organisation, set out a strategy for the acquisition of external data, defining in particular the available resources to purchase data, to work on it and to ensure data quality. When defining available resources, particular attention will have to be paid to capital sourcing. Moreover, the strategy should also recognise the importance and proactively work on pursuing win-win data sharing partnerships.
Challenges addressed	- Data itself - Heterogeneity of tourism data

[186] For a detailed overview of the types of data sources – including context-specific information – please refer to the previous Section 2.1.3.

Trends anticipated	n/a
Recommendation 15 – Establish a set of indicators	
Description	A set of quantitative and qualitative indicators should be set-up, covering at least key areas such as digitalization level of stakeholders, destination inclusiveness and accessibility, social economic and environmental sustainability. Indicators must be used at all times to monitor smart tourism activities periodically, measuring their progress and results, and inform corrective actions.
Challenges addressed	- Data itself - Heterogeneity of tourism data
Trends anticipated	n/a
Recommendation 16 - Respect data privacy and security concerns	
Description	Data privacy and security can hinder data initiatives, especially when these entail cross-organisation, -domain or -border exchange of data. Privacy and security concerns among the public are bound to grow, as citizens and travellers look at how their personal data is used. A process to manage privacy and security matters is a prerequisite for any type of data use, ensuring the compliance with the legislative framework, including first and foremost the General Data Protection Regulation.
Challenges addressed	Privacy
Trends anticipated	Socio-demographic changes

Infrastructure and technology

Recommendation 17 – Open APIs	
Description	Make data available to third parties through open APIs. This contributes to the creation of data-driven solutions by private businesses, shaping the conditions for digital transformation towards innovation, while reducing costs and the risk perception (as private businesses bear the costs and risks of developing new solutions), especially in resource-constrained contexts. To the extent possible, use open schemas, vocabularies and standards to facilitate reuse.
Challenges addressed	- Data itself - Heterogeneity of tourism data
Trends anticipated	- Socio-demographic changes - Technological enhancements
Recommendation 18 – Set up a scalable and flexible IT infrastructure	
Description	In addition to setting up sandboxes, destinations should invest in scalable IT architectures through streamlined procurement procedures, in order to be prepared for the evolution of technology, including both open source and proprietary software. The IT solutions ought to fulfil different purposes for different internal stakeholders (e.g. decision-makers may want to have visualisation and simulation tools, data analysts may need data integration instruments, etc.).
Challenges addressed	Technology and power
Trends anticipated	Technological enhancements

Entrepreneurship and business	
Recommendation 19 – Catalyse the digital transformation of tourism businesses	
Description	Establish a supporting framework for the digitalisation of tourism business models, value chains and ecosystems. Policy measures might include: (i) Supporting travel-tech incubators, accelerators, mentoring sessions and other non-tech initiatives (e.g. tourism networks); (ii) Modernising regulatory frameworks to promote fair competition and encourage innovation; (iii) Supporting accessibility and affordability of digital technologies, tools and solutions for tourism businesses, including initial investment and ongoing costs; (iv) Facilitating increased access to high-speed broadband and other digital infrastructure for tourism businesses and visitors; (v) Encouraging collaborations between traditional and digital native enterprises to enhance knowledge sharing.
Challenges addressed	- Technology and power - Human and artificial intelligence
Trends anticipated	Technological enhancements

Sources: European Commission (2016)[187]; Pereira, R. L. et al. (2015)[188]; Höchtl, J. et al. (2015)[189]; OECD (2020)[190]; European Commission (2016)[191]; Micheli, M. (2020)[192]; HLEG (2020)[193] ; European Commission (2020)[194]; Invat.tur et al. (2015)[195]; Invat.tur et al. (2017)[196]; European Commission (2021)[197]; UNE (2018a)[198]; UNE (2018b)[199]; European Commission (2022)[200], Vuorikari, R., et al. (2022)[201].

6.2. Conclusions

The COVID-19 outbreak hit all stakeholders in the sector, generating extreme losses along the entire value chain.

In such a difficult context, however, the pandemic has also somewhat pushed destinations to increase the pace of digitalisation. The “smart” qualifier – frequently attached to “city” to describe the innovative use of technologies to optimise the use of resources and ensure effective and fair governance, sustainability and quality of life – now accompanies “tourism”, referring to the reliance on ICT of destinations, companies and tourists themselves. This allows data to be transformed into strategy.

[187] European Commission (2016). Big data analytics for policy making.
[188] Pereira, R. L., Sousa, P. C., Barata, R., Oliveira, A., & Monsieur, G. (2015). CitySDK Tourism API - building value around open data. Journal of Internet Services and Applications, 6(1).
[189] Höchtl, J., Parycek, P., & Schöllhammer, R. (2015). Big data in the policy cycle: Policy decision making in the digital era. Journal of Organizational Computing and Electronic Commerce, 26(1-2), 147–169.
[190] OECD (2020). OECD Tourism Trends and Policies 2020, OECD Publishing, Paris.
[191] European Commission, DG ENER (2016). Analysing the potential for wide scale roll out of integrated Smart Cities and Communities solutions.
[192] Micheli, Marina. (2020). Accessing privately held data: Public/private sector relations in twelve European cities.
[193] HLEG (2020). Towards a European strategy on business-to-government data sharing for the public interest. Final report prepared by the High-Level Expert Group on Business-to-Government Data Sharing (pp.1-112) European Union.
[194] European Commission (EC) (2020) Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions “a European Strategy for Data” COM(2020) 66 Final. Publications Office of the European Union, Luxembourg.
[195] Invat-tur, Generalitat Valenciana, Instituto Universitario de Investigaciones Turisticas, Universidad de Alicante (2015). Destinos turisticos inteligentes: manual operativo para la configuracion de Destinos Turisticos Inteligentes.
[196] Invat-tur, Generalitat Valenciana, Universidad de Alicante (2015). Guia de implantacion. Destinos turisticos inteligentes Comunitat Valenciana.
[197] European Commission (2021). The EU Pact for Skills – Skills Partnership for the Tourism Ecosystem. Available at: https://ec.europa.eu/social/main.jsp?catId=1517&langId=en
[198] Asociaciòn Española de Normalizaciòn (2018). UNE 178501:2018 Sistema de gestión de los destinos turísticos inteligentes. Requisitos.
[199] Asociaciòn Española de Normalizaciòn (2018). UNE 178502:2022 Indicadores y herramientas de los destinos turísticos inteligentes.
[200] European Commission (2022). Transition Pathway for Tourism. Publications Office of the European Union, Luxembourg.
[201] Vuorikari, R., Kluzer, S. and Punie, Y. (2022). DigComp 2.2: The Digital Competence Framework for Citizens - With new examples of knowledge, skills and attitudes, Publications Office of the European Union, Luxembourg.

Through desk-based research and interviews with experts in the field, the study has collected 200 cases of data use for tourism in many EU destinations. Contrary to the widely held belief that public sector institutions are slower at embracing innovation, public authorities appear to be very much conscious of the potential for tourism offered by data, as the majority of these cases were found to be implemented by the public sector.

In addition to this, the analysis of the evidence – including a selection of 30 good practices and 10 notable cases of cooperation – also provides an increased understanding of the main challenges faced by destinations when making use of data for tourism. These include:

- the issues to deal with the so-called four “Vs” of data: volume, velocity, variety and veracity;
- the significant investments required to set up the infostructure required;
- the need to accommodate different connection needs on behalf of the travellers, to make use of technologies but to avoid the so-called e-lienation risk (i.e. the negative impact of ICT on the tourist experience);
- as data lies at the core of smart tourism activities, privacy and security are a significant concern;
- the need to attract data experts in an industry that is traditionally characterised by relatively low-skilled workers.

At the same time, the study has shed light on the various reasons behind the use of data for tourism. Findings show how the key purposes of data use include the enhancement of the relationship with the tourist, the possibility of conducting data-driven decision-making processes, the improvement of the planning and operations of tourism services, and the increase of accessibility and sustainability standards.

The study has also identified and analysed the key megatrends that are going to act as drivers or obstacles in the path towards an increased use of data for tourism, namely:

- **socio-demographic changes**: as the population ages and digital-savvy or digital-native generations access the tourism market, the demand for smart tourism services is bound to increase.
- **technological enhancements**: similarly, as new technologies gain traction (e.g. 5G, 6G, big data analytics, cloud computing, recommender systems, artificial intelligence, augmented reality, virtual reality, facial recognition, etc.), the offer for smart tourism services is expected to diversity and grow.
- **sustainability and accessibility**: as people care more and more about sustainability and accessibility issues, tourism services will have to become greener and more digital, and acquire collaborative models.

This report provides an assessment of what destinations did in the recent past to become smarter, while offering an interpretation of the trends to come. Building on these, it proposes a set of preliminary recommendations for action across 6 key areas for destinations to take into account:

- **Strategy**: destinations should develop a smart tourism plan, defining their specialisation and ensuring the use of data to inform the entire policy cycle
- **Governance**: destinations need to foster the creation of an innovation ecosystem, ensuring the participation of a wide range of stakeholders especially through communication actions to advertise the benefits of sharing and reusing data
- **Skills**: to be able to extract value from data, destinations need to staff a balanced mix of experts on data-driven initiatives, to source or train staff on data management, to promote collaborations with other destinations, and finally to promote a data-driven culture
- **Data**: destinations ought to set out to exploit all readily available data, such as for instance statistics available through national or regional data portals. Moreover, they should also invest in metadata management, develop a strategy to acquire external

data, while paying attention to meeting privacy and security requirements and standards

- **Infrastructure and technology**: in order to contain IT costs, destinations should invest in flexible and scalable infrastructures, and create and maintain open APIs to encourage data reuse
- **Entrepreneurship and business**: finally, it is recommended that destinations contribute – together with other authorities responsible for policy-making such as regional and national governments – to the development of a supporting policy framework to catalyse the digitisation of tourism businesses and their uptake of new technologies

The remainder of the "Smart Tourism Destinations" project – of which this report constitutes the first public deliverable – will build upon these recommendations and develop a wide range of supporting instruments for all European destinations wanting to become or improve as smart tourism destinations.

7. Annex A – Good practices supplement

Annex A complements the previous Section 3, presenting the remaining 25 good practices.

Good practice 6:

Stavanger - Agile Piloting

Geographical area	*Stavanger (Norway)*
Purpose areas of data use	*Improve planning and operations of tourism services*
Type of data users	*Tourist destinations and public authorities*
Source of data	*User-generated data – Textual; Photo* *Other data – Business information; Statistics; Context-specific information*
Implementation period	*2019 - ongoing*
Actors involved	***City of Stavanger*** ***Nordic Smart City Network*** *(collaboration initiative joining five Nordic countries and 20 cities to create liveable and sustainable cities)*

Context and background

Stavanger is a southwestern Norwegian city. It is one of the Norway's most populous city, and the country's densest populated municipality. For long periods, the most significant city's industries were shipping, shipbuilding, and fish canning. During recent decades, Stavanger has become the Norway's capital of energy, due to investments in technologies and expertise linked to oil and gas, offshore, hydroelectric and wind power. Its focus renewable energies and the ambitious plan in combating climate change was accompanied by City Council's initiatives to promote a smart city transformation[202]. According to the Norwegian Citizen Survey, Stavanger is one of the most popular tourist destinations and a high-pressure area during the summer.[203] In 2019, it was the second most visited port in terms of number of passengers, and the third Norwegian city for conferences held. Key challenges such us demographic changes, recession in the oil and gas industry, improvement of the mobility system, and new sustainable tourism development approaches are currently faced and addressed by the City Council.

Solutions adopted

Since 2019, Stavanger adopted the urban development model "Agile Piloting" to accelerate the transition to a smart city, supporting the co-design of projects and innovative digital solutions with start-ups and small companies. It was introduced through the Nordic Network of Smart Cities, and already experienced in Helsinki within the Smart Kalasatama project to respond to similar needs[204]. According to the model's methodology, local stakeholders are supported to develop and test solutions during a period of six months in areas selected by the Municipality. Up to five solutions for each area are selected by the Municipality[205]. The first quick test focuses on the attractiveness of the Lervig park area to transform it in a social and cultural meeting place.

Key challenges

Stavanger's attractiveness differs from the Nordic capitals already characterised by stable tourist flows. Therefore, the challenge will be to promote tourism development throughout the year, while monitoring and addressing the negative impacts that the industry may generate. This is of upmost importance since tourism development should preserve local quality of life and be supported by citizens that should be intended as the

[202] More information on the actions Stavanger is undertaking against climate change is available at: https://www.globalcovenantofmayors.org/cities/stavanger/

[203] Innovasion Norgje. (2019). Key Figures for Norwegian Travel and Tourism.

[204] Nordic Smart City Network. (2020). Smart city update from Stavanger: Creating a better tourist destination through agile piloting. Smart City Update from Stavanger: Creating a better tourist destination through Agile Piloting | Nordic Smart City Network. Retrieved February 17, 2022, from https://nscn.eu/cityupdate/stavanger/agilepilot

[205] Stavanger Kommune. (2020, January 20). Kvikktest. City of Stavanger. Retrieved February 17, 2022, from https://www.stavanger.kommune.no/en/samfunnsutvikling/stavanger-smart-city/smart-city-projects/kvikktest/

primary beneficiaries of local development strategies. Moreover, the planning, implementation and evaluation of co-creation processes based on pilot projects requires the activation of multi-stakeholder mechanisms. The engagement of public, private, and communities therefore represent a key challenge.

Impacts

The adoption of the “Agile Piloting” model contributes to local attractiveness and efficient management of tourist flows, improving the experience of tourists and a positive resident's perception of tourism. Stavanger’s experimentation can also represent a benchmark for not yet advanced destination interested in developing smart tourism destination strategies. On the other hand, Stavanger can exploit lessons learnt from similar experiences developed in other Finnish cities focusing on mobility, health, and wellbeing. This project is also expected to foster the city’s collaborative culture, while arising knowledge and awareness about smart development practices. Finally, a model based on open competitions can foster creativity to define and meet common objectives of local development.

Replicability potential

The replicability potential is medium. Technologies and digital tools implemented are widely available in the market. On the other hand, a primary factor to ensure replicability is the availability of a proactive and collaborative local environment. Moreover, the focus on small projects within a wider smart strategy can represent a replication opportunity for small cities with limited budget.

Good practice 7:

Florence - Silfi Smart City Control Room

Geographical area	*Florence (Italy)*
Purpose areas of data use	*Conduct market analysis and inform decision making* *Improve planning and operations of tourism services* *Increase destination sustainability and accessibility*
Type of data users	*Tourist destinations and public authorities*
Source of data	*Device data – GPS, mobile roaming, RFID, Bluetooth, meteorological, Wi-Fi; Smart city*
Implementation period	*2021 - ongoing*
Actors involved	***Municipality of Florence*** ***Silfi SpA**, the in-house information systems and telecommunications network provider of the Municipality of Florence*

Context and background

Renaissance architecture, picturesque streets and palaces, iconic bridges crossing the Arno River and immense art collections make Florence one of the most visited tourist destinations in the world. In Summer 2021 only, the number of tourists who visited the city reached over 1.2 million, a figure that is still approximately 60% less than the tourist totals witnessed during pre-Covid periods[206]. In view of a gradual transition to pre-pandemic touristic flows, the local Administration has promoted several initiatives to improve its ability to manage congestion, tourist flows and over-tourism. This phenomenon has been a major challenge for the municipality to safeguard cultural heritage and reduce security risks for tourists and residents, with the latter become even a bigger concern after the pandemic outbreak[207]. Over-tourism affects the liveability of the city centre as residents are increasingly moving towards suburbs, both due to the gentrification processes and to the difficulty to live in a congested area, especially during peak tourist seasons. City's increasing attention in smart city and tourism practices was recently recognized by the inclusion of the city among the seven finalists competing for the 2022 European Capital of Smart Tourism title.[208]

[206] More information on tourism in Florence is available at: https://firenze.repubblica.it/cronaca/2021/09/21/news/firenze_in_estate_1_2_milioni_di_presenze_di_turisti_ma_non_basta_a_recuperare_sul_2019_-60_-318787221/

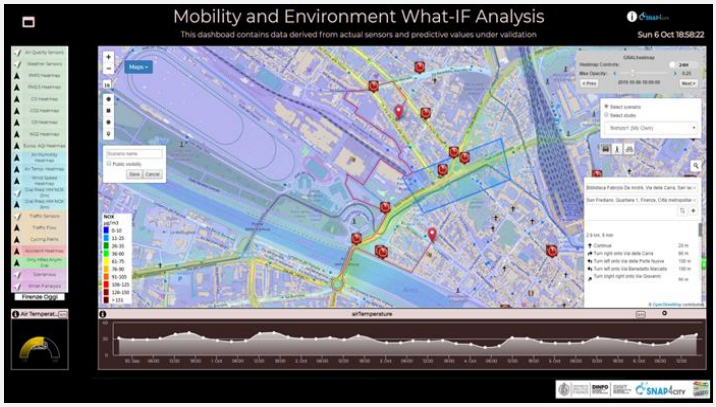
[207] Milano, C., Novelli, M., & Cheer, J. M. (2019). Overtourism and degrowth: a social movements perspective. Journal of Sustainable Tourism, 27(12), 1857-1875. Doi: 10.1080/09669582.2019.1650054.

[208] More information on Florence's participation to the Smart Tourism capital competition is available at: https://smart-tourism-capital.ec.europa.eu/news/seven-cities-competing-2022-european-capital-smart-tourism-title-2021-09-16_en

Solutions adopted

Florence developed a Smart City Control Room (SCCR), a physical space enabling a "cooperative model for managing the city and sharing data", connecting service operators (the city authorities, police department, traffic and parking management operators, public transport and utilities in the sectors of water, waste, and energy) and service providers (sharing mobility operators, taxi companies, tourist bus companies, etc.)[209]. City data and indicators are collected and aggregated as quickly as possible to produce analyses, indicators, forecasts, and simulations, and displayed through large monitors in which the status of the city is reported. Most of the SCCR dashboards are not accessible to the public as they contain sensitive data, while others are published through publicly accessible dashboards, providing for example parking availability forecasts, which is calculated through machine learning techniques. Data sharing amongst the parties is regulated through a combination of contractual obligations for service operators and mutual data sharing agreements with platform companies, which are obliged to share data to run a service in the city.[210] The digital solution that incorporates the tools used for the development of the SCCR of Florence is Snap4City[211], a platform to manage, aggregate, visualize and analyse data and information through Internet of Things, data analytics, and big data technologies. Snap4City has integrated and expanded the tool developed in the REPLICATE (Renaissance of Places with Innovative Citizenship and Technology)[212] project, funded by the Horizon 2020 Program to develop a solution for the Florence SCCR.

Figure 13 - A visual representation of the Snap4City program, one of the software used



Key challenges

The most challenging element for the construction of the control room concerns the implementation of a wide range of technological tools to collect and analyse data, such as those related to IoT, machine learning, and Big data. Also, the implementation of data sharing mechanisms with private data providers – as it was for the case of Waze, the community-driven GPS and navigational application – represents a key challenge in terms of interoperability and integration of data in the city infomobility system. Another challenge concerns the need to ensure that the restrictive contractual conditions related to compulsory data sharing mechanism doesn't affect competition between market operators[213]. Finally, the implementation of the solution requires high-level and multi-disciplinary expertise linked to each domain (e.g. mobility, energy, health and water) under analysis.

Impacts

The specific impacts on the tourism sector, they relate to the public administration's ability to manage city mobility (both related to private and public transport), public services and infrastructures, and to monitor environmental (water and waste) and social aspects (social media, citations, people flow). In the long-run, the wealth of data collected and analysed in the control room aims at becoming the pillar to inform data driven policy development and decision-making to improve city services and promote a sustainable and enjoyable fruition of the city.

Replicability potential

The replicability potential is medium. The smart monitoring system employs technological solutions that are readily available on the market. However, the impressive data collection and management system put in place requires a forward-looking vision and an incremental process of technology development. Moreover, partnerships with private data providers is a key issue to broaden the availability of data. Destinations already engaged in smart city transformation processes can be also facilitated in replicating the control room solution since infrastructures, technologies as well as skills could be – to a certain extent - already available. Other European cities, also thanks to the support of the European Commission, have already implemented similar projects.

[209] Information on data-sharing obligations is available at: https://ec.europa.eu/newsroom/dae/redirection/document/76268
[210] Information on data-sharing obligations is available at: https://ec.europa.eu/newsroom/dae/redirection/document/76268
[211] More information on Snap4City is available at: https://www.snap4city.org/drupal/node/531
[212] More information on REPLICATE (Renaissance of Places with Innovative Citizenship and Technology) is available at: https://replicate-project.eu/
[213] Information on data-sharing obligations and market competition of the SCCR is available at: https://ec.europa.eu/newsroom/dae/redirection/document/76268

Good practice 8:

Dublin - Smart Tourism Programme

Geographical area	*Dublin (Ireland)*
Purpose areas of data use	*Conduct market analysis and inform decision making*
Type of data users	*Tourist destinations and public authorities*
Source of data	*User-generated data – Textual; Photo* *Transaction data – Web search and webpage visiting; Online booking and purchasing; Consumer card transactions* *Device data – GPS, mobile roaming, RFID, Bluetooth, meteorological, Wi-Fi; Smart city* *Other data – Business information; Statistics; Context-specific information*
Implementation period	*2020 - ongoing*
Actors involved	***Dublin City Council*** ***Ruthdown County Council*** – Local authority in the Dublin Region ***Fingal County Council*** – Local authority in the Dublin Region ***South Dublin County Council*** – Local authority in the Dublin Region

Context and background

Dublin is the epicentre of Irish tourism, being the landmark of the Irish culture and a key hub for visiting the rest of the country. Dublin's tourism is characterised by cultural, sports and nature-related tourism (hiking or cycling). In 2019, the city has registered 6.6. million overseas tourists, which represents the 60% over the total number of foreign tourists at national level.[214] The City Council recently launched the ambitious "Smart Dublin Programme" to promote digital transformation and improve public services in several areas of public interest, including tourism. This programme – which is also aimed at supporting the recovery from the COVID-19 crisis - includes horizontal "smart city" actions, as well as specific smart tourism initiatives, which also led Dublin to be nominated among the finalist of the 2022 European Capital of Smart Tourism contest[215].

Solutions adopted

Tourism Programme to support the city's smart tourism transformation through projects, research and partnerships. The aim of the Programme is to identify cutting-edge innovations and technology trends in tourism that can inform current and future initiatives and stimulate the economic recovery. The Programme is focused on four key areas. The first one concerns the support to "Digital transformation", providing access to digital expertise and technology solutions to inform decision making. "Data assessment" regards the use of data and analysis to understand the tourism market and visitor behaviour to address sector recovery. Thirdly, "Digital Trail App Development" will support the development of mobile applications to enhance visitor experience, while "Visitor journey planning & Orientation" relates to the understanding of visitor navigation patterns to enhance visitor orientation and journey planning".[216] Among the first projects developed within this framework, it is worth mentioning the "Toolkit Digital Trail"[217], which provides a step-by-step guide to create digital trails and help foster the digitalization of tourism services. Stemming from this programme of work, partners are in the process of

[214] Information on data on tourism in Dublin is available at https://www.tourismireland.com/TourismIreland/media/Tourism-Ireland/Research/TI_FactsandFigures_2019.pdf?ext=.pdf

[215] Dublin is a finalist for European Smart Capital of Tourism 2022. Dublin City Council Culture Company. (2021, October 15). Retrieved February 17, 2022, from https://www.dublincitycouncilculturecompany.ie/news/dublin-is-a-finalist-for-european-smart-capital-of-tourism-2022

[216] More information on the projects within the Smart Tourism Database is available at: https://smartdublin.ie/smart-tourism/

[217] Fáilte Ireland (2021), Toolkit Digital Trail, Retrieved February 17, 2022, from https://www.failteireland.ie/FailteIreland/media/WebsiteStructure/Documents/Dublin/Digital_Trails_Toolkit.pdf

developing the "Heritage Trail Platform" for the Docklands area, enhancing the local industrial history through augmented reality and interactive technology.[218] Moreover, as part of the outputs related to the data assessment area, the Smart Tourism Programme releases an internal tourism monthly spotlight report[219] to support data-driven decision-making processes. It monitors Dublin's tourism economy recovery by using multiple indicators and up-to-date data collected from public and private sources. Data insights also feed the city's bulletin, *Dublin Economic Monitor*.[220]

Key challenges

The primary challenge concerns data collection, and the need to persuade private providers to share their data. This results in significant efforts to stimulate stakeholder's engagement and create a collaborative culture, highlighting the benefit derived from business to government (B2G) data sharing mechanisms.

Impacts

The Smart Tourism Programme is an ambitious action plan to turn Dublin into a world-leading smart destination. The range of solutions developed can enable the wider application of digital technologies and data driven approaches to support sector recovery and address the long-term tourism development. Solutions recently developed make the Irish capital a forerunner in the field of smart tourism and potentially a point of reference for other destinations in the EU tourism ecosystem, which aspire to become smart destinations and improve their data-mastering capabilities.

Replicability potential

The replicability potential is medium. The technological solutions promoted and adopted within the Smart Tourism Programme are readily available on the market, which would suggest a feasible implementation in other EU destinations. However, Dublin's Smart Tourism Programme is part of an ambitious and comprehensive Smart City project, which facilitates the implementation of smart tourism solutions and the enhancement of synergies between different sectors and stakeholders, generating economies of scale, especially in terms of technology and human resources.

[218] More information on the projects undertaken in Dublin by the Smart Tourism Programme is available at: https://cities-today.com/how-dublin-is-using-smart-tourism-to-rebound-and-reset/ and https://smartdublin.ie/smart-dublins-district-approach-fast-tracking-innovation-webinar/

[219] More information on the monthly reports released is available at: https://smartdublin.ie/smart-dublins-district-approach-fast-tracking-innovation-webinar/

[220] More information on the Dublin Economic Monitor is available at: https://www.dublineconomy.ie/

Good practice 9:

Lisbon – Historic Shops

Geographical area	*Lisbon (Portugal)*
Purpose areas of data use	*Improve interaction and engagement with the tourist*
Type of data users	*Tourist destinations and public authorities*
Source of data	*Transaction data – Web search and webpage visiting; Online booking and purchasing; Consumer card transactions* *Other data – Business information; Statistics; Context-specific information*
Implementation period	*2016 - ongoing*
Actors involved	***Lisbon City Council**, Economic and Innovation Department* ***Faculty of Fine Arts of the University of Lisbon** specifies the criteria used to define a Historic Shop, as well as surveys, visual identity and strategic consultancy.* ***Advisory Board** includes representatives from various local associations and business, cultural and academic sectors, as well as the general public. The representatives participate in the shop identification and selection process*

Context and background

Lisbon is the westernmost capital of the continental Europe, as well as the only one along the Atlantic coast. In 2019, it was the most popular Portugal destination for international tourists[221]. Its mild temperature makes it an ideal all year-round holiday destination, which encourages a slow tourism experience to enjoy the culture of hospitality of the inhabitants. Lisbon is a city of writers and navigators, with centuries-old traditions, monuments, and historic shops. It is collectively associated to melancholy - the famous "saudade" - which is uniquely combined with the city's cultural vitality and forward-looking vision. The gastronomic richness of the typical local cuisine characterised by the freshness of Atlantic fish, makes it also an ideal place to enjoy the Mediterranean cuisine in centenary taverns and contemporary restaurants. Because of Lisbon's geographical position, trade and commerce have historically played a prominent role, and still today significantly influence the city's economic and social life.

Solutions adopted

The "Historic Shops" project was launched by the City Council in February 2015 to promote the conservation and revitalisation of historic and traditional shops. The project has significant social and cultural implications, since these commercial activities generally have strong local roots, thereby playing a valuable role in social cohesion. The "Historic Shops" project features a web portal with an interactive map that provides citizens and tourists with information about commercial places. The portal also includes a series of short documentary films to increase the attractiveness of the involved shops. Thanks to the adoption of a unique visual identity and to the promotional actions carried out, the inclusion in the network of "Historic Shops" offers an important opportunity to generate business opportunities. In 2017, "Historic Shops" received the European URBACT award[222].

Key challenges

The project aims to give visibility to traditional and historic shops, ensuring the protection and transmission of their material and immaterial heritage to preserve the authenticity of the city. Based on the synergies between urban planning, economic activities, and cultural heritage, the initiative represents a unique strategy to encourage the emergence of new similar economic activities, creating new jobs and enhancing the attractiveness of the city. Moreover, the project enriches the local cultural offer, promoting new integrated tourism routes also in less known areas of the city.

[221] López, A. M. (2021, October 7). International tourists Portugal by region 2020. Statista. Retrieved February 17, 2022, from https://www.statista.com/statistics/1155142/international-tourists-portugal-by-destination/.
[222] More information on the European URBACT award is available at: https://urbact.eu/shops-history

Impacts
The project is designed to stimulate the local economy and generate employment opportunities, both within the historic shops sector, and in associated markets. It supports the full recovery from the crisis that hit hard particularly the historic centre of Lisbon during recent periods. The initiative also plays a key role in urban regeneration processes, being a pillar of an integrated and value-added tourism product to promote the city's traditions. Moreover, a strategy focused on local identity can represent a driver to increase domestic tourism, promoting the active commitment of citizens in local economic development, and encouraging social and territorial cohesion processes.
Replicability potential
The solution is highly replicable. The Digital solution implemented is widely available, while stakeholders should be interested since their engagement doesn't have costs or contraindication. Specific supporting actions to traditional shops represent a strategy that can be implemented by EU destinations to promote local development through cultural tourism. Similar networking projects can be also implemented in others commercial sectors. The "Historic Shops" initiative has attracted the interest of other EU cities, while it has been already replicated in Porto with the initiative "Porto with Tradition" (*Porto com Tradição*).[223]

[223] Gusman, I., Chamusca, P., Fernandes, J., & Pinto, J. (2019, October 15). Culture and Tourism in Porto City Centre: Conflicts and (Im)Possible Solutions.

Good practice 10:

Chambéry - Open data for eco-tourism

Geographical area	*Chambéry Region (France)*
Purpose areas of data use	*Improve interaction and engagement with the tourist* *Increase destination sustainability and accessibility*
Type of data users	*Tourist destinations and public authorities*
Source of data	*Other data – Business information; Statistics; Context-specific information*
Implementation period	*2016 - ongoing*
Actors involved	***Community Grand Chambéry*** ***Grand Chambéry Alpes Tourisme*** *(Tourism Office for Chambéry Montagnes)* ***Apidae*** *(Joint society of collective interest for tourism)* ***Opendatasoft*** *(Company providing a platform for data experiences and services)*

Context and background

Chambéry, is an alpine city in the French region of Auvergne-Rhône-Alpes region and the historical capital of the Duchy of Savoy. The town has steadily supported the tourism industry over the last decade, also joining cross-border collaboration programmes with neighbouring countries and provinces such as Cuneo (Piedmont, Italy)[224].. After the approval of the Digital Republic Law in 2018, Chambéry dedicated significant efforts to enhance the eco-tourism offer, also leveraging on the increased technological expertise acquired in the previous years. Chambéry's initiatives in eco-tourism assumed also centrality due to the tourists' behavioural changes resulted from COVID-19, which saw the increased propensity toward outdoor activities and "soft" means of transportation.

Solutions adopted

Chambéry developed an interactive map to promote eco-tourism by using its open data portal[225]. The map shows a selection of places easily accessible through soft mobility means of transport (walking or cycling) or public transport. It also includes tourists' attractions, bicycle paths, leisure areas. It was developed through the cooperation between public bodies - the administration of the Community Grand Chambéry, the Tourism office, and the cooperative society of collective interest Apidae Tourisme Scic SA – and a specialised offering data-driven solutions. This collaboration made possible the combination of different data (e.g. tourism related and data concerning bus and bicycle stops) to provide a solution to diversify the tourism offer.

Key challenges

The main challenge concerns the need to display in the interactive map updated information. Therefore, a dedicated team should be allocated to keep this tool practical. The portal also aims to include more data and information to offer an even comprehensive tourism product.

Impacts

Since the creation of the open data portal is relatively recent, there has been little time for measuring the impact. However, the initiative indicates how the simple combination of data and information related to different domains can support the creation of sustainable tourism products.

Replicability potential

The replicability potential is high. Critical factors for the implementation are the data gathering and the maintenance of the interactive map. Regarding replicability, one of the pivotal factors for the success of this

[224] S., R. (2019, June 23). Da Cuneo a Chambery per progetti europei. lastampa.it. Retrieved February 17, 2022, from https://www.lastampa.it/cuneo/2015/03/16/news/da-cuneo-a-chambery-per-progetti-europei-1.35284245

[225] More information on Grand Chambery's Data Portal is available at: https://donnees.grandchambery.fr/pages/page_accueil/

initiative has been the definition of a fruitful cooperation framework between public administrations and a private technological provider. At the same time, stakeholders engagement only concerns the fruition of the service.

Good practice 11:

Aruba – Biometric authentication

Geographical area	*Aruba (Kingdom of the Netherlands)*
Purpose areas of data use	*Improve planning and operations of tourism services*
Type of data users	*Tourist destinations and public authorities*
Source of data	*Transaction data – Web search and webpage visiting; Online booking and purchasing; Consumer card transactions*
Implementation period	*2016 - ongoing*
Actors involved	***Aruba Government*** ***Reina Beatrix Airport Authority NV.*** ***Royal Schiphol Group*** *(Airport owner and operator of Amsterdam airport)* ***KLM*** *(Flag carrier airline of the Netherlands)* ***Vision-box*** *(Multinational company specialised in government services, travel, border control, and smart facilities)*

Context and background

Aruba is an Antilles island located in Central America, and one of the four constituent countries that form the Kingdom of the Netherlands. During the last decades, Aruba registered a strong tourism development. The number of international tourist arrival have doubled since 1995, registering in 2019 almost 2 million arrivals; in the same year, the international tourism receipts reached more than two billion (USD), representing a fourfold increase from 1995[226]. According to the World Travel & Tourism Council, tourism accounts for almost 70% of GDP and 85% of total employment[227]. During the recent years, Aruba was committed in the promotion of smart technologies and innovation, with a view to support tourism development as a driver of the country's economy. The Government decided to strengthen its capabilities to manage tourism flows with the idea of smoothening the passengers' check-in and boarding, making it faster and more efficient.

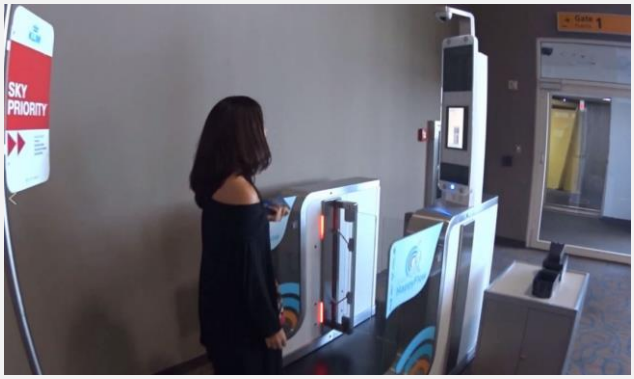
[226] Information on Aruba's increase in tourism is available at: https://data.worldbank.org/indicator/ST.INT.RCPT.CD?locations=AW

[227] More information on Aruba's tourism is available at: https://wttc.org/Research/Economic-Impact/moduleId/704/itemId/62/controller/DownloadRequest/action/QuickDownload

Solutions adopted

In 2015, the Aruba's airport launched the biometric technology "Aruba Happy Flow", a travel security system based on face-recognition cameras, which consists of a sequence of user-centric self-service touchpoints, from check-in to the boarding process. Passengers are only required to provide their identity at the check-in. At this step, their virtual identity will be created, allowing passengers to pass through all checkpoints using facial recognition.[228]

Figure 14 – Touchpoints' prototypes



Aruba Happy Flow combines the public border check process with the private passenger process at the airport. This is the first system of its kind, and it was created to speed up the flow, streamlining and safeguarding the passenger process. The implementation of Aruba Happy Flow was planned on progressive stages, initially involving KLM passengers flying from Amsterdam to Aruba, and then enlarging the testing to passengers travelling on other routes.[229] City authorities are already considering the extension of the Aruba Happy Flow solution to hotels and car rentals, with the aim to apply the biometric technology during the whole travel experience.[230]

Key challenges

The development of the solution required to balance the system's effectiveness and security means combining ISO and ICAO (especially ICAO DTC 1) standards concerning the quality of the images and the detection of spoofings. Data protection and data privacy issues were a precondition for the development of the solution. Indeed, the platform adheres to the international "privacy by design" principle, in compliance with the GDPR privacy compliance standards[231]. As concerns the extension of the biometric technology to car rental services and hotels, this would require addressing their process and regulatory requirements.[232]

Impacts

Aruba Happy Flow contributes to reducing congestion in the airport, while providing a safer, efficient and faster travel experience for airport. At the same time, this biometric technology allows local authorities to have a real time overview to monitor passengers' flow, to improve oversight, security infrastructure efficiency, and delivery of operations.[233] Moreover, especially during the COVID-19 pandemic, the solution allows airport personnel to operate at a significant safety distance from passengers, minimizing the potential risk of infections. The solution could be also extended to other passengers' credentials, such as Covid-19-related certificates.

Replicability potential

The replicability potential is medium. The biometric technology used is readily available and has been already tested. On the other hand, there are several aspects that make the implementation and replicability challenging. Firstly, the joint participation of different public authorities and private operators. Moreover, for bigger airports or large areas to control, the system becomes harder to design and function, especially considering the need of tracking the user at any time, alongside long distances, in multiple areas.

[228] En, L. M. (2021, December 14). How Aruba is creating a seamless travel experience with facial recognition. GovInsider. Retrieved February 17, 2022, from https://govinsider.asia/innovation/annet-steenbergen-how-aruba-is-creating-a-seamless-travel-experience-with-facial-recognition/

[229] Aruba happy flow lays foundations for European preclearance. Future Travel Experience. (2016, June 24). Retrieved February 17, 2022, from https://www.futuretravelexperience.com/2015/06/aruba-happy-flow-lays-foundations-for-european-preclearance/

[230] More information on the bio-metric technology implementation is available at:https://wttc.org/News-Article/WTTC-and-Government-of-Aruba-partner-for-the-world-s-first-air-and-non-air-seamless-journey-pilot-using-biometric-technology

[231] More information on GDPR privacy standards is available at: https://wttc.org/Portals/0/Documents/Reports/2019/Security%20and%20Travel%20Facilitation-Seamless%20Travel%20Journey-Emerging%20Model%20Overview%20Findings%20Report-Nov%202019.pdf?ver=2021-02-25-182755-503

[232] More information on regulatory requirements is available at: https://wttc.org/Portals/0/Documents/Reports/2019/Security%20and%20Travel%20Facilitation-Seamless%20Travel%20Journey-Emerging%20Model%20Overview%20Findings%20Report-Nov%202019.pdf?ver=2021-02-25-182755-503

[233] More details on Aruba Flow are available at: http://www.arubahappyflow.com/

Good practice 12:
London - Digital LITH

Geographical area	*London (UK)*
Purpose areas of data use	*Improve interaction and engagement with the tourist*
Type of data users	*Tourist destinations and public authorities*
Source of data	*Device data – GPS, mobile roaming, RFID, Bluetooth, meteorological, Wi-Fi; Smart city*
Implementation period	*2015 - ongoing*
Actors involved	***Transport for London**, a local government body responsible for the transport network in London*

Context and background

London is a multicultural and exciting city offering some of the world's most popular sights and attractions. Tourism is one of the London's main industries; the number of tourists has increased from 11 million in 2002 to more than 21 million in 2019[234]. Despite being among the most visited world's tourism destinations, the city is committed to a continuous process to improve the sector, mainly through the development of new technologies, the analysis of tourists' behaviours, and the creation of new products to meet their needs. On the other hand, despite the city's brilliant connectivity, the large number of tourists and attractions located throughout the city can impact the effective management of time and information during the visit.

Solutions adopted

Legible London is a wayfinding project designed to provide information to move around the city quickly and easily, relying on a constantly expanding range of products including totems, waymarker bollard, finger posts, and maps. Several signs also incorporate intelligent transport devices, such as interactive displays, touch screens, and ticket machines. The city has already installed over 1700 signs in strategic areas, which covered the majority of the city's 32 boroughs[235]. The system is integrated with public transport information (i.e. bus stops, tube stations, and taxi ranks), promoting inter-modality solutions to allow users to quick identify the best routes to specific places and attractions. The integrated smart mobility project also posed special emphasis on accessibility and inclusiveness issues, providing to travellers with mobility impairments key information such as steps, pavement widths and pedestrian crossings.

Key challenges

Legible London's intuitive and effective signage system is designed to encourage people to walk more and to adopt sustainable mobility solutions, through a better provision of public information and signage. The strategy relies on detailed research about movement behaviours in London, showing that more than half of the central London journeys are quicker to walk compared with other means of transport. Furthermore, the analysis of the use of the Legible London's signs allows to understand users' behaviours and to collect data and information to inform policies and projects for the development of the urban mobility. In this respect, the initiative contributes to make urban travels greener and to make London easier to understand for different kinds of walkers, be they residents or tourists.

Impacts

The provision of reliable and coordinated walking information to encourage people to join the city by walking offers a wide range of social benefit, including public health, personal safety, and greater street life. It also significantly reduces transport pressure and pollution and encourage a slow and sustainable mobility. At the same time, the solution stimulates the local economy, improving links to business and less known places. In addition to the benefits that increased walking brings, the project also provides a unique walking identity for the

[234] Elaboration of data from Visit Britain, available at https://data.london.gov.uk/dataset/number-international-visitors-london
[235] More information on Legible London is available at https://tfl.gov.uk/info-for/boroughs-and-communities/legible-london

city, impacting on city-users' public awareness. This is also the reason why time is used as the scale to show proximity with places, so that users can gain the confidence to try longer walking journeys.

Replicability potential
The solution is highly replicable. Technological availability and stakeholder's engagement doesn't appear to be challenging. The solution can be mainly implemented in large and highly populated urban contexts, to respond to the need to foster sustainable mobility and intermodality between transport modes. As with other innovative digital projects, the initiative can be reproduced through an incremental approach, starting from the available data and transport infrastructures to launch a medium and long-term mobility project. Similar solutions have been introduced also in other cities around the world. Examples include Rio de Janeiro in Brazil (Walk Rio – Intuitive pedestrian journeys), Madrid in Spain (Leer Madrid – Designing an accessible city) and Cleveland in the United States (Seamless Cleveland – Creating seamless journeys to help revitalise a city).

Good practice 13:

Kyoto – Sightseeing Comfort Map

Geographical area	*Kyoto (Japan)*
Purpose areas of data use	*Improve interaction and engagement with the tourist*
Type of data users	*Tourist destinations and public authorities* *Private sector – Tourism Industry*
Source of data	*Device data – GPS, mobile roaming, RFID, Bluetooth, meteorological, Wi-Fi; Smart city*
Implementation period	*2020 - ongoing*
Actors involved	***Kyoto City Tourism Association*** *(Offers travellers guidance and information on prefectural sightseeing, among other services)* ***KDDI Corporation*** *(Japanese telecommunications company. It is one of the main cell phone and mobile services provider with 40 million of clients in the country)* ***Gike*** *Shoji International (the leading provider in the field of geomarketing solutions in Japan)* ***Yahoo Japan Corporation*** *(Information & Communication company that provides e-Commerce business, Internet Advertising business and other information technology (IT) services in order to develop an IT society)*

Context and background

In recent years, Japan has registered a strong tourism development. According to UNWTO, in 2010 the country registered 8,6 million international tourist arrivals, which increased in 2019 to more than 32 million, reaching an all-time peak. In the same period international tourism receipt rose from almost 13.200 to more than 46,000 million USD.[236] Kyoto, one of the most popular Japanese destination, saw significative increasing trends as well. It registered in 2019 more than 53 million visitors, leading to the Kyoto Prefecture record of almost 88 million people, in both cases driven by domestic tourists.[237] Kyoto hosts the most famous Japanese attractions. It is known for its religious architecture as well as for being a global point of reference for the art of Japanese gardens.

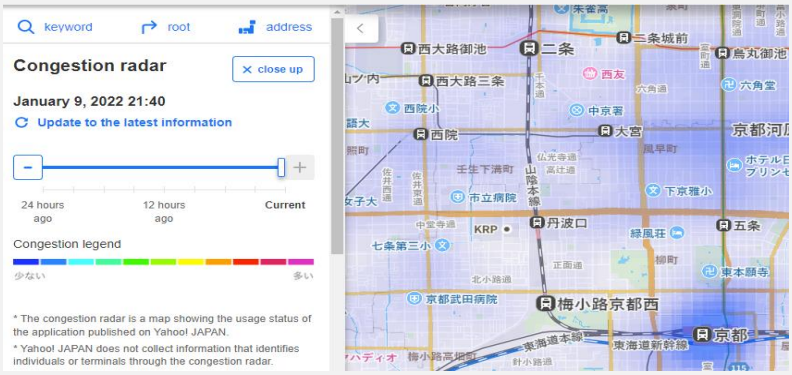
[236] The information was collected through the dashboard on country profiles with data on inbound tourism launched by the World Tourism Organization (UNWTO) and available at: https://www.unwto.org/country-profile-inbound-tourism

[237] Odanaka, Hiroshi. "Kyoto Pref. Had Record 88 Mil. Visitors in 2019; Virus Pushing Pivot to Domestic Tourists." The Mainichi, 18 June 2020, https://mainichi.jp/english/articles/20200618/p2a/00m/0na/025000c#:~:text=According%20to%20the%20Kyoto%20Prefectural,the%20most%20visitors%20on%20record.

Solutions adopted

The Kyoto Sightseeing Comfort Map applies digital solutions such as cameras, sensors, radars and Artificial Intelligence to monitor and predict flows of visitors throughout the city. AI techniques are used to collect and analyse data regarding visitor density through the geolocation of personal mobile devices. Data are used to develop a global indicator of tourist density (Tourism comfort level) at city level, which indicates tourism comfort level, and suggest specific routes based on the level of congestion of the area[238]. The comfort level can be checked in each city area by time zone through a coloured icon legend (image 1). Before visiting any touristic attraction, visitors can use other tools to monitor the level of congestion of specific areas, namely the congestion forecast based on a big data analysis tool, live camera images installed throughout the City, and the congestion radar providing almost real time information based on smartphones location.

Figure 15 - Congestion radar



Key challenges

The main challenges concern the forecast accuracy and the protection of visitors' privacy. Data comparability, especially during the COVID-19 pandemic, was ensured through the submission of integrated questionnaire. As concerns the protection of visitors' privacy, several measures have been put in place, including the use of video recording at a reduced resolution, and the possibility to use them only for the Kyoto Sightseeing Comfort Map purposes. Moreover, the collection of smartphones' information doesn't allow the attribution to specific individuals or terminals.

Impacts

This solution is aimed at improving tourists' experience, managing congested areas to avoid and address overtourism. The tool supports the activity and experience of a wide range of actors. Local authorities enhanced their planning and decision-making ability by monitoring real time data about flows' movement. Tourists and city users can easily obtain key information on when and how join the city in a more comfortable way, while services providers can orient their strategies through the understanding of movement' flows. The development of the tool also envisaged training programmes for local businesses to support their digitisation and social media expertise. This resulted in an increased digital presence as well as in an enhanced visibility ensured through map's promotional activities.

Replicability potential

Medium replicability potential. Even if the digital solutions adopted are available and already tested, the widest coverage of the city should be ensured. This also requires the engagement of private data providers. There are examples worldwide of similar practices such as Helsinki Heat Map, and Gothenburg destination data platform. The main drivers for the successful development of the solution are linked to technology, open data, privacy issues, and collaboration between public and private stakeholders.

[238] Rehow. (2020, November 19). Kyoto City about the release of "Kyoto tourism comfort map" on the Kyoto Tourism Official Site "kyoto tourism navi". Japan NEWS: https://re-how.net/all/767211/

Good practice 14:

France - DATAtourisme

Geographical area	*France*
Purpose areas of data use	*Conduct market analysis and inform decision making*
Type of data users	*Tourist destinations and public authorities* *Private sector – Tourism Industry*
Source of data	*User-generated data – Textual; Photo* *Transaction data – Web search and webpage visiting; Online booking and purchasing; Consumer card transactions* *Device data – GPS, mobile roaming, RFID, Bluetooth, meteorological, Wi-Fi; Smart city* *Other data – Business information; Statistics; Context-specific information*
Implementation period	*2020 - ongoing*
Actors involved	***Ministry for the Economy, Finance and Recovery*** ***Etalab (****Department of the Interministerial Digital Directorate that coordinates the design and implementation of French data strategy)* ***Atout France*** *(French tourism development agency)* ***ADN Tourisme (****French federation of tourist offices)* ***Ikoula (****a specialist in web hosting, dedicated servers and cloud computing****)***

Context and background

France is one of the world's most popular destination. According to the national "Recovery plan and transformation of tourism", in 2019 the country was the first global tourism destination, registering 90 million international tourist arrivals. Tourism plays a major role in the French economy, representing close to 8% of the GDP and employing two million jobs when considering direct and indirect tourism jobs[239]. The country presents a diversified tourism offers, which encompasses 46 world heritage sites designated by UNESCO, and an extraordinary presence of resources of cultural and natural interest, museums and festivals.[240] Tourism significance of the country is ensured by a constant improvement process of the national ecosystem focused on digitisation, sustainability and diversification of the offer.

Solutions adopted

The Directorate General of Enterprises (Minister of Economy and Finance) in partnership with ADN Tourisme (National Federation of Institutional Tourism Organizations), developed the DATAtourisme national initiative. It represents the first national centralised platform of tourism open data. The initiative, which involves the France's office networks of tourism as well as the regional tourism committees, aims to facilitate access to tourism data and information through a national Open Data platform. The platform is based on specific harmonisation procedures allowing the full data comparability and interoperability within the national tourism ecosystem[241]. Currently, DATAtourisme gathers data from nearly 40 local databases that are managed and supplied by more than 1200 tourist offices and other local organisations. In addition to the statistical use of tourism data to support the definition of public policies and business strategies, the tool supports promotional and marketing actions at destination level, also providing visibility to services and attractions.

[239] More information on impact of Tourism in the economy is available at the OECD iLibrary: https://www.oecd-ilibrary.org/sites/99da245e-en/index.html?itemId=/content/component/99da245e-en
[240] More information on the Tourism Programme of the French government was released in November 2021 and is available at: https://www.diplomatie.gouv.fr/IMG/pdf/destinationfrance_cle0f5dc4.pdf
[241] Information on the DATAtourisme initiative is available at: https://www.datatourisme.gouv.fr/

Key challenges
The main challenge concerns the active participation of data providers, even if the legal obligations linked to the 2016 Law for a Digital Republic fostered tourism organisations' commitment. At the same time, the management of different dataset at regional and local level, together with the digitalization of a significant and ever-increasing number of points of interest, require a constant effort to ensure the representativeness of the national offer. This also result in a challenge related to data quality and reliability, since data populating the DATAtourisme platform must meet various criteria such as accuracy, completeness, geolocalisation and interoperability, in a view to allow comparability and ease of use. Finally, a challenge is represented by standardisation issues, which is based on a shared periodically updated ontology also to enrich the tourist experience.
Impacts
DATAtourisme allows inter-operability and data sharing between different territories and tourism sub-sectors. Thanks to DATAtourisme, more than 400.000 points of interest and events have been published, providing an integrated tourism service covering almost 100 departments spread over 14 administrative regions[242]. Moreover, this solution facilitates the establishment of a data space for the tourism sector, which is connected to other sectoral spaces, such us mobility and cultural heritage, lays the foundation of a comprehensive open data strategy. This wider data availability also supports the creation of new tourism products and services based on a data driven approach, which is based on the analysis of tourist behaviours as a prerequisite to meet their needs and expectations. The platform can also allow the monitoring of tourism flows and the management of congested places and attractions.
Replicability potential
Medium replicability potential. The successful implementation of similar initiatives should be based on a standardised tourism ontology to harmonise data collected from different providers. In addition, key aspects include the availability of technical skills to ensure an appropriate collection and transmission of data, as well as the creation of a collaborative environment to encourage data sharing.

[242] More information on DATAtourisme available at: https://info.datatourisme.gouv.fr/

Good practice 15:

Valencia – Intelligent Tourist Destinations

Geographical area	*Valencian community (Spain)*
Purpose areas of data use	*Improve planning and operations of tourism services* *Increase destination sustainability and accessibility*
Type of data users	*Tourist destinations and public authorities*
Source of data	*Other data – Business information; Statistics; Context-specific information*
Implementation period	*2014 - ongoing*
Actors involved	*Valencian regional government* ***Invat·tur*** *(Valencian Institute of Tourism Technologies) (develops research projects to improve the competitiveness and sustainability of the tourism model of the Valencian Community)* ***University of Alicante*** ***Mabrian*** *Technologies (Company whose mission is to introduce the data culture into tourism's decision-making process)*

Context and background

During the recent years, tourism has become a key sector for the development of the Valencian Community. In 2019, it registered 29 million tourists, resulting in 179 million overnights and generating more than 13 million euros. Tourism represents 15.5% of the GDP in the regional economy and almost 16% of the total employment[243]. Considering the key role of tourism in the economy, tourism destinations of the Valencian Community identified the need to progress in terms of tourism planning and management, leveraging on the latest technological developments and looking for digital and innovations solutions to address the emerging tourism challenges and trends.

Solutions adopted

Since 2014, the Valencian Institute of Tourism Technologies (Invat·tur) is developing the project "Intelligent Tourist Destinations Comunitat Valenciana" (DTI-CV)[244]. The main objective of the project is to define a strategic framework to adapt the Smart City concept to tourist destinations, defining a proposal of methods and technologies to accompany the configuration of Smart Tourist Destinations in the Valencian Community. Several toolkits were developed to support destinations in the adoption of digital technologies or data driven decision making process, accessibility, governance or climate change adaption. Also, a network of Intelligent Tourism Destinations was created to foster dialogue and collaboration between stakeholders in a view to support the planning and management of tourist destinations based on the overall DTI-CV model. Moreover, the project developed several pilot actions focused on smart tourism solutions, including the Booking Monitor, a tool to measure trends in hotel reservations according to sales channel, market of origin, and average price. Other key tools are under development, namely the Social Analytics Destinations to monitor the presence of tourism destination on social media, as well as the Computer system that allows tourist destinations to compare destinations' indicator with agreed standards. Other key projects focus on specific products and areas, including natural spaces and beaches, with the objective of designing digital services to implement smart planning and management methods in areas with touristic relevance.

Key challenges

The key challenge is to establish a comprehensive framework and an adaptive model with a regional perspective to guide the transition to smart tourism destinations, addressing the needs of different urban, rural and seaside destinations. This would also require the capacity to engage a wide range of stakeholders in the definition of the

[243] Turisme Comunitat Valenciana; Generalitat Valenciana; (2020). Evolució de l'Activitat Turística a la Comunitat Valenciana 2020 (http://www.turisme.gva.es/tcv/tcv2020/1-Actividad_CV2020_c.pdf)
[244] More information on the initiative is available at: https://invattur.es/

most appropriate and context-specific methods and technologies. The project also requires integration with local tourism development strategies, and the alignment of sector stakeholders around a common development vision, while providing them the required expertise to participate in a complex digital transformation process.

Impacts

The Intelligent Tourist Destinations model promotes an evolution to a smart tourism destinations paradigm, intended as a key pillar for the competitiveness and long-term prosperity of the sector. The project also supports the sector recovery from the COVID-19 crisis, while providing digital tools and expertise to understand and meet tourists' needs and expectations. Long-term benefits are also linked to the evolution towards a more integrated, sustainable and resilient tourism model, which foster open innovation, stakeholder engagement, new business opportunities and employment opportunities linked to tourism technologies.

Replicability potential

Medium replicability potential. The willingness of stakeholders and their propensity to be involved in a digital transformation process represent a key prerequisite for the effective development of the project. Moreover, factors such as technological infrastructures and data availability are pivotal to assess the replicability's potential.

Good practice 16:

Brussels – Neighbourhood Walks

Geographical area	*Brussels (Belgium)*
Purpose areas of data use	*Improve interaction and engagement with the tourist*
Type of data users	*Tourist destinations and public authorities*
Source of data	*User-generated data – Textual; Photo* *Device data - GPS, Mobile roaming, RFID, Bluetooth; Meteorological; Wi-Fi; Smart city (pollution, traffic; waste, etc.)*
Implementation period	*2014 - ongoing*
Actors involved	***Brussels City Council*** ***Visit.brussels –*** Tourism and convention bureau of Brussels

Context and background

Brussels is located at the heart of Europe and it is the centre of the European Union institutions. In the past few decades, the city developed a cosmopolitan community which coexisted seamlessly with the local Belgian residents. The EU institutions increased Brussels' touristic attractiveness, creating new urban tourism paths and attractions. The area of the European Parliament, for instance, has become a primary urban socio-economic centre, offering tourism experiences, and enriching traditional touristic circuits and sites, such as the Royal Palace. However, apart from the old city centre and the EU district which attracts most of the tourists flows, many neighbourhoods of the Belgian capital remain unexplored by tourists, despite the promising tourism potential of districts, such as Anderlecht. For this reason, the City Council was looking for an innovative solution to encourage tourists and residents to discover alternative and unexplored places of the city

Solutions adopted

'Neighbourhood Walks' is an interactive platform comprising 16 touristic circuits across the city, promoted by the local tourism bureau Visit.brussels. The solution enabled the administration to encourage visitors to discover Brussels' history, architecture and society, as well as to decentralize tourism flows in various neighbourhoods[245]. Tourists and locals can make autonomously a tour using the map freely available on the website, which provide the description of the point of interests in several different languages. On the other hand, they can be also accompanied by official guides of a local non-profit association, recognized and subsidized by the Flemish Community and by the Flemish Commission of the Brussels Regional Government. The tours are led by historians and/or city experts, and offered in multiple languages, including also activities such as greetings with locals. All 16 routes are thematic and are systematically updated by a core team of experts of Visit.brussels.

Key challenges

The main challenge concerns the continuous extension of available itineraries, to extend the coverage in terms of cultural themes and city neighbourhoods. Challenges may also concern the need to test the itineraries before releasing and the possibility to create collaborations with shops, cultural attractions, and tourism services providers to increase the attractiveness of the tours.

Impacts

The new proposed touristic circuits widen the range of districts and experiences that tourists can enjoy when visiting Brussels, leading visitors to discover attractions outside the usual tourism places and attractions. This can also bring additional economic opportunities to those neighbourhoods. With a long-term perspective, this approach could foster the tourism of repeaters and extend the tourism season, contributing to the quality of life of residents as well as to improvement of tourism-related infrastructures in areas not fully exploited from a tourism point of view.

[245] More information on Neighborhood walks: Discover Brussels' is available at: https://visit.brussels/en/article/neighbourhoods-walk-discover-brussels-districts

Replicability potential
The replicability potential is high. The Neighbourhood Walks employ digital solutions that have already been used and that are readily available on the market. At the same time, stakeholders' engagement doesn't represent a key issue for the implementation of the initiative.

Good practice 17:

Buenos Aires - Smartvel's technology

Geographical area	*Buenos Aires (Argentina)*
Purpose areas of data use	*Improve interaction and engagement with the tourist*
Type of data users	*Tourist destinations and public authorities*
Source of data	*User-generated data – Textual; Photo* *Other data – Business information; Statistics; Context-specific information*
Implementation period	*2019 - ongoing*
Actors involved	***Buenos Aires City*** ***Smartvel*** *(Technology company that builds data solutions for destinations)*

Context and background

In 2019, Buenos Aires registered 2.7 million international tourist arrivals, spending approximately 2 billion US dollars[246]. It plays a key role in the national tourism. In 2019, Argentina accounted for 3.4 million international tourist arrivals, which represent more than the 20% of the total number registered in South America.[247] Buenos Aires is an urban tourist destination with a pleasant climate. The tourism offers is focused on the variety of its cultural offer, many green and natural spaces, and a vibrant tradition of gastronomy and events, Recently, the City Government has promoted the diversification of the tourism offer, including new spaces and activities related to cultural tourism.[248] Moreover, due to the increasing role of tourism for the city's economy, Buenos Aires was looking for digital and innovative ways to collect and use data, to undertake a Smart Tourism Destination transition process.

Solutions adopted

The city of Buenos Aires has adopted a technology to collect from a wide number of different sources, categorise, and geolocalise tourism information about point of interests, events, restaurants, guided tours etc. Data management is based on Big Data and Machine Learning techniques, also allowing to perform a validation processes before publication. The solution was implemented within the official tourism website and mobile application of the city, allowing users – among other features - to select date of interest and create an itinerary to enjoy cultural attractions and tourism services collected and disseminated through the technological solution. The is part of a wider Smart Tourism programme called BA Turismo, which included the development of smart tourism solutions such as a dynamic Trip Planner available in the tourism InfoPoints of the city, a ChatBot to address tourists' requests, and a marketplace to book tourism services[249].

Key challenges

The main challenge concerned the need to collect, categorize and analyse heterogeneous contents, published in many webpages. A second challenge concerned the need to keep the contents updated, especially with reference to recreational activities and tourist services such as guided tours. This issue is also related to an effective validation process of the contents, including the protection of copyrighted contents. Another challenge was the need to adopt a user-friendly system of contents' dissemination, capable of returning appropriate information based on user searches.

Impacts

[246] More information on tourism numbers in Buenos Aires are available at: https://turismo.buenosaires.gob.ar/sites/turismo/files/Turismo%20en%20la%20Ciudad%20de%20Buenos%20Aires%20-%20Informe%20Anual%202018_0.pdf

[247] More information on tourism in Argentina and Buenos Aires is available at: https://www.e-unwto.org/doi/epdf/10.18111/9789284422456

[248] For more information on the diversification of tourism offers in Buenos Aires is available at: https://turismo.buenosaires.gob.ar/sites/turismo/files/Turismo%20en%20la%20ciudad%20anuario%202014_0.pdf

[249] Information on Smart City and Big Data utilisation is available at: https://www.esmartcity.es/comunicaciones/comunicacion-convertir-destino-turistico-referente-innovacion-digitalizacion-oferta-contenido-gracias-big-data

The solution is a step forward for Buenos Aires to promote the cultural offer and increase the city appeal, and to reduce the time spent for the collection of up-to-date information on tourism services and events. Additionally, thanks to its interoperability on different types of devices (pc browser, web mobile, mobile app, and info points in tourist information centres), the solution contributes to improve the overall quality of the tourists' experience, making it easier to obtain relevant and useful contents during their stay.
Replicability potential
Medium replicability potential. Replicability mainly concerns the availability of a dedicated budget to purchase and maintain a ready-to-use solution to collect and publish tourism-related information. On the other hand, the replicability could depend on availability of in-house skilled workforce in information technology to develop a similar solution. Stakeholders' engagement doesn't represent an issue for the development of similar solutions.

Good practice 18:

International - Tur4All

Geographical area	*Germany, Spain, Portugal, India, Colombia, Peru*
Purpose areas of data use	*Improve interaction and engagement with the tourist* *Increase destination sustainability and accessibility*
Type of data users	*Tourist destinations and public authorities*
Source of data	*User-generated data – Textual; Photo*
Implementation period	*2019 - ongoing*
Actors involved	***Foundation Vodafone Spain*** *(Non-profit organisation for the development of the areas where Vodafone Spain operates)* ***Foundation Vodafone Portugal*** *(Non-profit organisation for the development of the areas where Vodafone Portugal operates)* ***Accessible Portugal*** *(Non-profit organisation for accessible tourism in Portugal)* ***PREDIF*** *(Non-profit organisation for accessible tourism in Spain)* ***Civitatis*** *(Intermediation company for tourism experiences)*

Context and background

Accessible tourism entails measures that enable standardised, autonomous, and safe access, use, and enjoyment of tourism infrastructures, products, surroundings, and services. Promoting accessible tourism is a step toward growth and a more sustainable future for destinations, by allowing everyone to visit them, regardless of their physical or mental capabilities. The recent European Commission's report "Transition pathway for tourism"[250] underlines the presence of 87 million people with some form of disability in the EU, and a demographic trend that see the progressive aging of the population, considering that in 2020, 20.6% of the EU population was aged 65 or over. This indicates a growing demand for the use of tourist services characterized by high standards of accessibility. It is therefore necessary to consider the need to equip tourism businesses to provide services characterized by high standards of accessibility to promote a tourism for all and capture the opportunities linked with this significant market. At the same time, there is the need to ensure the availability of clear information on the availability of accessible services; the difficulty of accessing this type of information was confirmed by the recent Eurobarometer survey on European attitudes towards tourism[251].

Solutions adopted

Tur4All, "Accessible Tourism for All", is a platform dedicated to accessible tourism managed by accessibility experts. It consists of a dynamic, collaborative mobile application and website that disseminates the accessible tourism offer in the destinations included on the platform. Moreover, everyone can evaluate and recommend tourism establishments, and services and allocate an accessibility score. The platform provides an interactive searching tool for granting access to relevant items, such as the availability of personal assistants in the destination, specialised shops, or accessibility facilities in urban transportation. Moreover, it offers accessible tourism activities and experiences in several destinations around the world. This platform is an excellent solution for tourism accessibility responding to the demand of people with disabilities or accessibility needs to find accurate information about the accessibility of the destination, its transportation, tourist services, and leisure activities.

Key challenges

The platform is open to the contributions of tourism businesses and destinations, so a key challenge is related to the validation and verification process on the accuracy of the information uploaded. Another challenge concerns the need to raise awareness, among tourism services providers, about the benefits and the business opportunities linked to the provision of increased tourism accessibility services. Their engagement and the

[250] "For an overview of the support mechanisms focused on SME, including also those focused in tourism, please see: European Commission (2022). Transition Pathway for Tourism. Publications Office of the European Union, Luxembourg.
[251] Eurobarometro (2021), https://europa.eu/eurobarometer/surveys/detail/2283

progressive expansion of the scope of the platform in terms of number of destinations covered and types of services provided is a precondition for the success of the initiative.

Impacts
Tur4All provides reliable and updated information on the accessibility conditions of tourism facilities in several destinations around the world. Therefore, by enhancing the concept of accessible tourism, TUR4all will contribute to equal opportunities for all travellers, which represents a key issue for the development of the sector. The platform also provides training opportunities, thus supporting the growth of the accessible tourism segment.
Replicability potential
The replicability potential is medium. The destination needs to find relevant partners in accessibility and ICT for the development of the technological solution. On the other hand, it is pivotal the engagement of stakeholders and tourism services in the development of tourism accessible products to populate the platform.

Good practice 19:

Ho Chi Minh City - Go!Bus App

Geographical area	*Ho Chi Minh City (Vietnam)*
Purpose areas of data use	*Improve interaction and engagement with the tourist*
Type of data users	*Tourist destinations and public authorities*
Source of data	*Device data – GPS, mobile roaming, RFID, Bluetooth, meteorological, Wi-Fi; Smart city*
Implementation period	*2020 - ongoing*
Actors involved	***HCMC Department of Transport*** ***FPT Information System*** *(provider of software solutions and IT services)* ***Grab*** *(App for deliveries, mobility, or financial services in Southeast Asia)*

Context and background

Ho Chi Minh City (HCMC) has served as Vietnam's economic engine. As Vietnam is growing as an international destination, the HCMC's city council is actively working to strengthen the city's tourism sector. In 2019, Ho Chi Minh was the thirtieth most visited city in the world, registering more than 8 million visitors.[252] The city is also committed in a significant tourism development process driven by the "Tourism development strategy of Ho Chi Minh City to 2030".[253] Main actions concerns the development of strategies to identify potential markets and specific customer segments, to improve the quality of services and the visitor satisfaction, to enhance tourism infrastructures, services and human resources skills

Solutions adopted

The HCMC Department of Transport, in partnership with technological providers, released the Go!Bus application to provide the best ways and detailed instructions to support tourists and locals to move around the city. The application provides information on the routes, including timetables and fares, suggesting multimodal solutions that integrate public transport with car and bike sharing solutions. The service also offers real-time updates on bus locations and estimated arrival time and enables communication with customer support services. Travellers can also send feedback and share information through a chat, supporting the transport department in improving the quality of the service.

Key challenges

The tourism development process requires the improvement in the management of transport infrastructure and of the quality public services. The Go!Bus application should also evolve, providing new services such as the integration with ticketing services or with other public transport systems, such as water taxis or metro.. Including more languages than Vietnamese will also improve its usability, especially from a tourism point of view. Nonetheless, new functions are also under development (e.g. detailed prediction of bus service, or "not operating" warnings). Another challenge comes from the interactive nature of the app and on the need to incentive users in providing data and information to enhance the quality of the solution based on their needs and behaviours.

Impacts

The application is expected to improve the mobility experience of both locals and tourists. It encourages the use of public transports and sharing transport solutions, thus reducing private transport and improving traffic management. The service could be also extended in the near future to city's water taxis and metro lines, addressing the need to promote a more sustainable transport system.

[252] More information on World Data concerning HCMC is available at: https://www.worlddata.info/asia/vietnam/tourism.php

[253] More information on HCMC is available at: http://sodulich.hochiminhcity.gov.vn/UPLOADS/TINTUC/FILE/2018/8/201808270221359666.pdf

Replicability potential
High Replicability potential. The development of an app similar to Go!Bus would likely imply the adoption of well-established technologies already available on the market, resulting in an easy-to-replicate solution. Users' engagement is also a key issue to improve the quality of the service, even it doesn't represent a primary issue for the successful implementation of the service.

Good practice 20:

Seville – City Past View

Geographical area	*Seville (Spain)*
Purpose areas of data use	*Improve interaction and engagement with the tourist*
Type of data users	*Tourist destinations and public authorities*
Source of data	*Other data – Business information; Statistics; Context-specific information*
Implementation period	*2017 - ongoing*
Actors involved	***Sebka Technology***, Private IT company providing solutions and services in multiple sectors including tourism

Context and background

Seville is the capital of Andalusia, one of the most beautiful and worldwide known regions of Spain. Its historical heritage can be admired through beautiful squares and historical buildings, characterised by different styles and cultures. Nowadays, Seville has progressively consolidated its position as one of the country's main tourism destinations. In 2019, Seville – a city of around 700.000 inhabitants – registered more than 2.8 million visitors, including both Spanish and international tourists.[254] The increased tourism development of the city also posed concerns related to mass tourism and overtourism issues, especially about the need to manage urban transformation and ensure citizens quality of life in the central areas of the city.[255] For instance, Seville developed a wide and extravagant night life with numerous bars and cafés located in the central districts or along the fascinating Guadalquivir river.[256] However, a common local perception was that many visitors were not truly attracted by the historic beauties of the city as much as they were from occasional traditional events such as "La Feria", or other leisure activities. For this reason, the local administration was looking for digital solutions to enhance the attractiveness of its cultural and historic heritage

Solutions adopted

Past View Seville adopts a technological solution based on smart sensory glasses to develop a two-hour tour through the most traditional squares, streets, churches of the city, available in Spanish, English and French languages. . At each stop - called "Virtual Recreation" [257] - tourists can use the virtual glasses to enjoy a reproduction of the past environment of the city in different ages, such as the Ancient Roman era, the Middle Ages, the Renaissance, or the Aragonese Reign. Furthermore, the experience offered by the sensory virtual glasses is enriched thanks to the interaction with virtual historical characters such as artisans, soldiers, or sellers, who explain details and anecdotes of Seville's past. The storytelling linked to these virtual interactions was created by communication experts to ensure the quality of the experience and the engagement of the users.

Figure 16 - A Past View Smart Seville presentation

Key challenges

[254] Chaplow, C. (2022, January 22). International tourism statistics for Andalucia. Andalucia.com. Retrieved February 17, 2022, from https://www.andalucia.com/spain/statistics/tourism.htm

[255] See for example https://ejtr.vumk.eu/index.php/about/article/view/2427/497 and https://www.tandfonline.com/doi/abs/10.1080/09669582.2020.1717504

[256] Parralejo, J.-J., & Díaz-Parra, I. (2021). Gentrification and Touristification in the Central Urban Areas of Seville and Cádiz. Urban Science, 5(2), 40. https://doi.org/10.3390/urbansci5020040

[257] More information is available on the official page of the Past View Seville initative: https://pastviewexperience.com/en/seville/

The engagement of a multidisciplinary team of experts involved in the design and development of the virtual tours represent the main challenge. The creation of an attractive storytelling to engage users also represent a challenge, while representing a prerequisite to encourage the wider use of the solution.
Impacts
The solution enhances the heritage of the city by applying digital solutions to make Seville's history and culture more attractive and accessible. Past View Seville especially aimed at developing a real interaction with the virtual characters, enhancing the fruition of cultural contents of younger generations.
Replicability potential
The replicability potential of the Past View Seville digital solution is high. The technological solutions are already available on the market and implemented in cities such as Barcelona and Athens. The availability of a skilled and multidisciplinary team should be also considered. On the other hand, stakeholder engagement doesn't represent an issue for the development of the solution.

Good practice 21:

Gothenburg -The Knowledge Hub

Geographical area	*Gothenburg (Sweden)*
Purpose areas of data use	*Improve interaction and engagement with the tourist*
Type of data users	*Tourist destinations and public authorities* *Private sector – Tourism Industry*
Source of data	*Transaction Data – Web search and webpage visiting; Online booking and purchasing; Consumer card transactions* *Other data – Business information; Statistics; Context-specific information*
Implementation period	*2021 - ongoing*
Actors involved	***Göteborg & Co** (Municipal company of Tourism)* ***The tourism industry in the Gothenburg region***

Context and background

Gothenburg has historically been an important commercial fishing hub, even if constantly inclined to a innovation and modernization processes. In a view to foster industrial diversification, Gothenburg has also recently positioned itself as one of the main destinations of the Northern Europe. In the period from 2008 to 2018, the number of international visitors strongly increased by 59%, reaching 1.43 million overnight stays; tourism is also a key employment source for the city, accounting for 4% of the total employment in the region.[258] The promising trends and the increased relevance of tourism in the local economy were accompanied by measures and investments to exploit the potential of tourism development. Tourism propensity as a factor of local development was also recognised through the 2020 award of European Capital of Smart Tourism, which fostered the development of solutions linked to open data, sustainability, and tourism experience quality.[259]

Solutions adopted

The Municipality has developed “The Knowledge Hub” in collaboration with the local tourism ecosystem. In the framework of this project, a Data Platform was developed to collect, harmonise, and distribute anonymised visitors’ data. The tool allows the analysis of tourism data to create knowledge and inform decision making processes linked to tourism development. Tourism actors can submit several types of relevant tourism data (e.g. data from mobile operators, traffic, credit card companies) which are then analysed to understand and obtain insights about visitor behaviours. The Data Platform can be integrated with customer relationship management (CRM), and other customer care and analysis systems in order to collect and combine additional data and information about visitors (e.g. location, age, and behaviours and preferences in terms of purchases and activities). The availability of historical data allows the development of predictive analyse to identify and anticipate trend about tourist behaviours, also supporting segmentation processes and optimizing the interactions between supply and demand.

Key challenges

The main challenge concerns the engagement of tourism service providers in the collection and transmission of data. This is a key issue for a collective platform whose value increase through the largest participation of data providers. Moreover, another key challenge is related to the need to ensure data confidentiality to protect business information, while ensuring common standards and interoperability procedures to allow data comparability.

[258] More information on Gothenburg’s Smart Tourism programme is available at: https://goteborgco.se/uploads/2019/11/Gothenburg_SmartTourism_2020_Ansokan.pdf

[259] For more information on the EU Smart Tourism Capital programme contest: https://smart-tourism-capital.ec.europa.eu/cities/competition-winners-2020/gothenburg/gothenburg-2020-eutourismcapital_en

Impacts
The analysis of data disseminated through the “The Knowledge Hub” supports decision making process and inform business strategies to enhance destination competitiveness. The tool allows the comprehension of tourist’ behaviours both prior to, and during their visit, analysing among other elements their movements or purchasing patterns. This makes it possible the comprehension of the tourist behaviour, which represent a starting point to provide targeted tourism services that can meet their needs and expectations. Moreover, the hub promotes research and innovation among private companies to strengthen the overall city’s digital ecosystem and its capacity to support tourism development processes.
Replicability potential
Medium replicability potential. The implementation of the initiative in other destinations does not depend exclusively on technological issues, but also on the collaboration culture and the willingness of operators to share data. Long-term partnerships between public and private stakeholders therefore represent a pivotal issue for the functioning of the tool and for the long-term prosperity of a destination. To this regard, smart city and smart destination policies and strategies are key drivers to support and encourage digital transformation processes.

Good practice 22:

Helsinki - Real-time crowding heat map

Geographical area	*Helsinki (Finland)*
Purpose areas of data use	*Improve interaction and engagement with the tourist*
Type of data users	*Tourist destinations and public authorities*
Source of data	*Device data – GPS, mobile roaming, RFID, Bluetooth, meteorological, Wi-Fi; Smart city*
Implementation period	*2021 - ongoing*
Actors involved	***City of Helsinki*** ***Hypercell*** *(Software company providing smart solutions based on big data analytics)*

Context and background

In recent years, Helsinki has become a popular EU tourism destination. Prior to the COVID-19 outbreak, the number of passengers at Helsinki Airport has increased, also thanks to investments and development of new routes. The number of bednights in Helsinki reached in 2017 an all-time peak, registering more than 4 million bednights. This trend remained almost stable also in 2018, with Helsinki accounting for one third over the country's total number of foreign bednights.[260] Due to the city's dependence to tourism and related services, the COVID-19 crisis has heavily hit the sector's economy. To respond to the crisis, the city Helsinki is therefore looking at new digital and innovative solutions to foster the sustainability and resilience of the sector. This represents a pivotal issue also to preserve its ecosystem characterised by the proximity to the sea and the presence of its archipelago consisting of over 300 islands, which represent a key element for the quality of life of citizens as well as for the attractiveness of the city.

Solutions adopted

The city of Helsinki has launched in 2021 a new colour-coded heatmap to monitor crowd movements in real time, within the framework of a data pilot under the "Regional management of safety in tourism" project. The tool is based on a network of sensors that collect anonymous real time data from a crowd stream by detecting Bluetooth devices.[261] Sensors are positioned in both outdoor and indoor places; data can be accessed data in real time or at specific time frames of interest. The sensors can measure the average time spent in specific areas or points of interest, the crowd volume at specific places, as well as the direction of movement detected by sensors. The heatmap is open and freely available, being a key tool to support urban experience for both citizens and tourists in a view to make their visits safer and comfortable.

On a long-term perspective, the tool can be used to combine mobility data to inform the development of policies and strategies to manage flows and address congestion issues. The city of Helsinki has launched in 2021 a new colour-coded heatmap to monitor crowd movements in real time, - within the framework of a data pilot under the "Regional management of safety in tourism" project. The tool is based on a within the framework of a data pilot under the "Regional management of safety in tourism" project. The tool is based on a network of sensors that collect anonymous real time data from a crowd stream by detecting Bluetooth devices. Sensors are positioned in both outdoor and indoor places; data can be accessed data in real time or at specific time frames of interest. The sensors can measure the average time spent in specific areas or points of interest, the crowd volume at specific places, as well as the direction of movement detected by sensors. The heatmap is open and freely available, being a key tool to support urban experience for both citizens and tourists in a view to make their visits safer and comfortable. On a long-term perspective, the tool can be used to combine mobility data to inform the development of policies and strategies to manage flows and address congestion issues.

[260] Mustonen, P. (2020). Tourism statistics of Helsinki in a nutshell. Helsinki; City of Helsinki: https://www.hel.fi/static/kanslia/elo/tourism-statistics-helsinki.pdf

[261] Helsinki for Companies - Safety in tourism. Helsingin kaupunki. (2022, January 19). Retrieved February 17, 2022, from https://www.hel.fi/yritystenhelsinki/en/travel-trade/safety-in-tourism/

Key challenges
The key challenge is related to the need to monitor and manage urban flows especially in places and areas characterised by tourist congestion, supporting a safer urban experience. It also represents a pivotal action to support resilience and sustainability of the destination. Other challenges concern the functioning of the tool. Security and digital privacy of the data collected should be ensured. Despite data collection is based on IDless Bluetooth signal detection which is fully complaint with the EU General Data Protection Regulation, privacy should be constantly monitored. Also, sensors detection is possible only for devices with enabled Bluetooth, therefore data collected provides a partial overview. Coverage expansion also depends on the continuous engagement of services providers in holding new sensors.
Impacts
The tool offers the opportunity to plan a visit while limiting the expositions to risk linked to crowded places. This also allow to evaluate the appeal of the tourist attractions of the City and measure tourism potential of different areas. The management of flows in crowded places is especially important to increase safety and security, which is a main concern in the COVID-19 period, as well as one of the main factors guiding tourist's preferences in the selection of a destination. By responding to emerging tourist's needs and expectations, the tool is pivotal to support the recovery of the tourism sector, ensuring overtourism management, and providing key information for the development of new products and services. In addition, businesses receive visibility from the map, while getting valuable information about mobilities patterns to optimise their marketing strategies.
Replicability potential
Medium replicability potential. The tool is based on a mature technology, even if a wider use of sensors should be ensured. Different examples of similar tools used as beacons to collect visitors' information can be found in several cities such as Amsterdam and Brisbane. A similar initiative has been also launched in several EU cities to exploit the potential of lampposts under the slogan "dozen things you can do with a 'humble lamppost' that has nothing to do with light"[262]. On the other hand, the successful implementation of the initiatives also depends on the availability of private operators to hold sensors.

[262] EIP-SCC & Sharing Cities. (2017, May 1). Exploiting the 'humble lamp post' a kick start to smart city: https://smart-cities-marketplace.ec.europa.eu/sites/default/files/EIP%20Humble%20Lamppost%20v1.pdf

Good practice 23:

Lombardy – Digital Tourism Ecosystem

Geographical area	*Lombardy (Italy)*
Purpose areas of data use	*Improve interaction and engagement with the tourist*
Type of data users	*Tourist destinations and public authorities*
Source of data	*User-generated data – Textual; Photo* *Transaction data – Web search and webpage visiting; Online booking and purchasing; Consumer card transactions* *Device data – GPS, mobile roaming, RFID, Bluetooth, meteorological, Wi-Fi; Smart city* *Other data – Business information; Statistics; Context-specific information*
Implementation period	*2014 - ongoing*
Actors involved	***Lombardy region*** ***inLombardia*** *(Official tourism board of the region)*

Context and background

Lombardy is a Northern Italian region characterised by a varied tourism offers, covering urban, natural, skiing and MICE products and services. It is characterised by a significant cultural offer, being also the Italian region with the highest number of UNESCO sites. The number of tourist arrivals in the region have increased during the recent years, reaching in 2019 almost 15 million arrivals (i.e. 15% over the total at national level), and 30 million nights spent (i.e. 10% over the total)[263]. The significance of tourism is ensured by the role of the city of Milan, which in 2018 was the third Italian destination for tourist presences.[264]

Solutions adopted

The Digital Tourism Ecosystem (DTE) is a collaborative digital platform for the management and sharing of contents related to the tourism offer of the Lombardy region. Data and information come from Explora (Destination Management Organization of the Lombardy Region), regional InfoPoints, private operators and public institutions. The platform covers a wide range of services, including accommodation and transport services, tourism packages, ticketing for guided tours, excursions, and tasting experiences. It also offers the development of interoperability solutions between operators and the platform through technological standards, such as the E015[265]. The main objective of the tool is to connect tourists, services providers and public authorities in a collaborative digital platform to enhance the competitiveness of the regional offer. The inclusion in the ecosystem allows operators to access to B2B opportunities promoted by the Lombardy Region for the tourism sector, including participation in national and international fairs, commercial and networking opportunities. The platform also provides training programs to support operators in filling the lack of management software and the connections with channel managers. Data and information that populates the platform are analysed to provide operators with a greater ability to understand the market and inform business development strategies. The network of approximately 100 official Infopoints of the region represents the physical terminal of the Digital Tourism Ecosystem

[263] Istat (Italian National Institute of Statistics). "Arrivals and Nights Spent by Italian and Foreign Guests in Hotels. - Italia, Lombardia and Provinces." RSY Lombardia, 1 Jan. 2022, https://www.asr-lombardia.it/asrlomb/en/opendata/Arrivals_and_nights_spent_by_Italian_and_foreign_guests_in_hotels___Italia__Lombardia_and_provinces.

[264] Italian National Institute of Statistics. (2019). ISTAT - C19 - Annuario Statistico Italiano: https://www.istat.it/it/files//2019/12/C19.pdf

[265] To know more about the portal of Regione Lombardia visit: https://www.en.regione.lombardia.it/wps/portal/site/en-regione-lombardia/DettaglioRedazionale/institution/policies/e015-digital-ecosystem

Key challenges
The integration and connection of the regional tourism offer represent the main challenge. This required a high level of data standardisation and interoperability between different types and sources of data, which was addressed through the development of a digital ecosystem based on an API-driven approach to make the platform accessible to all sector operators of the region. Stakeholders' engagement is also a key driver of success for the digital ecosystem, since the participation of the widest number of operators can support the integration, digitalization and commercialization of a comprehensive offer, especially in a vast territory where a multitude of service providers operate.
Impacts
The initiative promotes the development of the regional tourism system and the competitiveness of sector's operators. The institutional promotional showcase provides visibility to the offer and support the connection with the national and international demand. The ecosystem also offers the possibility of bridging the lack of digitalisation of SMEs, increasing and diversifying channels and commercial opportunities. At the same time, it promotes a gradual process of digital transformation of sector operators through the development of training programs.
Replicability potential
Medium replicability potential. The adoption of common standards and interoperability procedures are critical factors for the successful replication of the initiative, which also depend on the operators' propensity toward collaborative mechanisms and digital transformations.

Good practice 24:

Berlin - Virtual Experiences

Geographical area	*Berlin (Germany)*
Purpose areas of data use	*Improve interaction and engagement with the tourist*
Type of data users	*Tourist destinations and public authorities*
Source of data	*Other data – Business information; Statistics; Context-specific information*
Implementation period	*2021 - ongoing*
Actors involved	***Municipality of Berlin*** ***German Society for multimedia customer loyalty systems - Deutschen Gesellschaft für Multimediale Kundenbindungssysteme (DGMK)*** *is an innovative technology and AI solution provider. It develops concepts and solutions for public organisations and private companies.*

Context and background

Berlin is a young, alternative, and cosmopolitan destination at the heart of Europe, famous as an experimentation centre for art, music, and design. The transformations linked to the post-Second World War and to the city's reunification enhanced a European city that marked the history of the twentieth century. Berlin's tourism sector plays an important economic role. The number of visitors constantly increased prior to the COVID crisis, reaching in 2019 around 14 million tourists[266]. The synergy between historical monuments and places of memory, post-industrial and contemporary buildings, creative and artistic avant-garde has made Berlin one of the main European tourism destinations. This complexity provided a unique appeal to the city, which is at the same time anchored to its past and projected into the future.

Solutions adopted

The city has implemented a free digital solution based on the QR (Quick Response) code technology. Tourists can discover the history of Berlin while walking across the city, framing with their devises the QR codes positioned close to cultural resources such as building walls, paving stones, and tiles[267]. After scanning the QR code, user can easily access to informative contents and multimedia information, including descriptions and virtual representations of historical transformations that took place in the city. An interactive map provides information about all project's QR codes positioned in the city, creating a thematic guided tour of a unique open-air museum. This overall map can also address the potential limited visibility of the QR codes, supporting users especially in crowded places.

Key challenges

The complexity linked to the last century's legacy and the continuous transformation of Berlin represents a distinctive element of its tourism offer. The technology can also support the decongestion of over visited attractions, giving visibility to less visited places through the map of QR codes. This is relevant to address the consequences of overtourism, which is a key concern considering the rapid increase of tourism flows.

Impacts

This smart tourism solution fosters the attractiveness of the city, providing a tool to promote and understand the complex historical fabric that underlies the cultural heritage. The digital access to cultural knowledge also represents a way to diversify the offer and enrich the tourist experience, as well as to involve citizens and young generation in the local cultural life. The solution also promotes a walking tourism approach, which represents a sustainable way to experience a destination, and to engage with local people and business to join the destination as a local.

[266] More information on Tourism data in Berlin are available at : https://about.visitberlin.de/en/press/press-releases/annual-review-2019-german-visitors-love-berlin

[267] More information on the Virtual Experience initiative is available at: https://www.visitberlin.de/en/blog/top-11-audio-walks-Berlin

Replicability potential
The solution is highly replicable. The QR code technology is commonly used to provide virtual reality experiences in different cultural contexts. Stakeholders' engagement doesn't represent a key issue. The concept of enabling tourists to have an immersive experience in different timeframes can be replicated in other cities, providing an enhanced tourist experience and a greater knowledge about the cities' main attractions. The digital solution adopted in Berlin seems to be also particularly appropriate for cultural resources and contexts in which historical transformations and facts represents a key element for their promotion and understanding.

Good practice 25:

Brasov – Augmented Reality App

Geographical area	*Brașov (Romania)*
Purpose areas of data use	*Improve interaction and engagement with the tourist*
Type of data users	*Tourist destinations and public authorities*
Source of data	*Device data – GPS, mobile roaming, RFID, Bluetooth, meteorological, Wi-Fi; Smart city*
Implementation period	*2020 - ongoing*
Actors involved	***Municipality of Brașov*** ***Brașov Metropolitan Agency (AMB)**, a non-governmental organisation dealing with promotion and cooperation between public, private actors and NGOs, for the sustainable development of the Brasov Metropolitan Area.*

Context and background

Brasov is a picturesque and evocative town founded in the thirteenth century and located in the historical region of Transylvania. The city is characterised by a maze of narrow streets characterised by baroque facades, Gothic spiers, and ancient fortifications. Brasov is the second most visited Romanian destination for foreign tourists. It is mainly appreciated for the historical and architectural heritage of its medieval citadel, and for the Black Church, the largest Gothic cathedral located in Eastern Europe. The city's geographical position allows to visit several nearby places of interests, such as the surrounding Carpathian Mountains and the perfectly maintained castles and fortresses. Brasov has recently launched a process of city's modernisation, also investing in the tourism sector to stimulate the economy and generate employment opportunities. The city offers several types of products linked to its historical and natural heritage, which make it particularly attractive for cultural, mountain, and rural tourism.

Solutions adopted

Brasov's local authorities developed the application "Virtual Brașov" to create interactive augmented reality experiences for the fruition of the local cultural heritage. The application is based on algorithms that identify representative monuments and sites located in the historical centre, providing information and images related to past periods[268]. "Virtual Brașov" offers an interesting cultural storytelling experience to discover the city. The informative contents - developed through the engagement of experts from different fields - place emphasis on the immaterial dimension of the cultural heritage, providing anecdotes, legends, and curiosities to enrich the educational experience.[269]

Key challenges

"Virtual Brașov" provides a key solution to promote and diversify the local cultural heritage offer. The development of the application reflects a strategy to promote the destination with innovative digital tools, bringing the tourism offer as close as possible to other well-known EU cultural destinations. At the same time, the initiative aims to develop the creative and cultural industries, as part of a broader smart development strategy. "Virtual Brasov" also improves the availability and public access to historical knowledge, providing a high-quality experience for tourists. On the other hand, the access to cultural information raises awareness about the importance of local heritage, increasing citizens' sense of belonging and participation in the cultural life. The engagement of citizens and stakeholders in the provision of cultural related services represents a key element to support the long-term development of the tourism industry. "Virtual Brasov" also allows to remotely enjoy the major city attractions, becoming a key promotional tool to persuade tourists to visit a cultural destination far from mass tourism.

[268] More information on Virtual Brasov is available at: http://turism.brasovcity.ro/index.php/tururi/index_en
[269] Briciu, A., Briciu, V. A., & Kavoura, A. (2020, July 1). Evaluating How 'Smart' Bras, ov, Romania Can Be Virtually via a Mobile Application for Cultural Tourism. Transilvania University of Brasov; University of West Attica.

Impacts
The enhancement of the cultural heritage represents a pillar of the Brasov's development strategy. Thanks to its cultural heritage and storytelling, Brasov is uniquely positioned to build its value proposition on the augmented reality technology, which can represent a distinctive element of its offer, and a key tool to enhance the tourist experience. The solution can also allow an effective users profiling, to improve the offer and bring the service as close as possible to tourists' needs. Finally, the development of the application can arouse the interest of local tourism operators about the relevance of the digitisation of the sector, which currently represent one of the main strategic actions to promote the competitiveness of a destination.
Replicability potential
The solution is highly replicable. The format of the "Virtual Brașov" application can be replicated in almost all elements of cultural interests, as it is built on tested ICT solutions that are available off-the-shelf. The solution can be also extended in other cultural domains, for example to promote the natural environment surrounding the city.

Good practice 26:

Singapore – Virtual City Platform

Geographical area	*Singapore (Singapore)*
Purpose areas of data use	*Improve interaction and engagement with the tourist* *Conduct market analyses and inform decision-making* *Improve planning and operations of tourism services*
Type of data users	*Tourist destinations and public authorities*
Source of data	*Other data – Business information; Statistics; Context-specific information*
Implementation period	*2020 - ongoing*
Actors involved	***National Research Foundation,*** *a department within the Prime Minister's Office who sets the national direction for research and development by developing policies, plans and strategies for research, innovation and enterprise.* ***Singapore Land Authority,*** *an authority under the Ministry of Law of the Singapore Government that is responsible for the optimisation of land resources for Singapore's social and economic development through real estate.* ***Government Technology Agency of Singapore (GovTech),*** *an agency under the Prime Minister's Office that develops platforms and applications for Singapore. The Agency plays an important role in making Singapore a smart nation.*

Context and background

Singapore has grown as a nation over the past few years, and it is now globally recognised for its innovation, competitive economy, education, and healthcare. The constant gaze into the future finds evidence in the futuristic structures and modernity of transports, as well as in the city's attention to urban green, quality of life, and sustainable development. Singapore is now positioned as an international destination, also thanks to targeted interventions linked to new tourism infrastructures, activities, and products. This makes the city an ideal destination for several types of tourists with different needs and expectations, enclosing the best of the Asian continent. Its tourism offer is based on the cultural, artistic, architectural heritage, while also placing emphasis to unique elements, such as markets, iconic green areas, and recreational experiences.

Solutions adopted

"Virtual Singapore" is a dynamic three-dimensional city model and collaborative data platform, including the 3D maps of Singapore. The solution, which is part of "Smart Nation" initiative, integrates data from government agencies, 3D models, Big and real time data from Internet of Things devices[270]. The tool includes data and information about demographics, movement, and transportation infrastructure, as well as environmental data about climate, air quality, and noise. Data also covers information about buildings (e.g. shape, location, energy generation and consumption), and streets (e.g. accessibility, traffic and shaded walkways). "Virtual Singapore" supports the virtual and physical experience in the city, providing key information about convenient routes and useful facilities to respond to the needs of tourists and city users.

Key challenges

Singapore's digital twin offers an endless range of applications to solve challenges linked to a small size and high-density city. Concrete applications are mainly linked to collective urban planning and decision-making processes. Based on the exploration of potential future scenarios, the improvement of the city environment is led by a data driven and integrated approach. The project also responds to the need to co-create and communicate decisions to citizens, intended as the main beneficiaries of urban development processes.

[270] More information on Virtual Singapore is available at: https://www.nrf.gov.sg/programmes/virtual-singapore#:~:text=Virtual%20Singapore%20is%20a%20dynamic,private%2C%20people%20and%20research%20sectors.

Impacts
The creation of a liveable and efficient city is an essential pre-condition for the city's long-term sustainable tourism development. Tourists can virtually plan a tailored experience, identifying attractions and places of interest, as well as the preferred ways to move around the city. Once arrived in the destination, real time data and information support their travel experience. The project also increases the reputation of the city as a modern, safety, and green international tourist destination, enhancing the competitive city's brand positioning and the capacity to expand the overall tourism demand.
Replicability potential
The potential to replicate the solution is medium. Given the considerable data collection, management and interoperability efforts and expertise, as well as stakeholders to be engaged, destinations with previous experience in data management would probably rely on a more robust basis to replicate the initiative. In any case, the project can be replicated in other cities through a gradual and incremental approach based on data and information available so far. Inspired by the Singaporean case, a similar cloud-based collaborative solution was implemented in the French city of Rennes in 2017[271].

[271] More information on Rennes Metropole 3DExperience available at https://www.3ds.com/insights/customer-stories/rennes-metropole

Good practice 27:

Nijmegen – Smart Tourism Management

Geographical area	*Nijmegen (Netherlands)*
Purpose areas of data use	*Conduct market analyses and inform decision-making* *Improve planning and operations of tourism services* *Increase destination sustainability and accessibility*
Type of data users	*Tourist destinations and public authorities* *Private Sector and tourism industry*
Source of data	*User-generated data – Textual; Photo*
Implementation period	*2020 - ongoing*
Actors involved	***Nijmegen City Council*** ***Nijmegen Tourism –*** Official Tourism office of the Nijmegen City Council

Context and background

Originally a Roman settlement of the I century A.D., the city of Nijmegen features beautiful monuments, old castles and towers dominating the fascinating Waal river and its surrounding hills. In some periods of the year, the city also attracts mass-tourism due to the presence of significant cultural and music events. One of such annual events is the Four Day Marches – the largest marching event in the world – which attracted 45,000 participants from more than 70 different countries[272]. In order to best manage these events – which pose considerable organisational challenges in terms of urban mobility, visitors' and residents' security, natural and cultural heritage protection – the city has been looking for innovative digital solutions to support data driven decision making to increase the city's attractiveness[273].

Solutions adopted

Nijmegen adopted a data analytics solution centred on continuous data collection and management to monitor and analyse the movements of tourists and residents in the city centre, using a digital toolkit focused on artificial intelligence and applied statistics. Data about flows is transmitted to the by tourist entrepreneurs, municipalities and local management organisations three times a day.[274] The City Council uses the artificial intelligent toolkit to gain an overview of crowd and health situation around the city centre and make informed decisions on the management of Nijmegen urban spaces. The digital toolkit was especially useful for the City Council during the initial stages of the Covid-19 pandemic, given the urgency of having clear and regular snapshots of the flows of people in the city centre, to avoid crowds and ensure social distancing. Given the versatility of this solution and the growing adoption of urban smart monitoring by public administrations, this data-driven approach is likely to become a permanent solution for the city to manage urban flows also in the post-pandemic period.

Key challenges

Such a persistent monitoring system faces primarily a challenge linked to stakeholder engagement. The effectiveness of the decision-making process is related to the number of local public and private data providers taking part in data collection and transmission. A high-rate participation allows the data to be more precise and the digital system to effectively function.

[272] Information on the Four Day Marches is available at: https://www.4daagse.nl/en
[273] G. L. P Films. (2021). Smart Tourism Management in Nijmegen, Netherlands. Vimeo. GLP Films, Green Destinations, ITB Berlin. Retrieved February 17, 2022, from https://vimeo.com/548089555.
[274] More details on the initiative are available at: https://vimeo.com/548089555.

Impacts
The smart monitoring system allows to better monitor crowds generated by both local and tourists, guaranteeing an optimal balance for the fruition of public urban spaces. Moreover, thanks to the support provided by this smart monitoring system for informed decision-making, Nijmegen's City Council will enhance its capabilities concerning the organisation and management of major events. On the long term, the adoption of similar data-driven approaches for destination management will contribute to the city attractiveness.
Replicability potential
The replicability potential is medium. The artificial intelligence toolkit is readily available on the market which would suggest an easy adoption by other destinations. To ensure a successful replication of Nijmegen's solution, it will be crucial to involve a high number of data providers, requiring dissemination and awareness raising activities about the valuable role of the use of data. The dimension of Nijmegen could suggest easier replicability in destinations of similar size. However, the digital solution may also result suitable for largest destinations, also leveraging on Smart City and Smart Mobility solutions that can be used to collect useful data for tourism monitoring purposes.

Good practice 28:

Antwerp – Crowd Monitoring

Geographical area	*Antwerp (Belgium)*
Purpose areas of data use	*Conduct market analyses and inform decision-making* *Improve planning and operations of tourism services* *Increase destination sustainability and accessibility*
Type of data users	*Tourist destinations and public authorities* *Private Sector and tourism industry*
Source of data	*Device data – GPS, mobile roaming, RFID, Bluetooth, meteorological, Wi-Fi; Smart city*
Implementation period	*2017 - ongoing*
Actors involved	***City Council of Antwerp*** ***Orange Business –*** International Telecommunication provider

Context and background

Antwerp is a multicultural city located in the Belgian region of Flanders and known as the "world's capital of diamonds". Antwerp's proximity to the North Sea coastline makes it a crucial trade hub for Belgium and Europe, being home to one of the most strategic and active commercial ports in the world. Antwerp is also a relevant destination both for tourism and business purposes. Tourism flows caused concern amongst the local administration, regarding the quality of life of citizens and the protection of the city's cultural heritage. This is particularly relevant especially in tourism peak seasons or in coincidence with specific events – such as expositions, city festivals and music concerts – which require a detailed planning and management of the city's public spaces

Solutions adopted

Antwerp's local administration adopted a set of digital solutions to monitor people flows across the city centre, in cooperation with mobile phone and technology providers.[275] The city administration obtains a large amount of data from sensors and mobile devices to track in real time the status of traffic and crowding of the city centre. 25 sensors that emit signals - based on Wi-Fi and Bluetooth – were placed by the city administration across the city-centre to detect and connect with smartphones of users.[276] They collect visitors' movements and provide insight about the size of visitor flows, their origin (by identifying the prefix) and the economic activities they visit in the center. The solution proved to be useful also to manage and forecast people flows during key events.[277]The Smart Tourism programme of the city of Antwerp are an integral segment of wider digital and innovative projects that are being systematically promoted by the City Council with investments on digital hubs and innovation centres. The City Council, in cooperation with Orange Business, is also promoting the construction of 5G innovation labs, that aim at consolidating the knowledge and dissemination of the 5G to work on Smart City (and Smart Tourism) projects focused on smart mobility and manufacturing.

Key challenges

A key challenge to face for the digital solution to be successful concern the need to ensure that the collection and use of data is anonymous and transparent, in compliance with national and European regulations in terms of privacy and personal data. Furthermore, the maintenance of the sensors, and the active operativity of a core team of experts to analyse data, represent a significant effort for both the implementation phase, and the successful implementation on long-term perspective. As mentioned before, the solution was already

[275] Harris, S. (2021, November 3). Possibilities of 5G in Port of Antwerp and beyond. Orange Business Services. Retrieved February 17, 2022, from https://www.orange-business.com/en/blogs/return-port-showcasing-possibilities-5g-port-antwerp-and-beyond

[276] World Tourism Cities Federation. (2018). Antwerp, Belgium. UNWTO.

[277] More information on the solution is available at: https://www.gsma.com/iot/wp-content/uploads/2016/09/cl_antwerp_cs_web_09_16.pdf

implemented in different local events, indicating how partnerships between mobile services providers, city authorities or private companies represent a well-established data collection and management strategy.

Impacts
Antwerp implemented digital solutions to address monitoring of crowds, and to become a national and European digital innovation hub centre. The crowd monitoring system makes it possible to better monitor people flows in real time, offering also the possibility to detect the share of tourists within the total number of people. This also allows for the accumulation of data which allow the development of increasingly accurate digital solutions that are able to forecast visitor flows and better manage public spaces. Moreover, the City Council is growingly promoting the presence of start-ups and innovation hubs in the city to incentivise the development of digital solutions to consolidate Smart Tourism and Smart City projects.
Replicability potential
Replicability potential is high. The technological tools are readily available, and any destination might establish a partnership with mobile providers to collect data. However, it is crucial that such ad-hoc partnerships with one or more telephone providers will be continuous over time and based on agreed standards for data sharing that ensure data harmonisation and interoperability. On the other hand, stakeholder engagement doesn't represent an issue

Good practice 29:

Gipuzkoa - Hodeian Big Data Analytics

Geographical area	*Gipuzkoa Province (Spain)*
Purpose areas of data use	*Conduct market analyses and inform decision-making*
Type of data users	*Private Sector and tourism industry*
Source of data	*User-generated data – Textual; Photo* *Transaction data – Web search and webpage visiting; Online booking and purchasing; Consumer card transactions* *Device data – GPS, mobile roaming, RFID, Bluetooth, meteorological, Wi-Fi; Smart city* *Other data – Business information; Statistics; Context-specific information*
Implementation period	*2017 - ongoing*
Actors involved	***Gipuzkoa provincial government*** (*Etorkizuna Orain)* ***Gipuzkoa Tourism Board*** *(Gipuzkoa Turismoa, public regional OMD)* ***Tecnalia*** *(R&D centre, member of Basque Research and Technology Alliance)*

Context and background

Gipuzkoa is one of the three provinces of the Basque region in northern Spain, close to the French border. Nowadays, Gipuzkoa and its 88 municipalities are popular tourism destinations, mainly driven the tourism attractiveness of the city of San Sebastian. The Basque province offers a wide variety of attractions, such as eco-tourism, sea and sports tourism, as well as cultural tourism linked to important heritage sites (Loiola, Arantzazu) or local gastronomy. However, the tourist expenditure has been a challenging parameter to measure, as well as tracking the tourist behaviour

Solutions adopted

Hodeian is a tool designed to measure visitors' expenditure and consumption habits based on data analysis. It is a Big Data analytics tool to support market comprehension, tourism planning and management, and decision making for public and private tourism stakeholders[278]. The Provincial Council of Gipuzkoa is the promoter of the project and its primary user, having developed it under the “Etorkizuna Eraikiz” strategy (i.e. collaborative and open governance)[279]. Data and information are collected from different sources. They include data collected by credit card payments in commercial establishments, sensors tracking devices using Wi-Fi or Bluetooth signal, visitor movements information through cell phone operators and people counting sensors. This information is processed, categorized (e.g. nationality, expenditure category, date and time) and made freely available on the website of the project (i.e. www.hodeian.eus). Data and information are published according to three different areas: expenditure (by category, municipality, country of origin, time, or destinations visited), mobility (attendance, mobility within the province, length of stay) and descriptive statistics about visitors (every month, weekly, or daily).

Key challenges

Tracking tourists through their connection to mobile networks requires the compliance with the relevant legal framework, to guarantee privacy and data protection. On the other hand, if the tracking occurs via Bluetooth or Wi-Fi, those users’ devices switched off in both networks might result unnoticed. Another challenge is related to the efforts and costs related to data collection, aggregation and anonymisation. On top of this, Big Data systems rely on dedicated hardware and software facilities, which might require significant initial investments, both for the set-up of similar open data platforms, as well as for the collection and management of data.

[278] More information on Hode1an, the Gipuzkoa Smart Destination Analytics, is available at: http://www.hodeian.eus/es/index.php
[279] More information on the Etorkizuna Eraikiz is available at: https://www.gipuzkoa.eus/eu/web/etorkizunaeraikiz

Impacts
The solution aims to develop an open and accessible big data system that will become an effective decision-making tool for tourism public and private stakeholders. Moreover, the tools support market comprehension, tourism diagnostics, and possibility to anticipate market trends through forecast exercises.
Replicability potential
The replicability potential is medium. Many cities and municipalities already possess the infrastructures to implement the solution (i.e. spots and facilities to position sensors, mobile coverage, staff skilled and committed to set-up the project). Furthermore, the digital solutions utilised – such as Big data analytics - are already fully available in the market. On the other hand, there are some aspects of the implementation such as developing a network, investing on human resources or gathering private data upon payment that represent key issues for the development of similar solutions.

Good practice 30:

New York City – LinkNYC

Geographical area	*New York City (USA)*
Purpose areas of data use	*Conduct market analyses and inform decision-making*
Type of data users	*Tourist destinations and public authorities*
Source of data	*Device data – GPS, mobile roaming, RFID, Bluetooth, meteorological, Wi-Fi; Smart city*
Implementation period	*2014 - ongoing*
Actors involved	***City of New York (****NYC Department of Information Technology & Telecommunications****)*** ***Intersection*** *(media and technology company)* ***ZenFi Networks*** *(mobile and wireless infrastructure provider)*

Context and background

New York City is one of the main destinations in the world. In 2019, it accounted for 66,6 million visitors in 2019, corresponding to about 25 percent of the State's 265,5 million visitors. The tourism industry employed more than 280.000 people in the same year, accounting for 7,2% of private sector jobs.[280] Through information, communication technology, and the Internet, urban communication networks have evolved to address urban needs. Due to the growing quantity of Internet devices and users, developing a network infrastructure capable of adequately servicing urban locations has become increasingly difficult. The NYC local administration was aware of this need, and recently opted to modernise its urban payphone system replacing phone booths with new iconic street furniture that would serve as a platform for the City, its people, and tourists to connect, communicate, and benefit from digital services.

Solutions adopted

LinkNYC launched a project plan to replace thousands of payphones with kiosk-like structures called *Links.* Each Link is equipped with free services like Wi-Fi, phone calls, device charging, a touch screen tablet providing maps and information on city services. The solution was developed with no cost for users or taxpayers, since it is financed – and generate its own revenue - through sponsorships and advertising displayed on Links' 55-inch displays. Advertisers are also able to target specific audiences using anonymous and aggregated information collected by each Links, including session length, device type or language. Data collected are also an essential source of information to local administration to monitor city-users flows and behaviours.

Key challenges

Project implementation raised some concerns related to privacy issues, and monopolistic usage of the data collected from users. On the other hand, the provision of free Wi-Fi services can mitigate the digital divide of certain areas of the city.

Impacts

Links' kiosks were initially planned to be equally spread around the city. Since its launch, LinkNYC has expanded, with over 1.700 Links across New York, Philadelphia, and Newark. Millions of individuals did not have access to high-speed Internet in those boroughs. LinkNYC filled this gap by providing the fastest available Wi-Fi for free on city streets. Moreover, New York's administration generated a new revenue source thanks to the targeted advertising possibility linked to the kiosks. More broadly, the Links' deployment, operability and maintenance had positive effects on employment. Addressing the roaming obstacle is another advantage of the system, mainly supporting the need of international tourists to remain connected while visiting the city.

[280] To know more about the tourism industry in New York City: https://www.osc.state.ny.us/reports/osdc/tourism-industry-new-york-city

Replicability potential
LinkNYC has a medium replicability potential. The technology to install Wi-Fi around the city is at the reach of most cities in the EU. The main factors are enforcing Wi-Fi connections and setting up the kiosks network as core infrastructure. Creating a consortium seems necessary since technological partners would be required. This system might be interesting and helpful for destinations presenting connectivity and digital gaps in some of their areas and where future 5G, 5G Advanced or 6G networks are not expected to become operative in the short-medium term.

8. Annex B – Case studies of cooperation supplement

Annex B complements the previous Section **Error! Reference source not found.**, presenting t he remaining cases of cooperation.

Case Study: F

Tourism 4.0

Geographical area	*Slovenia*
Purpose areas of data use	*Improve planning and operations of tourism services*
Type of data users	*Tourist destinations and public authorities* *Private sector – Tourism Industry*
Source of data	*Other data – Business information; Statistics; Context-specific information*
Actors involved	*Arctur, a Slovenian SME, in partnership with over 200 members worldwide including ministries, destinations, national and international networks, research organisations and providers of tourist services.*

Context and background

ICT solutions are a key component can provide innovative solutions also for tourism. The so-called Tourism 4.0 enables the development of new solutions for better services for tourists at lower impacts for the environment and the heritage of the destination sites, bringing tourism more in line with both tourist preferences and the needs of the inhabitants. The key issue is to increase the adoption of these technologies through an acknowledgement of their impacts and cost-effectiveness in real word settings.

Solutions adopted

Tourism 4.0 is an initiative that aims at leveraging of the potential of ICT innovations in the tourism sector paying particular attention to the needs and preferences of the residents. Its main pillars include: (a) Collaboration Impact Token, a crypto-voucher based on blockchain technology to guarantee a trustworthy interaction among the individuals participating in the initiative using an award system and suggestions for redirecting the touristic flows based on information of the context; (b) Tourism 4.0 LIVING LABs, real-life sandboxing environments where solution providers can test, validate and present their innovative solutions; (c) Tourism Impact Model – a tool that acts as a digital twin of a tourist destination and estimates the impact of tourism in a certain location; (d) T4.0 Alpine Flows – a monitoring system that collects data on visits to popular locations to enable a better understanding of the visits in the Alpine area and to support the sustainable rerouting of Alpine flows; (e) Digital Innovation of Cultural Heritage, the development of new products and services that use the potentials of new technologies (augmented reality, 3D scanning and 3D printing, web platforms, …), to enhance the cultural heritage.

Reasons for cooperation

The key reason for cooperation is the establishment of national models of data collection from various sources (economy, environment, heritage, etc.) to understand to what extent ICT innovation can enhance tourist services and boost positive impacts of tourism on tourist destinations and also on other related sectors.

Areas of cooperation

Developing a “digital twin” for modelling the tourist ecosystem (at the level of towns and regions), thus allowing real time support to decision makers in simulating — in advance — the impacts of their policy decisions on tourism. Knowledge sharing on best practices and lessons learned.

Typology of data shared

Digitalised data related all aspects of life in the tourist destination (economy, environment, collaboration, etc. For instance, the Tourism Impact Model includes up to 100.000 data inputs), natural and cultural heritage, automatically gathered data from space satellites (e.g. Copernicus Atmosphere Core).

Approach to data management and sharing
Project results and lessons learned are available on: https://tourism4-0.org/wp-content/uploads/2020/04/T40_Technical_Guidelines_for_Multimedia_v1_2.pdf. DOTI is a personal digital passport of a tourist. It is a solution adopted for the individual (tourist) for maintaining the ownership and full control of his or her own data while he/she made available his/her personal data and preferences to better, more personalised touristic services. The Collaboration Impact Token is the crypto voucher based on blockchain technology to reward positive behaviour of the tourist and to readdress touristic flows in relation to changes in the context's conditions.
Key challenges
Open data availability; human effort to map data sources and collect data; data quality; awarenedd of the value of data for strategic planning by the tourism and other stakeholders (municipalities, DMOs, tourist providers, etc.).
Impacts

• Regarding the Tourism Impact Model (TIM) developed, the following impacts have been registered:
  ○ Built-in transparency and inclusion of local inhabitants in strategic planning.
  ○ Supervised collecting of data from various sources and their transformation into valuable information.
  ○ Real picture of the whole spectrum of positive and negative impacts of tourism based on real data.
  ○ Complex concepts made simple and understandable through the visualisation of results and sets of recommendations for improvements.
  ○ Dynamic real data simulations of possible scenarios for quick and competent responses in all situations.
• Regarding the Collaboration Impact Token, the following impacts have been registered (see also Collaboration impact token – Tourism 4.0 (tourism4-0.org)):
  ○ Diverting tourists from overcrowded destinations.
  ○ Changing Tourists' behaviours into more sustainable alternatives through gamification and a rewarding solution.
• Regarding Tourism 4.0 living labs Slovenia, the following impacts have been registered (see also Living Lab – Tourism 4.0 (tourism4-0.org)):
  ○ a laboratory environment for testing and validation of the new solutions and business practices,
  ○ a permanent demonstration space (showroom) for developers of various applications,
  ○ a training room for actual and future tourist workers who can practice how to deal with emerging technologies, solutions and processes,
  ○ a real-experience simulator for legislators and other decision makers from authority and business to grasp the urgency and impact of different decisions,
  ○ a unique opportunity for researchers, teachers and students for hands-on trainings in various roles, a unique experience for tourists who want to co-create the tourism of the future.
• Regarding the Digital Innovation of Cultural Heritage, the initiative has allowed to:
  ○ Digitise over 100 units of cultural heritage in Slovenia, which were used for creation of over 30 unique, high added value tourist experiences (see also Making Slovenian success story)
  ○ Enable digital transformation in the tourism sector; connecting both sectors to collaborate and capitalise their business
  ○ Take first steps in creating data spaces for tourism and cultural heritage

Success factors
(a) T4.0 Core, a semantically organised data storage where applications store their data, was crucial to secure the interoperability of technological pillars with the collaborative Tourism 4.0 platform. It includes tools to seach and merge data and supports secure exchange of enriched data between stakeholders. The use of joint data catalogue enables discovery, search, understanding and increases trust in data. T4.0 Core supports sustainable development of services and products, improves interaction of stakeholders in development, and increases added value of services. (b) Certain Tourism 4.0 products were awarded prices at tourism events, such as the Tourism Impact Model, which won the best innovation in the field of artificial intelligence and data analytics at the Tourism Innovation Summit in 2020 in Seville, or the Digital Innovation of Cultural Heritage, which received the Destination of Sustainable Cultural Tourism award in 2021 (ECTN) in Athens.
Replicability potential
Medium. The introduction of a common digital ID card of the tourist and the adoption of a block chain platform require political agreement among stakeholders that are not easily replicated and scaled-up.

Case Study: G

BODAH

Geographical area	*Santiago de Compostela (Spain), San Sebastian (Spain), Pau (France), Cork (Ireland)*
Purpose areas of data use	*Increase destination sustainability and accessibility*
Type of data users	*Tourist destinations and public authorities* *Private sector – Tourism Industry*
Source of data	*Device data – GPS, mobile roaming, RFID, Bluetooth, meteorological, Wi-Fi; Smart city*
Actors involved	*Santiago de Compostela Municipality; University de Pau et des Pay de l'Adur, Nova University of Lisbon, Faculty of Science and Technology, Cork Institute of Technology, Fomento San Sebastian Municipal firm, Santa Maria la real Foundation for historical heritage, Bangor University, Glasgow Caledonian University*

Context and background

BODAH aims to improve the cooperation, joint planning and better management of touristic destinations of great cultural, historical and heritage importance. Some of such sites are also classified as World Heritage sites by UNESCO, but are nevertheless affected by mass tourism, which creates environmental and social burdens for both historical heritage and inhabitants of the sites.

Solutions adopted

A decision support system based on a big-data-gathering process on tourism, transport, environment, etc., and data mining techniques to develop relevant indicators (the Policy Toolkit) for touristic destination preservation.

Reasons for cooperation

The BODAH project aims to leverage upon opportunities from the cooperation of key stakeholders of touristic destinations to develop, test and assess new tools, solutions and knowledge in line with the current sectoral changes and characteristics of smart destinations to improve the decision-making processes of the policy decisions related to tourism, as well as to identify the most cost-effective solutions for determining positive behavioural change in tourists and inhabitants.

Areas of cooperation

To develop indicators and tools to understand the behaviour of both citizens and visitors of the destination. Some issues are addressed: which places are visited the most; what level of visitation these sites experience; how this traffic affects the site in question; what perceptions tourists and citizens have of the destination, and, finally, the socio-economic effects associated with the destination.

Typology of data shared

Mobility and transport, environmental information; touristic flows characteristics, opinions and behaviours. More information in: https://www.bodah.eu/sites/default/files/2020-09/np_bodah_eg_02_09_2020.pdf.

Approach to data management and sharing

To identify a series of key activities and actions to be implemented by the partners from December 2021 onwards, to guarantee the future use and impact of the tools created in the framework of the project and monitor their impact. Collaboration and knowledge sharing among the participants have also contributed to the development of best practices, lessons learned and recommendations, which are included in the so-called Policy Toolkit aimed at transferring the results for future use and ensuring replicability of the experience.

Key challenges

Stakeholders' engagement; citizens, tourists and travellers' participation and adoption of proposed solutions; data availability, ownerships, privacy and security; 5G availability.

Impacts
• a Policy Toolkit aimed at transferring key results for a future use and to guarantee a higher replicability of the initiative. • Several networking events. • 30 impacts indicators and related metrics. • A Data Mining tool to create Data Analytics Reports, including living graphs and the analysis of people flows, uses and habits, as well as predictive analysis carried out by the technical partners • Development and testing of a web based transnational platform to share data management services for public organisations managing tourism and heritage sites. • Open and Big data collection tools, to gather relevant data in four pilot sites. • Development of a training tool and organisation of local events to transfer the results. More info on: https://keep.eu/projects/22134/Big-and-Open-Data-for-the-d-EN/
Success factors
Already existing ICT infrastructure; decision makers more informed and available to address the proposed ICT solutions; existing network of key stakeholders available to be engaged in the project activities.
Replicability potential
Thanks to the availability of the Policy Toolkit, the identification of 30 indicators that are common to all sites and that are based on both SMART principles and the choice of state-of-the art technologies for data gathering, there is a high replicability potential for the project.

Case Study: H

Social Museum and Smart Tourism project

Geographical area	*Venice, Florence, Rome (Italy)*
Purpose areas of data use	*Improve interaction and engagement with the tourist*
Type of data users	*Tourist destinations and public authorities*
Source of data	*Device data – GPS, mobile roaming, RFID, Bluetooth, meteorological, Wi-Fi; Smart city*
Actors involved	*Vitrociset SpA; Engineering SpA; RAI; Telecom Italia; Consorzio Imprese PMI; La Sapienza University of Rome; IUAV; MICC – Florence University; Scuola Normale University of Pisa, University of Modena and Reggio Emilia, CNR (Italian National Council for Research).*

Context and background

Italian Cultural Heritage is an important social innovation driver and a significant economic contributor for the country, particularly insofar as it concerns the cultural tourism and publishing industries and commerce. Internet technologies and multimedia, together with the spread of mobile devices, have significantly changed the cultural tourists' behaviours.

Solutions adopted

A cloud-based solution aimed at optimizing the time of the visits and the information provided to each tourist, based upon his or her own preference structures and the suggestions/judgement provided by social networks linked to the platform.

Reasons for cooperation

Develop test and assess, in real life environments, innovative ICT solutions to better personalise the user experience of museum visitors. These solutions are based on the following technologies: new wireless communication protocols for the Internet of Things; recognition of images captured by the visitors' mobile devices; computer vision solutions for real time people identification and behaviour analysis; personalised multimedia content through social profiling solutions (semantic profiles and social networks); advanced augmented reality solutions.

Areas of cooperation

- New wireless communication protocols for the Internet of Things (IoT).
- Cloud Computing.
- Computer vision solutions for the recognition of images framed by tourists' mobile devices.
- Computer vision solutions to extract in real time information on flows and group behaviors and on anomalous events such as queues, blocks, etc.
- Extended user profiling solutions in the field of social networks.
- Advanced solutions of augmented reality and 3D visualisation for the use of contents.

Typology of data shared

Data related to cultural tourists' travel experiences

Approach to data management and sharing

Regarding data generated by users interactions, audio-visual data collected from social networks are analysed through social profiling engines and UGC engines to develop 'Smart Social Suggestions' through a hints engine based on content mash-up. Data on views and readings of users are also analysed in order to develop 'interactive storytelling. Data gathered from devices and sensors is analysed through IoT engines to map and visualise tourism flows in dashboards, also with the support of technology service providers. Specific advances sensors are also used to develop augmented reality visualisations.

Key challenges

- 5G diffusion in urban context.

- Extreme fragmentation of the supply.
- Modest technological orientation of the main institutions in the field.
- Small family-run businesses in the tourist sector.
- Lack of institutional coordination at the national level.
- Lack of integration in the sector at national level due to the exclusive competence of Italian Regions in the area of tourism.
- Passive resistance from more conservative players that may prevent innovation in the field.
- Lack of sufficient resources and know-how about smart tourism.
- High burden of administrative issues.

Impacts

- Quality time spent by cultural tourists in cities of art.
- Reduction of traffic congestions and queues for visiting touristic sites.
- Increase of numbers of visitors per hour in touristic sites and related revenues.
- New digitally driven revenue streams due to an increase of digital services for cultural tourists.

Success factors

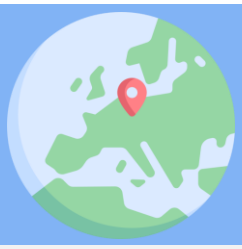
- World class, globally recognised heritage.
- High tourist attractiveness.
- Recent increase of start-ups in the tourist sector.
- Recent diffusion of calls for tenders and funds for developing smart tourism practices (see also National Plan for Recovery and Resilience - PNRR).
- Proposal of creation of a Digital Tourism Register (Registro Digitale Turismo).
- Recent creation of Association and Observatories regarding smart tourism.

Replicability potential

Very High Replicability Potential in all cities of art. The driving concept of this project is not necessarily “new” since there are many existing services/applications for cultural tourists around the word. Most of them are web mapping services to track users’ actions and suggest information. In this project the innovations are mobile bases, meaning an increased possibility for replicability of the proposed services.

Case Study: I

Smart Destination Project



Geographical area	*Tuscany Region, Sardinia Region, Liguria Region (Italy), Metropolitan area of Nice (France)*
Purpose areas of data use	*Improve interaction and engagement with the tourist* *Conduct market analysis and inform decision making*
Type of data users	*Tourist destinations and public authorities*
Source of data	*User-generated data – Textual; Photo* *Transaction data – Web search and webpage visiting; Online booking and purchasing; Consumer card transactions* *Device data – GPS, mobile roaming, RFID, Bluetooth, meteorological, Wi-Fi; Smart city* *Other data – Business information; Statistics; Context-specific information*
Actors involved	*Tuscany Region, Sardinia Region, Liguria Region, Metropolitan area of Nice, Technical Assistance Centre Confesercenti of Pisa, System Foundation of Tuscany, CCI*

Context and background

Globalisation requires that traditional touristic destinations have to compete with emerging ones through identifying innovative organisational models different from those that have ensured the success to traditional touristic destination until now. For instance, in the Mediterranean basin, if the traditional touristic destinations want to increase their competitive level, they need to cooperate with one another to find a way to make a joint offer to tourists, instead of promoting themselves separately, as was done in the past. The common governance of the information for and from tourists is a fundamental prerequisite to provide rapid, complete and accessible answers to the changing needs of information and personalisation of the tourist. The project aimed to identify cost-effective data governance solutions that could address the aforementioned issues and increase the competitiveness of the destinations involved in the project.

Solutions adopted

The initiative is the first step towards defining a common strategy (Management Model) for integrating the information flows available to the public-private system with the territorial tourist offer, as well as the development of the related technological architecture (Technological System or cross-border digital ecosystem) through common API. The solution allows the integration of the offer available in several portals / existing web tools active within the geographical area of the project, in order to improve the competitive positioning on local and international markets.

Reasons for cooperation

The various Italian and French actors involved cooperated in a view of developing and providing tourism services for the entire area of the northern Tyrrhenian Sea, regardless of national borders.

Areas of cooperation

Cooperation was mainly activated to address interoperability issues.

Typology of data shared

Data about accommodation availabilities and touristic landmarks and offers to be displayed in interactive maps.

Approach to data management and sharing

A dedicated team within the project focused on addressing technical matters, addressing interoperability issues, setting-up common APIs and developing a prototype app for tourists.

Key challenges
Data availability, data privacy and data ownership, key stakeholders' engagement, common vision and strategy.
Impacts
• Increase of accessibility and sustainability of touristic offer in the area. • Increase of tourism. • Increase of services related to tourism, developed by using data and information provided by the portal. • Increase added-value information and its availability for tourists through web applications and mobile devices. • Create a touristic ecosystem in the area.
Success factors
A common strategic plan was developed for the entire touristic area. A pilot app was developed to test its effectiveness and potential within different scenarios. Various project phases were characterised by a strong involvement of stakeholders through innovative approaches, such as living labs.
Replicability potential
Medium**.** To replicate the initiative in other or similar contexts, would require a strong willingness to cooperate among public and private stakeholders that are open to sharing data and gathering processes to develop a common data governance. Moreover, policy makers have to show a common vision and strategy in committing stakeholders to sharing data, perceiving at the same time a competitive advantage in doing so.

Case Study: J

SmartCulTour

Geographical area	*Rotterdam (Netherlands), Scheldeland (Belgium), Utsjoki (Finland), Huesca (Spain), Split (Croatia), Vicenza (Italy)*
Purpose areas of data use	*Conduct market analysis and inform decision making*
Type of data users	*Tourist destinations and public authorities*
Source of data	*Other data – Business information; Statistics; Context-specific information*
Actors involved	*Catholic University (KU) Leuven, Stichting Breda University of Applied sciences, University of Split – Faculty of Economics Business and Tourism, Ca' Foscari University of Venice, Modul University of Vienna, United Nations, Mediterranean Agronomic Institute of Zaragoza / International Centre for Advanced Mediterranean Agronomic Studies, Tourism agency of the Belgian Flemish Government, Quantitas Srl*

Context and background

Sustainable cultural tourism represents a significant opportunity for the development of European regions. Cultural tourism, especially in rural areas and as well as in urban peripheries, can also represent a factor of economic growth.

Solutions adopted

SmartCulTour (Smart Cultural Tourism as a Driver of Sustainable Development of European Regions) is a project funded by the European Union in the framework of Horizon 2020. It aims at redefining the concept of cultural tourism, providing new strategies to co-create smart cultural tourism practices in European regions through the engagement of stakeholders. The project is developing – among other tools – a decision-support system (DSS) to monitor the regions combining traditional and non-traditional data sources.

Reasons for cooperation

Development of six living-labs to test models for managing sustainable cultural tourism development, to support collaboration and capacity building. Identification of success and failure factors related to the contribution of cultural tourism to sustainable development.

Areas of cooperation

Cultural tourism, sustainable development, co-creation of strategies for sustainable cultural tourism experiences.

Typology of data shared

See dashboard platform in http://www.smartcultour.eu/smartcultour-platform/

Approach to data management and sharing

Big Data Analytics. Six Living Labs that will inspire novel, creative approaches to stakeholder engagement are tested, notably arts-based methods, serious games, and service design which will help to provide local context and support. Co-creation of sustainable cultural tourism experiences.

Key challenges

Data availability, privacy and security, stakeholder and user engagement, policy decision-maker commitment, 5G.

Impacts

- The establishment of six living labs in rural areas as well as in urban peripheries to co-create sustainable cultural tourism experiences.
- the validation of a common Decision Support System (DSS) to support knowledge-led destination management in planning and implementing sustainable solutions for tourism.

- The development of best practices, lessons learned and policy recommendations validated in six living-labs and openly available to other EU cultural destinations.

More information is available on: https://www.ciheam.org/project/smart-cultour/.

Success factors
Stakeholder and user participations. Data availability and Open Data.
Replicability potential
A significant level of adoption of the proposed solution in six Living Labs and the availability of co-developed best practices, lessons learned, and policy recommendations are an indicator of an high replicability potential.

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