UNWTO
World Tourism Organization

BIG DATA
IN CULTURAL TOURISM
BUILDING SUSTAINABILITY
AND ENHANCING
COMPETITIVENESS

Big Data in Cultural Tourism

Building Sustainability and Enhancing Competitiveness

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Introduction

The close linkages between culture and tourism are undisputable, but also common challenges such as the ones related to the COVID-19 crisis which call for joining efforts to build more solid alliances and common responses.

The lack of data is among the main obstacles to understand the relationship between both sectors, the added value they bring to each other, the means to balance benefit sharing, and the systems geared towards joint decision-making. In cultural tourism, the complexity of data gathering and analysis relies on the participation of an extensive spectrum of players, requiring new efforts to exchange and improve data collection that needs to fully implicate both sectors.

In this endeavour, the uses of new technologies can shorten processes, reduce data gathering and analysis costs, complement traditional metrics to provide an in-depth knowledge, and provide real-time data to address immediate issues for visitors or communities. Tools such as big data, use the digital footprint of users to understand them better and craft tailor-made responses that can improve their experiences or mitigate undesired results. The use of big data maximizes the benefits of the unprecedented volume of data identified in the past few years, which has been further broadened by the recent global events.

With this publication, the World Tourism Organization intends to provide a baseline research on using new technologies by tourism and culture stakeholders, like big data, in order to improve the competitiveness of cultural tourism and reinforce its sustainable development.

Through a brief introduction of big data and its relevance to cultural tourism chapter 1 sets the basis to connect tourism, culture and new technologies for mutual benefits, while it also calls for a reflection on the ethical implications of such approaches for policymakers, businesses and users. Chapter 2, addresses the practical use of big data in cultural tourism. Through a survey conducted among UNWTO Member States and complemented by a desk research, ten good practices have been selected to illustrate the potential use of big data for: 1) tracking and monitoring of visitor

flows; 2) profiling visitors; 3) measuring visitor satisfaction and sentiment; 4) measuring expenditure; 5) promoting visitor engagement; 6) predicting visitor behaviour, and 7) cultural resources.

Big Data in Cultural Tourism – Building Sustainability and Enhancing Competitiveness underlines the issues shared between tourism and culture, and some of the innovative solutions implemented around the world. The cases intend to inform cultural tourism stakeholders, ranging from national tourism administrations (NTAs) to cultural tourism destinations, on alternatives that can respond to diverse needs and available resources.

The study highlights the relevance of building alliances for the transition of cultural tourism towards the digital era, while overcoming a series of existing challenges and boosting new opportunities. The different uses of big data during the COVID-19 pandemic lay outside the scope of the study, as the cases and information had been collected prior the pandemic. Nonetheless, in most cases, the suggested applications of big data can be adapted to the new conditions of cultural tourism under the impact of the COVID-19 era.

Chapter 1
Introduction to big data and cultural tourism

Summary

This section is aimed at giving a brief overview of big data, its main functions and data sources. The chapter highlights the steps taken in tourism to enable an ethical and responsible collection and use of data. It concludes by narrowing down the use of big data in cultural tourism, particularly in addressing the existent challenges in building reciprocal partnerships and creating benefits for culture and tourism stakeholders within destinations.

The analysis of big data use during the COVID-19 pandemic lays outside the scope of this chapter and this publication.

Key features

- Growing production of the world's volume of data.

- Big data as an alternative to access real-time data and reduce costs.

- Relevance of partnerships between private and public sectors to unleash big data's potential.

- Big data's benefits translating into responsible, ethical and inclusive uses.

- *Recommendations on the Responsible Use of Ratings and Reviews on Digital Platforms* of the World Committee on Tourism Ethics.[1]

- Big data in cultural tourism as a tool for informed decision-making, enrichment of cultural experiences, source of information for visitor experiences and digital access to culture.

Key message

Big data analysis requires joint efforts between different sectors and key players in cultural destinations, in order to harness all its benefits for tourism and culture, visitors and communities.

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1 Established in 2003, the World Committee on Tourism Ethics is an impartial body responsible for interpreting, applying and evaluating the provisions of the UNWTO Global Code of Ethics for Tourism.

1.1 Introduction to big data

This century is marked by the world's digital transition with an unprecedented volume of data. The United Nations estimates that in the last couple of years 90% of the data has been generated, projecting to increase by 40% annually. In COVID-19 times, the digitalization of various sectors and daily life activities has been accelerated, producing even a greater growth trend of the volume of data.[2]

Big data sources vary, containing in most cases users' digital footprint from mobile phones, credit cards and social media. In tourism, big data sources include:[3]
– Communication systems, e.g., mobile network data, social media;
– Worldwide web, e.g., individual/business websites;
– Transaction data, e.g., flight booking systems, retail transactions;
– Physical sensors, e.g., points of interest/information; and
– Crowdsourcing, e.g., images and content from platforms, i.e., YouTube, TripAdvisor.

The digital transformation has leveraged the capacity of many sectors to respond with real-time data and reduce the costs of data gathering. The findings of big data can complement traditional measurement methods, such as surveys and official statistics, adding clarity to human behavioural patterns, experiences and profiles. Therefore, the combination of traditional and big data methods can enable prompt and informed decision-making in most sectors.

The private sector has widely explored the benefits of big data for consumer profiling, improvement of experiences, personalizing products and services, and predicting consumer behaviours. On the other hand, the public sector is lagging behind, particularly with regards to using the benefits of big data to address a wide range of social challenges. This referres in particular to the yet untapped potential of big data in measuring progress of the Sustainable Development Goals (SDGs).[4]

1.2 Ethical approach to big data in tourism

The benefits of big data come with relevant implications. The World Committee on Tourism Ethics has emphasized the responsibility of digital platforms to ensure that big data are transparent and truthful.[5] Moreover, Article 6 of the *UNWTO Convention on Tourism Ethics* states that "[…] tourism professionals have an obligation to provide tourists with objective and honest information […]". Yet, the numerous sources generating big data imply significant challenges to manage this information and ensure its veracity.

In 2017, the World Committee on Tourism Ethics adopted the *Recommendations on the Responsible Use of Ratings and Reviews on Digital Platforms.* These Recommendations outline a series of

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2   United Nations (n.d.), 'Big Data for Sustainable Development', United Nations Global Issues (online), available at:
     www.un.org/en/global-issues/big-data-for-sustainable-development (15-06-2021).
     This flood of digital data is known as big data.

3   Adapted after: Demunter, C. (2017), *Tourism statistics: early adopters of big data?,* Eurostat, European Union, Luxembourg.

4   United Nations (n.d.), 'Big Data for Sustainable Development'.

5   World Committee on Tourism Ethics (2017), *Recommendations on the Responsible Use of Ratings and Reviews on Digital Platforms,* UNWTO, Madrid.

responsibilities for digital platforms in gathering and displaying information, and in dealing with its potential misuse. For service providers, this UNWTO milestone document highlights the need to regularly monitor the data they use, while ensuring its accuracy and regular updates. In reference to consumers, the Recommendations focus on the responsible generation of content, mainly related to facilitating genuine, accurate and useful information for other users.[6]

The recent developments and additional potential of big data for improving competitiveness or addressing sustainability, show the need for the private and public sectors, as well as academic institutions, to work together. In this digital transition, all parties shall committ to reliable and transparent data collection processes and uses, leaving no one behind, especially the disadvantaged social groups.[7] Only this way, the transition can be ethical, responsible and inclusive.

Overall, big data can offer feasible and effective alternatives to tackle the existent obstacles towards informed decision-making in tourism. In the sphere of cultural tourism, it can enable the adoption of informed approaches to build upon and boost further the direct links between tourism and culture, ranging from market advantages to fair distribution of economic benefits. In views to boost the benefits of cultural tourism, the next section explores the main approaches of big data across two dimensions: competitiveness and sustainability of cultural destinations.

1.3 Big data in cultural tourism

The convergence of tourism and culture enriches the visitors' experiences, facilitates intercultural dialogue and cultural appreciation, while enabling the access to culture to a broader audience.

Culture can reinforce the competitiveness of destinations, while tourism revenues can be invested in programmes benefitting cultural institutions, creatives, local communities and other cultural players. In the same vein, the sources for funding, commercialization of products and experiences, and social benefits for these key players can be generated trough cultural tourism activities. Moreover, in the COVID-19 crisis, a sustainable future of the already fragile cultural and tourism ecosystems, requires bold actions and joint approaches to address shared issues.

One of the main challenges for building strong partnerships between both sectors includes the lack of data to illustrate the interlinkages and symbiotic relationships between tourism and culture, among others:
– Understanding of the added value of culture in destinations;
– Defining carrying capacity in cultural sites;
– Profiling cultural tourists;
– Predicting consumer behaviours; and
– Balancing sustainability and competitiveness.

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6   World Committee on Tourism Ethics (2017), *Recommendations on the Responsible Use of Ratings and Reviews on Digital Platforms,* UNWTO, Madrid.

7   The UNWTO Ethics, Culture and Social Responsibility Department has been issuing a series of thematic inclusive recovery guides reflecting the sociocultural impacts of COVID-19, with a particular focus on women, youth, persons with disabilities and indigenous peoples. These groups may face digital divide, but also prosper more if big data are used to enhance their socioeconomic empowerment.

The use of technology can shift unsustainable cultural tourism practices towards more effective alliances and benefit sharing. These partnerships ought to involve culture and tourism sectors, communities and businesses.[8]

With this approach, big data analysis can become an effective alternative for addressing long-standing challenges in cultural tourism destinations. Through the often location-based use of big data, real-time information from cultural sites, events and visitors in a specific area, can be of great use. Therefore, in cultural destinations big data can:

– **Support informed decision-making:** cultural destinations are exploring ways of using big data to enable informed decision-making, particularly related to the improvement of visitor experiences and marketing. Big data analysis can include quantitative and qualitative data, the latter related to user generated content (UGC), e.g., social media posts;

– **Enrich cultural experiences:** big data can provide information on the location and interpretation of cultural elements, such as heritage sites, gastronomy routes or traditional artisan workshops. Augmented and virtual reality in cultural sites and museums can broaden the visitor experiences, particularly in challenging times, when travel is restricted;

– **Facilitate information for visitor experiences:** cultural tourism tends to be an information-intensive experience, with learning as one of the main motivations. Visitors often wish to know more about the places they visit and their cultures, making the information a vital element in cultural experiences;[9]

– **Enable digital access to culture:** the vast storage of cultural heritage elements in museums and archives is transitioning towards the digital world, providing new opportunities to access cultural data by visitors and residents alike; and

– **Managing tourism flows and congestion:** a proper management of big data is crucial to ensure acceptable levels of carrying capacity at cultural sites, venues and events, such as concerts, festivals and fairs. Big data can therefore lower the pressure of visitors on cultural elements and local communities by dispersing visitor flows and diversifying the local cultural offer. Alternative products, promoted by harnessing the big data vast potential to learn about consumer preferences, can improve the overall visitor experience.[10]

In the future, big data in cultural destinations could become an element *per se* within the whole tourism value chain, rather than just a method to analyse behavioural or expenditure patterns. The growing familiarity with different uses of big data by visitors could lead to their active participation in the elaboration of interpretation resources in cultural destinations, generating new and creative ways of analysis and handling of data. It is also conceivable that big data will turn into key information sources to feed in the development of other experiences in destinations, or new tourism products, like cultural routes (see chapter 2, Montreal good practice).

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8   World Tourism Organization (2018), *Tourism and Culture Synergies,* UNWTO, Madrid,
     DOI: https://doi.org/10.18111/9789284418978.

9   Richards, G. (2018), 'Cultural Tourism: A review of recent research and trends', *Journal of Hospitality and Tourism Management,* volume 36, pp. 12–21.

10   See for more information on the topic: World Tourism Organization (UNWTO); Centre of Expertise Leisure, Tourism & Hospitality; NHTV Breda University of Applied Sciences; and NHL Stenden University of Applied Sciences (eds., 2018), *'Overtourism'? – Understanding and Managing Urban Tourism Growth beyond Perceptions,* UNWTO, Madrid,
     DOI: https://doi.org/10.18111/9789284419999.

Despite the multiple benefits, the use of big data in cultural tourism is still uneven. The private sector is taking the lead, while the public sector often lacks the necessary resources and expertise to develop own systems. Specific public-private partnerships are essential to unleash all the potential of big data. In response, UNWTO has identified some of the most relevant actions deployed in cultural destinations where big data analysis has provided benefits for tourism and culture stakeholders, destinations and visitors.

The following chapters showcase selected case studies, offering a wide array of options to build alliances, develop efficient processes, and, more importantly, to use the real-time data for informed decision-making in cultural tourism.[11]

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11   The scope of the best practices compendium lays outside the COVID-19 context, as the practices had been collected prior to the pandemic. However, they can certainly guide the key players in crafting their response to issues provoked by the current crisis.

Chapter 2
Good practices:
Big data and cultural tourism

Summary   This chapter reviews specific approaches of the use of big data in cultural tourism, drawing on the responses to a survey conducted among UNWTO Member States and Affiliate Members. The selected case studies illustrate at national, regional and local scales the different use given to big data to foster the sustainability and competitiveness of cultural destinations. The main findings include big data use for increasing visitor numbers, improving visitor experiences, and more importantly, supporting informed decision-making in destinations. Informed decision-making increases the competitiveness of cultural tourism operations and improves the overall sustainability of cultural tourism.

Note: The scope of the best practices compendium lays outside the COVID-19 context, as the practices had been collected prior to the pandemic. However, they can certainly guide the key players in crafting their response to issues provoked by the current crisis.

Key features
- Cultural tourism is fertile soil for big data uses.
- Big data improves experience quality, marketing effectiveness and overall competitiveness.
- Benchmarking of cultural destinations and experiences can be broadened by using big data.
- Monitoring visitors can aid in managing visitor flows, increasing the sustainability of cultural tourism.
- Analysing visitor experience and sentiment can result in new product development and tailored experiences.
- More accurate data can result from comparing data sources and information generated by traditional mechanisms and big data.
- At present, most big data applications are found at urban tourism destinations, leaving a window of opportunities to explore the benefits in rural settings.

Key message   Big data has significant potential to increase the overall sustainability and competitiveness of cultural tourism experiences and products.

2.1   Study methodology

Chapter 2 is largely based on a survey carried out among UNWTO Member States and Affiliate Members. The answers provided an insight into big data use in the private and public sectors within cultural tourism destinations. The information was complemented with desk research and interviews with national tourism administrations (NTAs) and other tourism stakeholders.

The survey aimed not only to explore the use of big data in the tourism sector, but also to gauge how different stakeholders in cultural tourism made use of this innovative tool. This chapter presents the outcome analysis of various cases of big data applications within the following categories:

1.   Tracking and monitoring of visitor flows;
2.   Profiling visitors;
3.   Measuring visitor satisfaction and sentiment;
4.   Measuring expenditure;
5.   Promoting visitor engagement;
6.   Prediction of visitor behaviour, and
7.   Use of big data for cultural resources.

In general, the selected cases illustrate different experiences and lessons learned on improving the sustainability and competitiveness of cultural tourism. Before presenting the selected best practices, the following section provides a more detailed description of the seven identified categories of big data use in cultural tourism.

2.2   Categories of big data uses in cultural tourism

Big data uses in cultural tourism have been divided into seven main categories based on the survey's findings. The categories intend to facilitate the understanding of its different uses among culture and tourism stakeholders in destinations.

1.   **Tracking and monitoring of visitor flows:** big data can facilitate information on the visited sites, duration of visitors' stay in a destination or at cultural sites;

2.   **Profiling visitors:** from the combination of measurements, big data can provide new insights into visitor preferences and behaviours, particularly when identifying *cultural* visitor preferences in destinations;

3.   **Measuring visitor satisfaction and sentiment:** due to the current engagement with a wide range of information sources and social media, it is possible to capture visitor experiences, from trip planning to subsequent reviews or posts about their journey, facilitating qualitative data to foster positive experiences or improve services with low satisfaction rankings;

4.   **Measuring expenditure:** the combination of information retrieved from tourist movements and transactions creates useful results for expenditure analysis. This approach allows the access to real-time information on levels and patterns of expenditure, or the origin of top spenders;

5.   **Promoting visitor engagement:** big data makes cultural institutions and destinations more open, accessible and connected with their visitors. New technologies provide more potential for tailor-made and personalized experiences. The widespread digitalization also makes cultural tourism available to those unable to physically visit certain sites or experience the existing cultural offer;

6.   **Prediction of visitor behaviour:** based on profiling and analysis of previous behaviour, big data allows the prediction of tourism flows across different elements of the tourism and culture

value chains. This element is key when referring to carrying capacity, and balance between tourism, culture and local communities; and

7. **The use of big data for cultural resources:** among the main findings, the study shows the shift of big data from a practical tool to a source of creativity. Cultural institutions are producing new cultural elements and crafting new experiences in destinations with big data as one of the key instruments for digital art.

The categories of big data use in cultural tourism show that there is a large potential, ranging from more basic enumeration and profiling of visitors to more complex strategies of interactive engagement and prediction. The illustration of these different categories of big data applications in cultural tourism is given in more detail in the following section of this chapter.

2.3   Good practices: big data in cultural tourism

This section showcases the selected cases in cultural tourism. Table 2.1 summarizes the section's content divided into the seven categories of big data use in cultural tourism (see section 2.2), the main stakeholders and cultural components involved and lessons learned from each case, as well as the specific dimension addressed, i.e., competitiveness/sustainability.

The order of cases is organized by spatial level; from national programmes and local (city/national regions) levels, to specific cultural assets and experiences.

Table 2.1 **Cases selected**

Case study	Focus		Big data categories							Main stakeholders/ cultural components involved	Lessons learned
	Competitiveness	Sustainability	1) Tracking and monitoring	2) Profiling visitors	3) Measuring satisfaction	4) Measuring expenditure	5) Promoting visitor engagement	6) Predicting visitor behaviour	7) Cultural assets/ resources		
1. Identifying added value of culture to tourism destinations, Republic of Korea	×		×	×						DMOs; technology companies; festivals	Data analysis can support the development of cultural tourism strategies for specific markets and underline the added value of culture for destinations.
2. Branding perceptions, Sri Lanka	×	×		×	×					Tourism observatories; NTO; heritage sites	Satisfaction/interest levels of cultural experiences can improve marketing and management efforts.
3. Joining efforts in Buenos Aires, Argentina, to better understand its visitors	×	×	×	×					×	DMOs; technology companies; cultural clusters	Institutional support and collaborations can provide shared benefits from big data use in cultural destinations.
4. Identifying visitors' cultural preferences in Antwerp, Belgium	×	×	×	×	×			×	×	DMOs; tourism and social media platforms; historic centres;	User generated content can enhance the spread of benefits and quality of cultural tourism.
5. Profiling cultural visitors in rural destinations and heritage sites, Peru	×		×	×					×	NTO; DMOs; private sector; World Heritage Site; living heritage	Big data can support understanding of the interests of cultural visitors in rural destinations and heritage sites.
6. Managing cultural tourism in Amsterdam, Netherlands	×	×	×	×	×		×	×	×	DMOs; social media; residents and visitors; museums	Cultural tourism flows and behaviour can be improved through big data.
7. Combining technologies to improve cultural tourism experiences, Barcelona, Spain	×	×	×	×	×			×	×	DMOs; technology companies; historic buildings	The combination of big data with other technologies can support measures to improve citizens and visitor experiences.
8. Understanding domestic tourism flows, World Heritage cities, Mexico	×		×	×						Research centres; NTA; World Heritage cities	In countries with a significant share of domestic tourism, big data can improve the understanding of domestic markets.
9. Creating new cultural sites in Montreal, Canada	×				×		×			DMOs; social media; creative industries	Uses of big data as means to express users' creativity.
10. Culture Trip – online platforms addressing cultural visitors	×	×		×			×	×	×	Online platforms; street art; living heritage	The experience of the online platform, Culture Trip, underlines the role of big data in identifying consumption patterns and predicting behaviour in cultural tourism.

Case 1
Identifying the added value of culture to tourism destinations in the Republic of Korea

Stakeholders/components:	DMOs, technology companies, festivals
Big data categories:	1. Tracking and monitoring
	2. Profiling visitors

The Republic of Korea has given high priority to big data in its tourism strategy, to better understand cultural tourism products and events. The strategy intends to analyse tourism flows and income in order to make management decisions more efficient.

The Korea Tourism Organization (KTO) has recently collaborated with technology companies to address challenges that include a downturn in international tourism arrivals. One of the approaches was building partnerships with technology companies to cover specific markets.[1] The objectives included the accurate measurement of market trends and introduction of customized tourism products. The collected data was shared by KTO with some of the Korean tour operators to support the design of strategies aimed at attracting specific visitors' profiles from nearby countries, particularly the Chinese market.

The data retrieved from the latter provided important insights into visitor profiles based on their place of origin and interests in Korean products, many of them linked to the country's culture. The gathered data showed that 55% of Chinese visitors who searched for 'Korea tour' were mainly women aged between 20 and 30 years. The most frequently searched terms by visitors included Korean TV stars, fashion in Seoul and Korean food. The results allowed to customize the travel products addressing the needs of Chinese visitors and their cultural interests, as well as the design of KTO marketing strategies.[2] In the latter, KTO has broadened its collaboration with technology

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1   Kim, Eun-jung (2014), 'Korean tourism agency partners with China's Baidu to use big data on travelers', *YonHap News Agency,* published 26 November 2014 (online), available at: en.yna.co.kr/view/AEN20141126005000320 (24-02-2020).

2   Ibid.

companies to increase the numbers of Chinese visitors to the country, as well as to ease their travel within the destination. In the project, KTO released specific advertisements in social media channels and video platforms promoting visits with a cultural purpose.

Other dimensions covered with big data analysis were events, visitor flows and expenditure levels by regions. In 42 cultural festivals around the country, big data techniques were used, including mobile positioning data (MPD), credit card transactions and analysis of social media. In the pilot phase of 16 selected festivals, the visitor numbers were measured using MPD analysis, while user generated content (UGC) on news websites, online communities and social media were used to evaluate qualitative data.[3]

The results of the pilot marked a 12% increase in daily visitor numbers during all 16 festivals. The analysis also showed that distance was an important factor, as almost a third of the festival visitors were from the same municipality where the festival was held. Moreover, during the festivals revenues increased by 7.4% on average, particularly in accommodation, sports, food and entertainment. This underlines the important role of cultural events, like festivals, in tourism.[4]

The implementation of strategies using big data shows the relevance of partnerships between the public sector and technology companies for generating valuable information on cultural tourism flows, cultural tourism motivations and behaviour, through social media analysis. Big data analysis allows DMOs to increase their competitiveness by better targeting and differentiate the needs of cultural visitors from a great variety of markets. It also reveals the added value of culture, such as festivals, for the destinations' overall competitiveness.

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3   Detailed information on Cultural Tourism Festivals selected by the Ministry of Culture, Sports and Tourism is available at: english.visitkorea.or.kr/enu/ATR/SI_ENG_4_1_1.jsp.

4   Korea Tourism Organization case study submission.

Case 2
Branding perceptions in Sri Lanka

Stakeholders/components:	Tourism observatories, NTO, heritage sites
Big data categories:	2. Profiling visitors
	3. Measuring satisfaction

Sri Lanka has recently experienced a growing number of Chinese visitors, which required the improvement of capacities to understand the Chinese visitor behaviour and sentiment. In response, the Monitoring Center for Sustainable Tourism Observatories (MCSTO) in China conducted a study to analyse the sentiments of this market in Sri Lanka.[1]

In the study, MCSTO reviewed user generated content (UGC) from about 14,200 comments of Chinese websites commenting about 17 cities in Sri Lanka. The data were used to analyse the perceptions of Sri Lanka among Chinese visitors and the possible impact of these on their satisfaction and loyalty to the destination. It also contributed to identify the cultural elements of interest to Chinese travellers. Particular attention was paid to the popular cultural routes with Chinese nationals including World Heritage Sites, and other routes covering cultural and spiritual elements, like meditation, tea and Buddhism.[2]

The Internet search analysis indicated that most interest in Sri Lanka as a destination came from first-tier cities such as Beijing, Shanghai and Guangzhou, whereas most of the people interested in Sri Lanka were aged between 20 and 39 (80% of searchers) and were predominantly male (71%). In regards to visitors' sentiment, Sri Lanka has a positive image among Chinese visitors with 75% satisfaction rates with Buddhism, as the most relevant cultural tourism product. However,

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1   Big-Data Research Group of MCSTO (2017), 'Mega-data and Sentimental Image of Sri Lanka', *Researchgate*, DOI: 10.13140/RG.2.2.30862.46403.

2   Ibid.

some travellers complained about the management of some tourism spots, as well as the lack of connectivity between sites. When narrowing down the analysis, it was found that the frequency of comments indicated some important cultural clusters, mainly focussed on Buddhism. Visitors to the main Buddhist cultural heritage sites, such as Sri Dalada Maligawa, show a high incidence of words like 'followers', 'piety' and 'temple', noting the spiritual nature of the experience. Comparisons were also made between the major urban destinations in Sri Lanka, revealing Colombo as the destination with the highest satisfactory experience for visitors (83% positive comments), followed by Kandy (81% positive). Nonetheless, Kandy had a much higher incidence of words related to religion, reflecting its attractiveness as spiritual centre for visitors.

In Sri Lanka, big data analysis showed the cultural elements that are of interest for visitors, and the visitors' satisfaction and preference levels of the country's cultural sites and cities. This example illustrates how the sentiment analysis can be useful at national level to compare experiences in different cities and destinations. The results can support the identification of the most popular sites and specific attractiveness based on either cultural or spiritual values.

If well-used, the retrieved information can help integrate cultural clusters in the cities' tourism offer, create new cultural routes or tourism products. Moreover, the sentiment analysis can also boost the use of cultural elements to build or reinforce the image of a destinations for visitors, enhancing the effectiveness of marketing and promotion strategies for specific markets.

Case 3
Joining efforts in the city of Buenos Aires, Argentina, to better understand its visitors

Stakeholders/components:	DMOs, technology companies, cultural clusters
Big data categories:	1. Tracking and monitoring
	2. Profiling visitors
	7. Cultural assets/resources

Buenos Aires was the first city in South America to produce a digital platform entirely dedicated to the evaluation and analysis of tourism activity.[1] The DMO of Buenos Aires has been using big data as a tool for informed decision-making in the sector. Big data provided an effective focus for strategies of marketing and promotion, as well as for the identification of new business and investment opportunities for companies and entrepreneurs in this cultural destination. Better information on tourist behaviour helped to improve and design the tourism offer to match the existing demand, as well as to develop promotional strategies to attract new markets.

The platform was funded by the DMO of the City of Buenos Aires and developed in cooperation with the Ministry of Tourism of Argentina, the National Directorate of Migration, the National Institute of Statistics and Censuses of Argentina, Telefónica Argentina, Amadeus South America, SEGITTUR of Spain and other partners.

The data is retrieved through different tools including global distribution system (GDS) which uses searches, bookings and passenger transfer data. Online searches and reservations through travel agencies are valuable elements to understand the intention and willingness to travel to a cultural destination. Other travel search engine platforms like Booking.com or TripAdvisor also register prices, ratings and reviews of stays.

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1   World Tourism Organization and World Tourism Cities Federation (2018), *UNWTO/WTCF City Tourism Performance Research,* UNWTO, Madrid, DOI: https://doi.org/10.18111/9789284419616.

The platform tracks visitor behaviour in 161 areas of the city, allowing to analyse the quality standards of tourism services and products, particularly those located in the historic district and close to major cultural sites.

The city's big data platform has located the traces of movement patterns to some of the main cultural attractions of the city from museums, theatres or bookstores, to events and traditional markets. It facilitated matching visitor flows with areas that have a greater concentration of cultural sites. In the revision of visitor flows to cultural and sport events, the global system for mobile communications (GSM) data showed different patterns of attendance by domestic and international visitors. GSM data also allowed for major events, like the San Telmo Fair, to address, through the identified patterns of international visitor flows, alternative strategies and alternative promotional activities.

Another key contribution of this project was the generation of a greater volume of visitor information, particularly data on visitor consumption patterns and behaviour within the different districts of the city. These data permitted the division of the city in districts based on the visitors' preference and nationality. The information is useful for defining the city's tourism development strategies including the adjustment of opening hours and improvement of marketing actions and security measures to increase visits.

The initiative deployed by the city of Buenos Aires illustrates the use of big data to understand visitor behaviours, profile cultural tourists and promote the benefits of institutional support and partnerships in tourism with technology companies.

Case 4
Identifying visitors' cultural preferences in Antwerp, Belgium

Stakeholders/components:	DMOs, tourism/social media platforms, historic centres, museums
Big data categories:	1. Tracking and monitoring
	2. Profiling visitors
	3. Measuring satisfaction
	6. Predicting visitor behaviour
	7. Cultural assets/resources

In Antwerp, the use of big data includes the analysis of visitor flows and visitor experiences for the improvement of marketing and management strategies.[1] The initiative covers the analysis of user generated content (UGC) including social media. In total, 90,000 reviews of the city of Antwerp were analysed: descriptions and quality of experiences, locations of the sites, types of tourism services, times of visit and visitor profiles.[2]

In the analysis, the results showed that visitors who reviewed one location in Antwerp were more likely to post other reviews. The reviews were mainly concentrated on the historic city centre and its emblematic cultural sites, like the Cathedral, the market square, or Rubens House with buzz words such as 'medieval' or 'baroque'. The data also indicated the trend of visitor concentrations in the historic centre. However, the Museum aan de Stroom (MAS) and the Red Star Line museum were

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1   World Tourism Organization; Centre of Expertise Leisure, Tourism & Hospitality; NHTV Breda University of Applied Sciences; and NHL Stenden University of Applied Sciences (eds., 2019), *'Overtourism'? – Understanding and Managing Urban Tourism Growth beyond Perceptions, Volume 2: Case Studies,* UNWTO, Madrid, DOI: https://doi.org/10.18111/9789284420629.

2   Ibid.

the exceptions, as both sites are located on the northern fringe of the city. In the MAS, visits also included international tourists, although with a far more limited time spent in the area.[3]

Another layer of analysis included the profiling of visitors based on their country of origin and service preferences, i.e., accommodation and restaurants. For instance, residents and domestic visitors tend to concentrate around specific museums, heritage sites and the zoo, whereas the historic city centre is the main spot for non-European visitors. When analysing the trends in restaurants and hotels, these are distributed more evenly although there is a larger concentration of restaurants' reviews around the historic city centre. In reviews provided by international visitors, the city's gastronomy included expressions such as 'beer and fries', particularly around the central station and the historic city centre, while local reviewers had a more cosmopolitan mention when referring to the city's gastronomy.[4]

Altogether, the concentration of reviews in specific areas create an information cascade effect, meaning that the UGC influences other visitors' behaviours and therefore, narrows visits to specific areas in the city. This behaviour stresses the challenge of spreading cultural tourists to other less visited areas. Hence, big data analysis can support effective policymaking to spread benefits to more areas and improve visitor experience in the already popular and the *new* tourism zones.[5]

In general, the project highlights the value of analysing UGC to understand better visitor flows and cultural experiences in destinations. The research highlights the challenge of spreading tourists, particularly international visitors, in areas outside the main tourism spots. It also notes the limitations of collecting, extracting and analysing UGC on cultural tourism, as reviews are not necessarily representative of all visitors.

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3   World Tourism Organization and World Tourism Cities Federation (2018).

4   van der Zee, E.; Bertocchi, D. and Vanneste, D. (2020), 'Distribution of tourists within urban heritage destinations: a hot spot/cold spot analysis of TripAdvisor data as support for destination management', *Current Issues in Tourism,* 23 (2), 175196, DOI: 10.1080/13683500.2018.1491955.

5   Ibid.

Case 5
Profiling cultural visitors in rural destinations and heritage sites of Peru[1]

Stakeholders/components:	NTO, DMOs, private sector, World Heritage Sites, living heritage
Big data categories:	1. Tracking and monitoring
	2. Profiling visitors

Peru has been experiencing a growing number of visitors in rural settings, strongly linked to the country's cultures. For marketing, culture has become a very important asset appreciated and frequently quoted by visitors, especially foreigners. Therefore, it was deemed essential to investigate further the profiles of cultural visitors to respond to this growing trend with new strategies and products that meet their needs and interests.[2]

The six-month study involved the collection of data from different sources, including surveys from operators in different destinations, data from the Peruvian Export and Tourism Promotion agency (PROMPERÚ), financial institutions, websites and online applications. The information gathered included the visitors' country of origin, chosen destinations, length of stay, activities and expenditure.

The findings include the identification of the main markets whose main motivation of travel was 'culture'. The key markets are Spanish, English and German visitors, while Dutch visitors were identified as having the highest growth rate. Other important tourism markets included North America, with the United States of America and Canada as the countries with a higher cultural interest. In neighbouring countries, Chile and Colombia were among the ones sharing experiences and participating in rural tourism activities.

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1   Case study submitted by Centro de Formación en Turismo (CENFOTUR).

2   Tourism Organization (2016), *Tourism and Culture Partnership in Peru – Models for Collaboration between Tourism, Culture and Community,* UNWTO, Madrid, DOI: https://doi.org/10.18111/9789284417599.

In terms of length of stay, European tourists have the longest trips, with Germany on top of the list. However, the data showed that, although the total length of stay in the country is often of 15 days, in rural settings stays are no longer than 3 days. The length of stay increases by 15% when there are complementary activities such as fishing, agrotourism or participation in local cultural heritage or cultural events. The country's rural settings with the highest demand are in the southern zone, particularly cultural destinations like Puno, the region of Lake Titicaca and Cusco, home to the World Heritage Site of Machu Picchu.[3]

In the latter, big data also served to better understand visitors' motivations in Cusco compared to other destinations in the region with similar characteristics. The analysis covered user generated content (UGC) from comments made by visitors on travel platforms using sentiment analysis, text and opinion mining, i.e., data mining and ratings. The data were also adapted to benchmark Peruvian destinations with competing countries.

In the analysis of the demand market of the United States of America, the World Heritage Site of Cusco was among the top ranked sites in the country, as well as the World Heritage Site of Machu Picchu and the Inca fortress of Sacsayhuaman. When comparing the World Heritage Site of Machu Picchu with other similar cultural destinations in South America, the Peruvian site ranked the highest.[4]

For Latin American visitors, Cusco was well evaluated, although, for this market, gastronomy scored higher than cultural sites. Machu Picchu and central Cusco were also among the preferred sites with most of the comments.[5]

Big data use in this project could support tracing visitor flows and expenditure of cultural visitors at the regional level. Data analysis of this type is extremely useful in rural regions where data on tourism are often more difficult to collect and cultural assets are more dispersed. The results of big data analysis can help to better define visitor profiles, match supply and demand of cultural destinations, and understand the overall cultural experience in the country.

Moreover, in destinations with heritage sites, big data analysis can enable the comparison among similar cultural offers in other countries and regions, and the use of these tools can help tour operators, travel agents and DMOs design products and services that are competitive, while meeting the actual needs of cultural visitors.

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3   Tourism Organization (2016), *Tourism and Culture Partnership in Peru – Models for Collaboration between Tourism, Culture and Community,* UNWTO, Madrid, DOI: https://doi.org/10.18111/9789284417599.

4   PROMPERÚ (2018), 'Big Data Analysis: Insights for Travel and Tourism in Cusco', case study submitted to UNWTO.

5   Ibid.

Case 6
Managing cultural tourism through big data in Amsterdam, the Netherlands

Stakeholders/components:	DMOs, social media, residents and visitors, museums
Big data categories:	1. Tracking and monitoring
	2. Profiling visitors
	6. Predicting visitor behaviour
	7. Cultural assets/resources

The City in Balance programme developed by the City of Amsterdam aims to balance the liveability and hospitality functions of the city within the different user groups, particularly between residents and visitors. The objectives include the reduction of nuisance situations, creation of an attractive mix of functions, provision of a wider space in the streets and waterways, benefits sharing and mitigation of negative impacts of tourism. By addressing this wide range of issues, City in Balance intends to make tourism more sustainable.[1]

The programme is a combination of diverse and innovative approaches, including the use of big data. In cultural tourism, initiatives include the 'Live Lines' system (*Rijenradar* in Dutch), a monitoring system for museums' queues. Visitors are informed via a mobile application about the waiting times of queues at major museums, advising visitors to plan their visits outside the busiest times.[2] Some of the project's findings showed the influence of waiting times in the visitors' decisions. If the waiting times were about three hours, half the users would choose to change the visiting hour to the museum, while a smaller proportion decided to visit a different sight. The application rating was very high (9.0 on a 10-point scale), although it is not clear exactly how the waiting times influence

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1   World Tourism Organization; Centre of Expertise Leisure, T*ourism & Hospitality*; NHTV Breda University of Applied Sciences; and NHL Stenden University of Applied Sciences (eds., 2019).

2   Gemeente Amsterdam (2019), *Stad in balans* (online), available at: /bestuur-organisatie/volg-beleid/stad-in-balans/ (14-04-2021).

the overall spreading of visitors across the city.[3] The real-time data also facilitate the access to the levels of pedestrian traffic within the city. Amsterdam Detours uses such information to guide visitors along less busy streets.

Other big data use targets preferences and search terms with relevant information related to cultural assets in less well-known areas in the wider Amsterdam region and the rest of the Netherlands. Some examples include the promotion in social media channels of Van Gogh paintings in the Kröller-Müller Museum, two hour distance from Amsterdam. The monitoring of visitor flows is also relevant for cultural events. In the Noord 24H festival, global system for mobile communications (GSM) data have shown that in comparison to a regular weekend, during the festival there were about 10,000 to 12,000 additional visitors in the area. The results underlined the accuracy of GSM data for this kind of monitoring, which generates useful marketing and management data, as the system can also measure the visitors' pressure on different areas of the city.[4]

The implementation of the City in Balance programme presents the potential of big data analysis for monitoring and influencing cultural tourism behaviour, reducing crowds and improving the city's experience for both residents and visitors.

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3   Simply Amsterdam (2020), 'Rijenradar' (online) accessable at: www.simplyamsterdam.nl (20-04-2020).
4   Gemeente Amsterdam (2019).

Case 7
Combining technologies to improve cultural tourism experiences in Barcelona, Spain

Stakeholders/components:	DMOs, technology companies, historic buildings
Big data categories:	1. Tracking and monitoring
	2. Profiling visitors
	3. Measuring satisfaction
	6. Predicting visitor behaviour
	7. Cultural assets/resources

In Barcelona, a renowned cultural destination, research using big data has corroborated the relevance of cultural sites. The city's World Heritage Site of Sagrada Familia, was one of the elements of the pilot project for visitor management based on big data and the Internet of things (IoT). The objective was to obtain detailed information on visitor profiles and their mobility, in order to better plan city services and minimize the impact of high visitor numbers at major sites.[1]

The pilot was developed by the Municipality of Barcelona, Eurecat (Technology Centre of Catalonia) and the Mobile World Capital Foundation, with the support of the Global System for Mobile Communications (GSM Association), an umbrella organization of mobile operators worldwide. The first phase of the project included data from mobile operators to help understand visitor movements across the city, where they stayed and the cultural sites that they visited. The analysis identified the most common routes in the central districts of Barcelona, like Ciutat Vella and Sants-Montjuïc.

The project also included the installation of small number of Wi-Fi sensors, one GSM sensor and 3D cameras at the Sagrada Familia. The intention was to analyse the flow of people in the area within a

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1   Observatori del Turisme a Barcelona (2018), *Monitor de reputació turística online de Barcelona Ciutat 2018* (online), available at: www.barcelonaturisme.com/uploads/web/estadistiques/ReputacioOnline_2018_Ciutat.pdf (29-08-2019).

specific time slot. The sensors could track the total number of visitors and the direction from which they approached the site, while the IoT-enabled sensors to give further details to analyse the means of transport.

The results from the project showed that most tourists visited only the surroundings of the Sagrada Familia, without entering into the church. Therefore, the over-crowding problems around the cathedral are not only related to visitors entering the site, but also to the significant number of visitors admiring this monument from outside. The combination of sensors and IoT allowed an informed decision-making, particularly with regards to the appropriate locations for ticket offices and actions to encourage the sale of more tickets to actually access the site.

This tracking pilot with IoT and big data illustrates the combination of useful tools for visitor management, providing opportunities to improve public services for residents and visitors alike. For the visitors, the system additionally supports access to real-time information and notifications for a better planning of their visits and avoiding peak times. In the latter, big data analysis can be an effective mechanism in popular destinations, as real-time monitoring can detect unexpected agglomerations of visitors and provide tools to site managers and transport operators in designing both immediate and long-term measures.

Case 8
Understanding domestic tourism flows in World Heritage cities of Mexico

Stakeholders/components:	Research centres, NTA, World Heritage cities
Big data categories:	1. Tracking and monitoring
	2. Profiling visitors

When measuring tourism, one of the main challenges is the understanding of domestic tourism, including the related expenditure patterns. In some countries, as in Mexico, domestic tourism can take up to 83% of the total tourism expenditure, leaving 17% to outbound markets. Others share similar rates, such as the United States of America.[1]

Therefore, the Ministry of Tourism of Mexico in collaboration with the National Institute of Statistics and Geography (INEGI for its acronym in Spanish) joined efforts to further understand the domestic tourism market. In the pilot project, big data analysis was employed to understand visitor flows and origin of visitors within the cities of Puebla and Guanajuato,[2] two renowned cultural destinations whose historic centres are classified as World Heritage Sites.

The study analysed social media posts, particularly from Twitter. From a collection of 60 million tweets within a specific six-month timeframe, the posts were geo-referenced to identify those generated within the country and narrowed down to the polygons corresponding to the states of Puebla and Guanajuato. The last filter selected those tweets corresponding to the long-weekend holidays in February. Therefore, from the previous 60 million tweets, the study identified and covered a total of 7,955 Twitter users and their city of origin with activity in Puebla and Guanajuato during this long weekend.

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1   Organisation for Economic Co-operation and Development (2020), *OECD Tourism Trends and Policies 2020,* OECD Publishing, Paris, DOI: https://doi.org/10.1787/6b47b985-en.

2   The *cities* of Puebla and Guanajuato are the capital cities of their respective *states*.

The data retrieved were compared with data from the tourism observatories in both states. The results were illustrated in a coloured map showing the main domestic markets. For the city of Puebla, Mexico City, Veracruz and Tlaxcala were among the top three visitor states of origin, while for the city of Guanajuato the top three states of origin were Queretaro, Jalisco and Mexico City.

Nonetheless, in order to effectively use big data, decision makers are required to ask the right questions and adapt the retrieved data to answer these questions, bringing new knowledge for their informed decision-making. In the case of Puebla and Guanajuato, the data required a geographical context based on:
1. Means of transport;
2. Distance;
3. Available infrastructure between the different states; as well as
4. Scope of the study based on a long-weekend variable (the results may have varied if the analysed season was summer or Christmas holidays, which was not the case in this analysis).

The data retrieved in this type of research can be compared with similar cultural destinations in the surrounding areas, allowing to plug-in cultural products into cultural routes within destinations or to design itineraries and diversify the cultural experiences.

The described pilot project can be replicated in other cities and states of Mexico and beyond, as the data matching between big data analysis and the tourism observatories showed a great similarity of results: In the example of Puebla, there was a match of 'states of origin' of 9 out of 10 of visitors, when comparing the visitor flows identified through Twitter with the statistics obtained from the observatories.[3]

The pilot's results in Mexico placed big data analysis as a less expensive measurement tool, providing real-time information and improving the understanding of domestic visitor flows.

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[3]   Lichtle Fragoso, P. M. and Sánchez Salinas, J. C. (2014), *Uso productivo de big data y redes sociales en el sector turismo*, Secretaria de Turismo, Mexico (online), available at: www.sectur.gob.mx (14-04-2021).

Case 9
Using big data to create new cultural sites in Montreal, Canada

Stakeholders/components:	DMOs, social media, creative industries
Big data categories:	5. Promoting visitor engagement
	7. Cultural assets/resources

The Jacques Cartier Bridge is a major transport artery in the Greater Montreal area, and it was the location of a major creative project using big data for the celebrations of the 375th anniversary of the foundation of the City of Montreal, in 2017.

In Montreal, the artwork entitled *Living Connections* was created for the bridge, using big data feeds to generate a constantly changing light show. The bridge changed colour with the seasons, providing a "chromatic calendar", which also marked significant events with different colour displays. The LED light displays on the bridge were also fed by a big data stream of activity in the city. Every hour, short animations visually displayed Montreal's mood, using big data on traffic flows, weather conditions and social media data collected during the day.[1]

The illumination of the bridge provided a new cultural icon for the city which was incorporated into a "Stories and Bridges" multimedia tour for visitors. Tourists were also guided to the "best view spots" to see and photograph the bridge.

Using the bridge to frame art data provided a link between the industrial heritage and the city's contemporary creative industries, considering Montreal's designation as UNESCO City of Design. The importance of the visual framing of the bridge is highlighted by the fact that 400,000 visitors attended the illumination opening in 2017. The transformation of the bridge has also provided new

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1   Jaques Cartier Champlain Bridge (2017), 'Unveiling of Living Connections on the Jacques Cartier Bridge. The world's first connected bridge', published 18 May 2017 (online), available at: https://jacquescartierchamplain.ca/unveiling-of-living-connections-on-the-jacques-cartier-bridge-the-worlds-first-connected-bridge/?lang=en (20-04-2020).

experiences of the city and its culture. The city produced a map for residents and visitors with the best locations for viewing and photographing the illuminations.[2]

In this case, big data was not just a source of information, it was also used as an element to engage users in the creative expressions of the city's culture. The project was an important illustration of the vibrancy of Montreal as a UNESCO Creative City of Design.

2   Georgescu Paquin, A. (2019), 'Public data art's potential for digital placemaking', *Tourism and Heritage Journal,* volume 1, Universitat de Barcelona, pp. 32–48, DOI: 10.1344/THJ.2019.1.3.

Case 10
Culture Trip – online platforms addressing visitors' cultural interests

Stakeholders/components:	Online platforms, street art, living heritage
Big data categories:	2. Profiling visitors
	5. Promoting visitor engagement
	6. Predicting visitor behaviour
	7. Cultural assets/resources

The online platform Culture Trip, a start-up bringing together travel, storytelling and entertainment, creates stories that reveal what is unique and special about a place, its people and culture. The company aims to use big data generated by visitors and use them in its platform to analyse their activities and experiences, allowing them to develop tailor-made products for consumers.

Culture Trip's big data uses content-driven decisions for its creative process. The searches by its users provide a trace of content-browsing activity, creating heat maps of themes with high levels of cultural interest. By relating the search and content consumption patterns to locations, an analysis can be made of content gaps for locations where new cultural content can be developed. Data analytics can help to pinpoint what type of content is needed for different locations. For instance, big data analysis indicated a growing demand for street art in major urban destinations. A review of the available content indicated that there was already sufficient supply of street art experiences in London, but not in Berlin, identifying an opportunity for market development there. By matching user interests and destinations, right content in specific locations can be created.[1]
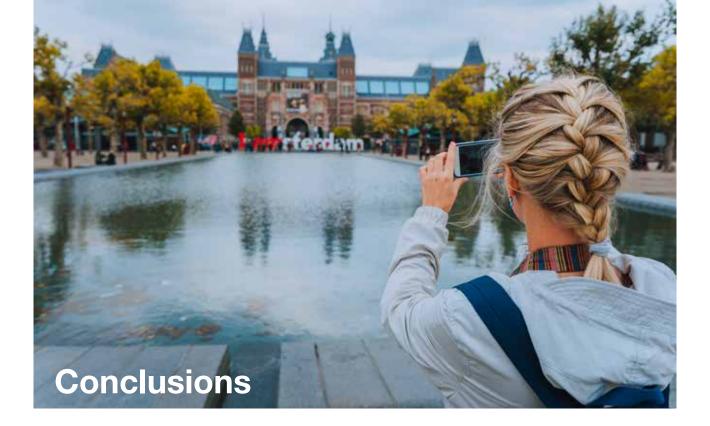
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1   Culture Trip (2019), *Beyond Borders: The Evolution of Culture* (online), available at:
    https://comms.theculturetrip.com/wp-content/uploads/2019/05/Culture-Trip-Beyond-Borders-May-2019-Final.pdf
    (24-02-2020).

Other initiatives include Culture Trip's psychographic research. It showed that people from cosmopolitan cities have a more conscious interest in other communities and their associated cultural expressions such as gastronomy, art, language, music and traditions. This underlines that cultural tourism is not only about the cultural expressions of other places, but also about the cultural diversity in everyday life. In this increasingly complex cultural tourism market, big data analytics coupled with market research provide an important means of monitoring fast-moving trends in consumers' taste and activities.[2]

Travel decisions are nowadays driven by a combination of social trends, individual taste and experience trajectories, the already visited locations and those that consumers wish to visit in the future. Therefore, the combination of big and small data analysis by online platforms like Culture Trip can broaden the understanding of the social and individual contexts influencing travel decisions in cultural tourism. The experience of Culture Trip underlines the role of big data in identifying consumption patterns and predicting behaviour in cultural tourism.

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2   Culture Trip (2019), *Beyond Borders: The Evolution of Culture* (online), available at:
     https://comms.theculturetrip.com/wp-content/uploads/2019/05/Culture-Trip-Beyond-Borders-May-2019-Final.pdf
     (24-02-2020).

Conclusions

In cultural tourism, shared benefits between tourism and culture can be reached through the implementation of inclusive and responsible approaches for economic development, without these compromising the actual cultural values of communities and places. However, given the lack of mutual understanding and effective dialogue between cultural and tourism key players, policies and commitments are in most cases characterized by a blatant absence of data.

In the current intensive data-driven world, the volume of digital footprint left by users is widely employed in many sectors, with the aim to improve their competitiveness, and, to a lesser extent, to support sustainable approaches. These refer in particular to the ones related to the achievement of the Sustainable Development Goals (SDGs).

Moreover, when discussing the vast potential of new information uses, it is necessary to size the level of responsibility and ethical implications related to generating, gathering and analysing digital data. In tourism, documents such as the *Recommendations on the Responsible Use of Ratings and Reviews on Digital Platforms*,[1] and statements of international bodies, such as the World Committee on Tourism Ethics, are important references for the ethical use of big data.

This study on *Big Data in Cultural Tourism – Building Sustainability and Enhancing Competitiveness* shows that in fields like cultural tourism, with a varied and extensive range of stakeholders, the use of new technologies, particularly big data, is an effective alternative to improve dialogue and to support informed decision-making. However, the use of these technologies, requires innovative steps adding alliances with tech companies to the cultural tourism equation. Through new partnerships, private and public sectors are using the unprecedented volume of digital data to understand the tourism market and elaborate responses to its needs, while mitigating a wide range of undesired impacts of cultural tourism in destinations.

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1   World Committee on Tourism Ethics (2017).

The study also shows that the use of big data in cultural tourism is mostly implemented to respond to seven main purposes:

1. Tracking and monitoring of visitor flows;
2. Profiling visitors;
3. Measuring visitor satisfaction and sentiment;
4. Measuring visitor expenditure;
5. Promoting visitor engagement;
6. Prediction of visitor behaviour; and
7. Use of big data for cultural resources.

Within these seven categories, selected practices in cultural destinations, such as the one from the city of Buenos Aires, showcase the leading role of public entities in data sharing among tourism stakeholders, aimed to improve the overall visitor experience. Other destinations, like the city of Amsterdam, use big data to address the unwanted impacts of tourism for local communities and to broaden the economic benefits to lesser known cultural destinations. In countries like Mexico, the use of big data enables tourism stakeholders to understand the domestic tourism in cultural destinations, while locations with an important cultural share in tourism, like the cultural sites of Peru, use big data to have a wider view of their competitiveness level in cultural tourism in comparison with other neighbouring destinations. Furthermore, the initiatives developed by online tourism platforms, such as Culture Trip that makes information available to meet the visitors' cultural interests, or the use of big data to create innovative ways to express a city's creativity, like the City of Montreal, are among the out-of-the-box approaches to new technologies in cultural tourism. Overall, the selected practices stress the importance of asking the right questions to harness the extensive volume of data and to support informed decision-making in cultural destinations.

In general, the transition of the sector towards the digital world requires new alliances combining the voices of tourism, culture and tech companies. However, joint efforts shall not only address the competitive side of cultural tourism, but also the responsibility of all sectors in cherishing and ensuring a collective well-being.

Big data use requires further reserach to contribute to the achievement of inclusive and responsible practices aligned with the Sustainable Development Goals (SDGs), so no one is left behind.

Glossary

Agrotourism: visits to agricultural operations, farms or ranches. Agrotourism is a manifestation of rural tourism, "…a type of tourism activity in which the visitor's experience is related to a wide range of products generally linked to nature-based activities, agriculture, rural lifestyle/culture, angling and sightseeing"[1].

App/application: software designed to run on smartphones and other mobile devices.

Augmented reality (AR): an interactive experience that combines elements of the real world with computer-generated information to enhance the experience.

Benchmarking: comparing business performance with other operators in an industry or sector.

Big data: vast data sets produced through the digitalization of human activity that require automatic processing.

Cultural routes: a route composed of tangible and intangible cultural elements which derive their significance from exchanges and multi-dimensional dialogue across countries or regions, illustrating the interaction of movement, along the route, in space and time.

Cultural tourism: is a type of tourism activity in which the visitor's essential motivation is to learn, discover, experience and consume the tangible and intangible cultural attractions/products in a tourism destination. These attractions/products relate to a set of distinctive material, intellectual, spiritual and emotional features of a society that encompasses arts and architecture, historical and cultural heritage, culinary heritage, literature, music, creative industries and the living cultures with their lifestyles, value systems, beliefs and traditions.[2]

Dashboard: centralized, interactive means of monitoring and analysing data collected from multiple sources displayed in meaningful ways (often graphs) for different users.

Data analytics: analysis techniques and processes used to enhance productivity by identifying and analysing behavioural patterns.

Data mining: process used to extract usable data from a larger set of raw data. It implies analysing data patterns in large batches of data using one or more software(s).

Destination management/marketing organization (DMO): is the leading organizational entity which may encompass the various authorities, stakeholders and professionals and facilitates tourism sector partnerships towards a collective destination vision. The governance structures of DMOs vary from a single public authority to a public/private partnership model with the key role of initiating, coordinating and managing certain activities such as implementation of tourism policies, strategic planning, product development, promotion and marketing and convention bureau activities.

The functions of the DMOs may vary from national to regional and local levels depending on the current and potential needs as well as on the decentralization level of public administration. Not every tourism destination has a DMO.[3]

Global distribution system (GDS): computerized network enabling transactions between travel industry service providers such as airlines, hotels, car rental companies or travel agencies.

Global system for mobile communications (GSM): international standard for mobile phone services. GSM signals can be used to track mobile phones and provide data on visitor origins and movement.

Heatmap: graphical representation of data where the individual values contained in a matrix are represented by colours.

Information cascade: information passed between Internet users, based on information on what other users are doing. Important in social media such as TripAdvisor where visits and reviews to a site affect the actions of other tourists.

Intangible cultural heritage: traditions or living expressions such as oral traditions, performing arts, social practices, rituals, festive events, knowledge and practices concerning nature and the universe, or the knowledge and skills to produce traditional crafts.

Internet of things (IoT): interconnection of devices via Internet connections of commuting devices embedded in objects that can send and receive data. IoT devices can collect data on activity or supply information to visitors.

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1   World Tourism Organization (2019), *UNWTO Tourism Definitions,* UNWTO, Madrid, DOI: https://doi.org/10.18111/9789284420858.

2   World Tourism Organization (2019).

3   Ibid.

Light-emitting diode display (LED light display): a screen display technology that uses a panel of LEDs as source of light.

Mobile positioning data (MPD): data used by mobile network operators for tracking mobile devices to establish their location, with the possibility to monitor user movement and activity.

National tourism administration (NTA): is the
  a) Central government body with administrative responsibility for tourism at the highest level, or central government body with powers of direct intervention in the tourism sector.
  b) All administrative bodies within national government with powers to intervene in the tourism sector.

National tourism organization (NTO): is an autonomous body of public, semi-public or private status, established or recognized by the state as the body with competence at national level for the promotion – and, in some cases, marketing – of inbound international tourism.[4]

Points of interest (POI): specific point locations that someone may find useful or interesting.

Psychographics: the study of population groups with respect to psychological attributes, such as values or attitudes, for marketing purposes.

Search engine: software system designed to search the World Wide Web in a systematic way for particular information specified in a textual web search query.

Small data: data generated by tourism actors through an analysis of their *own* consumer transactions or surveys.

Social media: computer-mediated technologies for sharing information and ideas, such as Facebook, TripAdvisor or Twitter.

Stakeholder (cultural tourism): actors with an interest in a cultural tourism activity who can either affect or be affected by that activity.

Tangible cultural heritage: includes movable cultural heritage (paintings, sculptures, coins, manuscripts) and immovable cultural heritage (monuments, archaeological sites, and so on).

User generated content (UGC): any form of content (images, videos, text, audios) posted to online systems by users, such as the information found on social media.

Wireless fidelity (Wi-Fi): radio technologies used for wireless local area networking of devices.

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4   World Tourism Organization (1997), *Budgets of National Tourism Administrations (1996),* UNWTO, Madrid, DOI: 10.18111/9789284401659.

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The use of big data is becoming increasingly important across the tourism sector and the value chain. With this publication, UNWTO intends to provide a baseline research on using big data by tourism and culture stakeholders, in order to improve the competitiveness of cultural tourism and reinforce its sustainability. The study sets the basis to connect tourism, culture and new technologies for mutual benefits, while calling for a reflection on the ethical implications for policymakers, businesses and end-users. The selection of case studies illustrates the most frequent case-scenarios of the use of big data in cultural tourism within destinations, compiled during the research. As the new technologies are facing ever-evolving scenarios, their use will be harnessed by the tourism sector in its endeavour to innovate and provide new cultural experiences.

The **World Tourism Organization (UNWTO),** a United Nations specialized agency, is the leading international organization with the decisive and central role in promoting the development of responsible, sustainable and universally accessible tourism. It serves as a global forum for tourism policy issues and a practical source of tourism know-how. Its membership includes 159 countries, 6 territories, 2 permanent observers and over 500 Affiliate Members.

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