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Tourism and ICTs: Advances in Data Science, Artificial Intelligence and Sustainability

Proceedings of the TURITEC 2023 Conference, October 19–20, 2023, Málaga, Spain

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ISSN 2198-7246 ISSN 2198-7254 (electronic)
Springer Proceedings in Business and Economics
ISBN 978-3-031-52606-0 ISBN 978-3-031-52607-7 (eBook)
https://doi.org/10.1007/978-3-031-52607-7

This Springer imprint is published by the registered company Springer Nature Switzerland AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

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Connections Between a Tourist Destination, the Digital Ecosystem, and ICT Actors

Aurkene Alzua-Sorzabal, Volha Herasimovich, Basagaitz Guereño-Omil, and Daniela Thiel-Ellul

Abstract The tourism sector and tourist destinations are undergoing a digital transition in order to improve their resilience and competitiveness. The way in which tourist destinations address this digital transition differs, as some incorporate more technology in their ecosystem than others, giving rise to the emergence of different types of digital tourism networks. This study seeks to determine the different ways in which a tourist destination connects with a digital ecosystem, specifically focusing on the connections with ICT actors. It is based on the theoretical framework of tourism as an ecosystem. Using web crawling, network data have been compiled on 670 tourism actors and more than 36,000 websites to which they are connected through hyperlinks. The most frequently linked entities of the discovered digital ecosystem have been identified and classified (n = 447), distinguishing between 13 types of ICT actors. The results show how the online destination network has been incorporated into the digital ecosystem. The study reveals that the configuration of the digital ecosystem surrounding a tourist destination is characterised by the different levels of importance for the network of destination actors in which the ICT actors play a central role.

Keywords Tourist destination · Digital ecosystem · ICT actors · Hyperlinks · Online network

1 Introduction

The tourism sector is currently immersed in a digital transition process in an attempt to improve its resilience and strategic autonomy (Koens et al., 2021). Digital technologies have a profound impact on the tourism industry and the digital environment

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A. J. Guevara Plaza et al. (eds.), *Tourism and ICTs: Advances in Data Science, Artificial Intelligence and Sustainability*, Springer Proceedings in Business and Economics,
https://doi.org/10.1007/978-3-031-52607-7_20

is gaining increasing importance for improving the competitiveness of destinations and facilitating its transition towards smart solutions. The way in which tourist destinations approach the digital transition differs (Gretzel, 2022), as some incorporate more technology in their ecosystem than others: technologies such as artificial intelligence, the Internet of Things, augmented reality, and virtual reality. The result is the emergence of different structural configurations of digital tourism networks.

Understanding these configurations is vitally important for managing the digital transition in tourism, as the ICTs have the potential to modify value chains, profoundly influence the operations and strategies of tourism companies and change the power dynamics between actors (Baggio & Del Chiappa, 2013; Januszewska et al., 2015). The interaction between the ICT actors and tourism actors is important to integrate technology and facilitate technological innovations in tourism (Buhalis, 2003).

This study seeks to determine the different ways in which a tourist destination connects with a digital ecosystem, specifically focusing on the connections with the technological actors. The research adopts an unusual perspective as it uses Hyperlink Network Analysis (HNA). HNA constitutes "an important basis for the more complete empirical analysis of tourism digital ecosystems" (Baggio, 2022: 1551). The theoretical framework of this study is based on the concept of tourism as an ecosystem, drawing upon the notions of the digital ecosystem, the digital business ecosystem, and the smart tourism ecosystem (Baggio, 2022; Baggio & Del Chiappa, 2013; Gretzel et al., 2015; Nachira et al., 2007).

2 Related Literature

2.1 A Tourist Destination as a Business Ecosystem

A tourist destination is a complex system made up of interdependent social and economic actors that interact with one another and jointly produce experiences for tourism (Baggio, 2008). Their competitiveness is conditioned by their environment and geographical, economic, cultural, political, and technological characteristics (Gómez-Vega & Picazo-Tadeo, 2019; Gretzel et al., 2015). Therefore, in order to fully understand and manage the complexity of the destination it is necessary to adopt a holistic approach that takes into account the economic, technological, environmental, social and cultural dimensions.

A tourist destination can also be understood as a business ecosystem whose principal components are organisations, including suppliers, clients, competitors and another series of actors that interact and evolve jointly to create and contribute value (Baggio, 2022). The actors are integrated into the environment, which can significantly influence the power relations within the ecosystem (Gretzel et al., 2015).

Given the growing incorporation of ICTs in the operations of tourism organisations (Buhalis, 2020), it is important to determine the role of the digital environment and

its actors in relation to the tourism ecosystem. This has led to conceptualisations such as the "tourism digital (business) ecosystem" (Baggio, 2022; Baggio & Del Chiappa, 2013) and the "smart tourism ecosystem" (Gretzel et al., 2015).

A digital business ecosystem (DBE) is a socio-economic and technical system composed of actors from the real world (public and private), digital objects, and technical infrastructures (Baggio 2022; Nachira et al., 2007). The emergence of digital ecosystems has been facilitated by the convergence of three networks: ICT networks, social networks, and knowledge networks (Nachira et al., 2007). As a result, a tourism organisation is represented in a DBE by a physical component and a virtual component (their technological representations such as websites), that co-evolve and intertwine to form a single entity (Baggio, 2022).

The websites of destination actors, interconnected through hyperlinks, form an online destination network (ODN). It is important to note that hyperlinks connecting websites also function as a form of interorganisational communication, specifically representational communication (Shumate et al., 2017), which is usually overlooked due to the perception that it is less efficient than direct face-to-face or technologically mediated direct communication. Representational communication is based on an organisation positioning itself with others and these connections are communicated to third parties, including the public. It may be considered as a type of "name dropping", which can reveal important inter-organisational relations (Shumate et al., 2017: 16).

The ODN is important as the websites seem to be the principal instruments for doing business in the tourism sector (Law et al., 2004; Wang & Fesenmaier, 2006). Similarly, hyperlinks are also used as service tools for providing value added to visitors, facilitating access to useful resources (Zach et al., 2019). Furthermore, the websites and the hyperlink network that connect them constitute an important instrument for giving visibility to a destination (Raisi et al., 2018; Ying et al., 2016).

As an ODN is a network of websites and hyperlinks, it forms part of a wider digital ecosystem. Therefore, the connections of the ODN with other online entities provide an initial approach to the different configurations by which a tourist destination is connected to the digital ecosystem.

2.2 ICT Actors: Supply of ICT Products to Tourism

Distinguishing the different types of ICTs to which the actors of the destination are connected can provide a deeper understanding of the place that a destination occupies in the digital ecosystem. However, this analysis is complicated, due to the difficulties in defining the ICTs as they embody a wide variety of technologies with different purposes. Furthermore, conducting an inventory of all of the ICTs is a real challenge as the websites incorporate different technologies in different ways.

In a broad sense, ICT refers to "both different types of communications networks and the technologies used in them" (OECD, 2023). It encompasses "the use of all possible means and methods offered by information technologies in the communication process (transfer of information)" (Januszewska et al., 2015: 66). The ICT

sector is comprised of both "manufacturing and services industries whose products capture, transmit or display data and information electronically" (UN, 2005: 39).

Within the context of tourism, ICT products are defined as "the entire range of electronic tools that facilitate the operational and strategic management of organizations by enabling them to manage their information, functions and processes as well as to communicate interactively with their stakeholders, enabling them to achieve their mission and objects" (Buhalis, 2003: 7). Taking into account the utility significance that is attributed to ICTs in tourism, it is important to distinguish the ICT actors focused on the provision of ICT technology and, in particular, the technology that is directly designed for tourism as specific layers of the digital ecosystem.

The success of the digital transition, particularly for destinations advancing towards smartness, does not depend solely on the availability and improvement of technology (the "hard" aspect of the transition) but also on the actors of the ecosystem who represent and use this technology and collaborate, co-creating value ("soft" competences such as the attitude towards innovation) (Boes et al., 2016). Therefore, the human element is essential, which suggests that those involved in the digital transition should be considered as being as important as the technology itself.

Different tourism actors can be expected to have different connections with ICT actors, due to the interconnection between the "real" and "virtual" and the social and economic factors that underlie the structure of the network (Gonzalez-Bailon, 2009). Therefore, it is necessary to (a) explore which ICT actors are connected to the online destination network; and (b) understand whether different actors of the online destination network are connected to ICT actors in different ways.

3 Methodology

3.1 Operationalisation of Concepts

In order to research the digital ecosystem, we have analysed the different web entities, such as websites and the hyperlinks that connect them. In this study, the ICT actors have been defined as websites that principally present ICT products and/or actors that produce ICT products (companies). The ICT products refer to the tools and services used for the electronic/digital transmission of data/information at any time of the communication process (sending, transmission, data reception).

3.2 Data Collection

The data of the online destination network (ODN) have been gathered in the province of Gipuzkoa in Spain, whose largest city, Donostia-San Sebastián, has recently been accredited as a Smart Destination by SEGITTUR (a state-owned company for the

management of tourism innovation and technologies in Spain) (DTI, 2023). The research employs an experimental design and utilises a convenience sample, drawing initial data from readily accessible directories provided by the Provincial Government of Gipuzkoa.

In 2021, the competent public administration facilitated an initial list of tourism actors that included 1,199 organisations from the directory of businesses and tourism activities of the Basque Country (Euskadi.eus, 2021). The authors updated the database twice: in January 2022 and April 2023. Entities that were not active were eliminated and new agents were added with their websites. The data represented six types of tourism agents: accommodations (57%), travel agencies and other reservation services (10%), destination management organisations (2.8%), natural and cultural resources (7.6%), sports and recreational activities (9.3%), and tourism-related public bodies (13.3%).

After compiling the directory, the web crawler Hyphe (Jacomy et al., 2016) was used to collect hyperlink data from the websites of tourism organisations (N = 690) in April 2023. The web crawler could not access 20 websites (2.9%), which were excluded from the final sample (N = 670). During the crawling, more than 36,000 websites hyperlinked by the ODN were discovered, together with more than 47,000 connections. Given that some actors were represented online with two or more different web domains, the sample was cleaned to guarantee that the actors were represented only once in the group of websites that obtained five or more links (for example, Euskadi.net and Euskadi.eus were merged into one web entity).

3.3 Elaboration of the Typology of ICT Actors

Due to the limited research resources, only a sample of the most popular discovered web entities was used to elaborate a typology of the ICT actors. The sample included entities with five or more links from the tourism actors of the ODN (N = 447). The elaboration of the typology was based on the analysis of information from the websites, the descriptions of the websites by the artificial intelligence of the search engine Bing, and Wikipedia entries. Following the descriptive analysis, a comprehensive coding scheme was developed to identify 13 distinct categories of ICT actors. This scheme was subsequently employed by two independent coders to categorize the websites.

3.4 Data Analysis

The data were analysed using quantitative metrics of Social Network Analysis and a qualitative analysis of the visual representation of the network with the help of Gephi 0.10.1 (Bastian et al., 2009).

4 Results

4.1 The Online Destination Network Incorporated into the Digital Ecosystem

The online destination network (ODN, N = 670) was integrated into the broader web—multiple websites connected through hyperlinks, constituting a discovered digital ecosystem (N = 36,813) (Fig. 1). The ODN connections with the discovered digital ecosystem were highly uneven, forming a power law L-curve distribution. Two types of entities were identified around the ODN: the entities linked by at least two tourism actors (n = 2374, 6%) and the majority of entities which were connected with only one tourism actor (n = 34,439, 94%) (Fig. 1). Thus, the ODN was integrated into a shared digital area and a non-shared digital area, characterised by clusters around specific tourism actors. The areas indicate commonalities and differences in the choices and interests of the tourism actors.

The most popular entities of the discovered digital ecosystem (with five or more links from the ODN) made up approximately one-fifth of the shared area (n = 447, 19%) and represented the strongest common point of the ODN. Although the ICT actors as a group constituted the minority of the "popular" discovered ecosystem (22.6%), some of them were the most important nodes of the network, appearing as the network's centre of attraction.

ODN (green, N = 670, 2%). **Discovered digital ecosystem** (all colours except green, N = 36,813, 98%). Most popular discovered entities, linked by five or more tourism actors (red, yellow, and black, n = 447): **ICT actors** (red, n = 101, 22,6%), **non-ICT actors** (yellow, n = 344, 77,0%), **unidentified actors** (black, n = 2, 0.4%). Less popular discovered entities: blue (2–4 links), grey (1 link). The **shared area** of

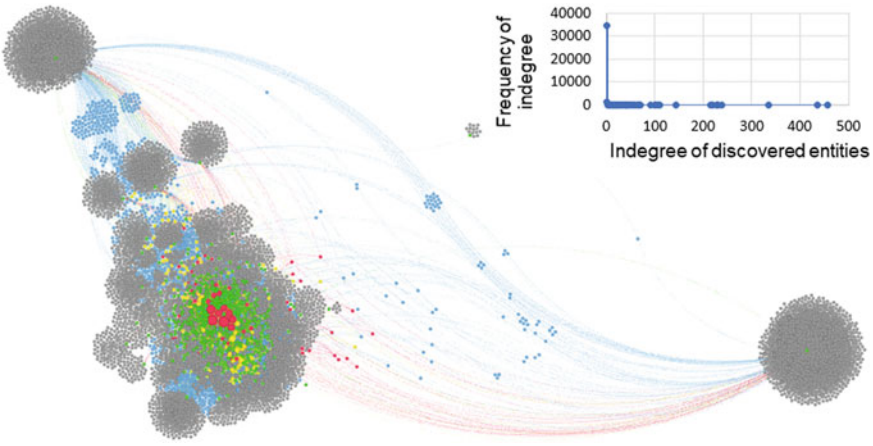

Fig. 1 The online destination network (ODN) within the digital ecosystem

the discovered ecosystem: red, yellow, blue, and black (n = 2374, 6%). The **non-shared area**: grey (n = 34,439, 94%). The colour of the links shows which type of entity they are connected to. Size: the importance, or the number of links that point at the actor (indegree).

4.2 Varying Connections of Tourism Actors to ICT Actors

The analysis distinguished 13 types of ICT actors (Table 1). Of these, three types represented tourism-related ICT actors: travel platforms, leisure platforms, and tourism management software (34.7%). Social media were the most popular actors, accounting for about 39% of all links, yet constituting only 11.9% of total actors. These were followed by software development and electronics (12.2% of the links for 5% of the actors) and multifunctional web portals (12.1% of links for 2% of actors). The tourism-related ICT actors accounted for only 13% of all links, three times less than social media, while they constituted approximately a third of all of the actors (34.7%).

There seems to be a stable predominance of certain ICT actors in the digital ecosystem, as seven of the ten principal ICT actors were the same as those in a similar research project covering the years 2013–2018 (cf. Zach et al., 2019) (Table 2).

The web entities that were subject to the grouping procedures described in the methodology section: 1, 4, 7, 8, 10.

Table 1 Types of ICT actors in the digital ecosystem of the online destination network

Types of ICT actors	No. of actors	%	No. of links[a]	%
Social media	12	11.9	1497	39.2
Software development and electronics	5	5.0	466	12.2
Multifunctional web portals	2	2.0	463	12.1
Web browsing	3	3.0	325	8.5
Travel platforms*	11	10.9	268	7.0
Web development	23	22.8	266	7.0
Videoconferencing and instant messaging	4	4.0	128	3.3
Leisure platform*	11	10.9	119	3.1
Tourism management software*	13	12.9	109	2.9
Content technology	7	6.9	98	2.6
Mapping and location technology	4	4.0	37	1.0
Marketing tools	4	4.0	34	0.9
ICT providers	2	2.0	13	0.3
Total	101	100	3823	100

* Tourism-related ICT actors

[a]Number of hyperlinks placed by the ODN tourism actors to the ICT actors

Table 2 Top 10 ICT actors related to the online destination network in 2023

Ranking	ICT actors
1	Google.com[a]
2	Facebook.com[a]
3	Instagram.com[a]
4	Twitter.com[a]
5	Youtube.com[a]
6	Apple.com[a]
7	Microsoft.com
8	Mozilla.org
9	Tripadvisor.com[a]
10	Whatsapp.com

[a] Actors coinciding with the study by Zach et al. (2019)

The actors closely related to the public domain (tourism-related public bodies, destination management organisations, natural and cultural resources) tended to have a higher proportion of links (>50%) to actors not related to the ICTs than to those related to the ICTs. On the contrary, businesses of accommodations, sports and recreational activities, and travel agencies and other reservation services had a greater proportion of links to ICT actors (≥ 60%) (Fig. 2a).

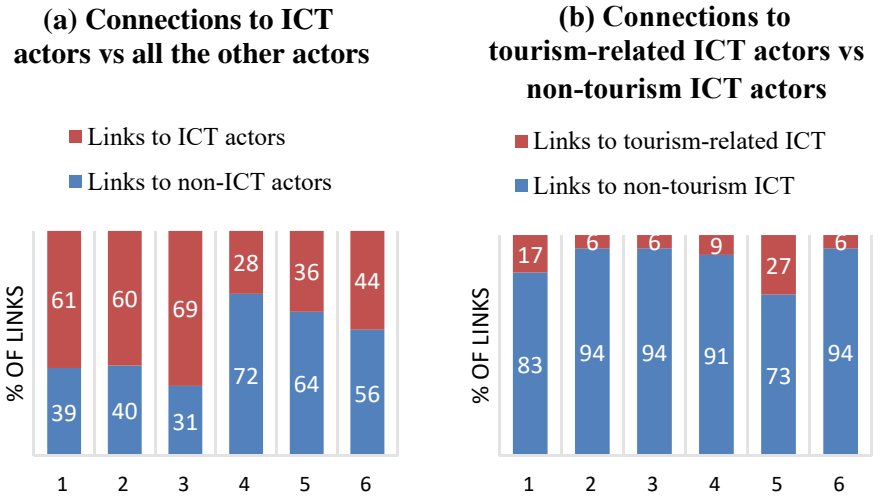

Fig. 2 Connections of the tourism agents with the ICT actors (**a**) and ICT actors specialised in tourism (**b**). 1—accommodations; 2—travel agencies and other reservation services; 3—sports and recreational activities; 4—tourism-related public bodies; 5—destination management organisations; 6—natural and cultural resources. The percentages represent the proportion of total links to the most popular discovered entities of the digital ecosystem (n = 445), except for those entities that could not be classified (n = 2)

Furthermore, tourism actors displayed differences in the way in which they referred to the different types of ICT actors: tourism-related and non-tourism ICT actors (Fig. 2b). While the majority of the sectors did not exceed the 10% barrier in terms of links to tourism-related ICT actors, two sectors stood out in their relations with tourism-related ICT agents: accommodation (17%) and the DMOs (27%), which were the most active users of the tourism-related technologies.

Tourism actors showed similar preferences when establishing links with social media, which were those most frequently used links compared to other types of ICT actors. Social media accounted for at least a third of the links to ICT actors in each tourism sector (from 33 to 53%). The higher percentages of links to social media was observed in the sectors of natural and cultural resources (53%), sports and recreational activities (46%), and travel agencies and other reservation services (46%). The second and third most popular ICT actors within tourism sectors were mainly the "multifunctional web portals" and "software development and electronics" actors, each receiving less than half the attention that social media received. Within this context of shared preferences, the DMOs stood out as they had a greater tendency to link with "travel platforms", which constituted 15% of all of their links.

5 Discussion

This study contributes to a better understanding of the digital business ecosystem of tourism, shedding light on the different configurations between tourism actors and the broader digital ecosystem, including the ICT actors. The different configurations analysed indicate different processes through which the various stakeholders become embedded in the digital ecosystem.

The results of this study reveal a highly disproportionate distribution in the degree of connectivity, with a few web entities being strongly connected to the destination and the majority being weakly connected, which is similar to the global structure of the Web, with few highly connected hubs and the lowly connected majority (Barabási et al., 2000). The existence of "shared areas", commonly linked by the destination actors, indicates possible common interests between tourism actors.

The presence of ICT actors in the nucleus of the shared area underlines the crucial role of ICTs in tourist destinations. The very small change observed in the nucleus of the ICTs compared to the most popular websites in a similar previous study (Zach et al., 2019) suggests a stable dominance of certain ICT agents in the tourism sector.

This coherence in choices is also evident in the prominent position of social media platforms within the overall digital ecosystem and within particular tourism sectors. The results confirm the solid incorporation of Web 2.0 into the tourism digital business ecosystem and ratify the evolution of social media as crucial platforms in the tourism sector (Zeng & Gerritsen, 2014).

The variances in how tourism sectors were linked to ICT and non-ICT actors, particularly between tourism sectors related to the public domain and business-focused stakeholders, suggest the role of underlying social and economic determinants. This is consistent with prior research highlighting the significance of these factors on the Web's structure (Gonzalez-Bailon, 2009). Likewise, socio-economic factors may be the reason why accommodations and DMOs had more incentives to connect to tourism-related ICTs than other tourism actors. These findings highlight the duality of tourism actors in the digital business ecosystem, where they are represented by both real-world actors and digital objects intertwined into a single entity.

One important direction for future research is the comparison of different configurations of Smart Destinations and destinations with a less developed incorporation of technology in different economic, cultural, and political environments.

Acknowledgements This research was supported by a Grant PID2021-127893OB-I00 funded by MCIN/AEI/10.13039/501100011033 and European Union Next Generation EU/PRTR.

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