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Extended destination ecosystems in smart tourism: networking behaviours and leadership

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Abstract

Purpose – This study aims to advance the understanding of tourism destination ecosystems amid smart tourism transformations by exploring an extended destination ecosystem. It focuses on its structure, integration patterns of tourism and non-tourism actors, networking behaviours, mediation engagement and ecosystem leadership.
Design/methodology/approach – This study employs the digital network to examine the ecosystem's structure and behaviours. Using databases and web crawling, it identifies 36,813 entities and analyses relationships among 1,117 key actors.
Findings – Strong integration with tourism actors makes ICT actors and various institutional and socioeconomic non-tourism (ISEN) actors indispensable ecosystem components. ICT actors, mostly foreign, play a central role, with general ICT outperforming travel tech. However, prioritising ICT ties alone is insufficient for ecosystem leadership or deeper integration for tourism actors. Links to ISEN actors, alongside ICT actors, high connectivity and diverse ties are essential for leadership. Connections to other tourism actors are relevant for greater integration and mediation. Networking behaviours of destination management organisations and public bodies differed from those observed across other sectors.
Practical implications – Tourism governance and management should engage actors beyond core tourism sectors to foster resilient ecosystems, while businesses aiming for greater leadership should diversify networks beyond ICT actors. Actionable recommendations are provided.
Originality/value – This research introduces a novel methodological approach and expands smart tourism frameworks with empirical evidence on diverse actor integration in the extended destination ecosystem. It highlights relationships between actors' networking behaviours, integration levels, mediation engagement and ecosystem leadership.

Keywords Tourism destination, Extended ecosystem, Smart tourism, Integration, Leadership, ICT
Paper type Research article

1. Introduction

The tourism industry is undergoing a significant digital transformation, with the adoption of the smart tourism approach at its core. Smart tourism leverages interconnected technologies and organisational networks to enhance tourist experiences and improve the effectiveness, competitiveness, sustainability, and resilience of tourism destinations, benefiting both tourists

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and local communities (Buhalis, 2020; Buhalis *et al.*, 2022; Gretzel and Scarpino-Johns, 2018). This transformation extends beyond technology adoption, encompassing human and organisational factors that influence its implementation and use (Bingöl and Yang, 2025; Boes *et al.*, 2016; Csapó and Végi, 2025; Rafizal Adnan *et al.*, 2020; Vaz Serra *et al.*, 2025). Without adequate governance structures to integrate and coordinate destination actors, implementing innovative technologies may be ineffective (Baggio *et al.*, 2020; Errichiello and Micera, 2021; Ivars-Baidal *et al.*, 2021). The primary challenge in smart tourism governance lies not in technology deployment but in designing and developing effective collaborative structures (Ivars-Baidal *et al.*, 2024).

Developing new governance models requires a holistic approach to the destination ecosystem, incorporating a network of all relevant actors (Csapó and Végi, 2025; Errichiello and Micera, 2021; Gajdošík and Valeri, 2022; Ivars-Baidal *et al.*, 2024). Tourism destinations are complex systems comprising diverse public and private actors who co-create value and depend on one another (Baggio *et al.*, 2020; Gajdošík and Valeri, 2022; Vaz Serra *et al.*, 2025). This interdependence allows destinations to be conceptualised as ecosystems where communities of interacting actors operate within shared environments (Boes *et al.*, 2016; Gretzel *et al.*, 2015). Smart technologies open tourism ecosystems to wider participation, enabling value creation by individuals and businesses (Gelter *et al.*, 2022; Gretzel *et al.*, 2015; Gretzel and Scarpino-Johns, 2018; Ivars Baidal *et al.*, 2017; Jovičić, 2019).

A comprehensive understanding of tourism destinations amid smart tourism transformations requires accounting for an extended ecosystem that includes a broader range of actors beyond traditional tourism industries (Gajdošík and Valeri, 2022; Jovičić, 2019). The diversity of actors involved makes it challenging to precisely define the ecosystem's components and boundaries, which is essential for gaining a holistic view (Gretzel *et al.*, 2015). Nevertheless, as Gretzel *et al.* (2015) stress, mapping the smart tourism ecosystem is essential and requires updated taxonomies of actors and categorisation of their relations. Csapó and Végi (2025) further call for attention to "multi-level, technology-mediated interactions" to better capture the complexity of smart tourism ecosystems (p. 12).

Theoretical models of smart destination structures (e.g. Gretzel *et al.*, 2015) provide valuable conceptual insights into destination ecosystems; however, they require empirical validation. To address ecosystem complexity, several studies have adopted a network perspective, analysing interconnections among core tourism industries (Baggio *et al.*, 2020; Raisi *et al.*, 2018; Ying *et al.*, 2016). While informative, this approach overlooks emerging stakeholders within smart tourism contexts. A recent study employing a network approach across a broader stakeholder spectrum identified formal relationships coordinated by tourism governance bodies and smart initiatives (Ivars-Baidal *et al.*, 2024). Nevertheless, effective governance requires acknowledging actors who are excluded from official planning yet remain essential to the ecosystem. This underscores the need to examine informal participation mechanisms, particularly those involving less organised or underrepresented stakeholders (Ivars-Baidal *et al.*, 2024). Thus, there remains a lack of empirically grounded, holistic representations of extended destination ecosystems amid smart tourism transformations, encompassing diverse actors and both formal and informal relationships.

This study aims to advance the understanding of destination ecosystems within the context of smart tourism transformations by exploring an extended destination ecosystem. It focuses on the ecosystem's structure, the integration patterns of tourism and non-tourism actors, and the relationships among networking behaviours, leadership roles, and actors' engagement in mediation—a connecting role between tourism actors. Specifically, the study addresses the following research questions:

(1) To what extent are actors beyond the core tourism sectors relevant to a tourism destination ecosystem?

(2) What patterns characterise tourism actors' connections in the extended ecosystem of a tourism destination?

(3) How do tourism actors' networking behaviours, leadership roles, integration levels, and mediation engagement relate to one another?

This study develops a theoretical framework grounded in the understanding of smart tourism transition as a socio-technical system change (Gelter *et al.*, 2022). It integrates concepts and approaches from research on digital business ecosystems (Baggio, 2022; Nachira *et al.*, 2007), smart tourism ecosystems (Boes *et al.*, 2016; Gretzel *et al.*, 2015), and socio-technical systems (Geels, 2002; Markard *et al.*, 2012). Recognising the increasingly interconnected nature of the physical and virtual dimensions within socio-technical systems, this research uses one of their core components—digital networks—as a proxy for examining the structure and actors' integration processes within the ecosystem. Using a novel methodological approach, this study extends smart tourism ecosystem frameworks by empirically analysing actor integration in extended destination ecosystems.

2. Theoretical framework

The mere implementation of advanced technologies does not ensure success, as smart tourism destinations require a balanced integration of technological and social factors, including coordination and collaboration (Boes *et al.*, 2016; Errichiello and Micera, 2021; Vaz Serra *et al.*, 2025). Furthermore, the socio-environmental sustainability goals of smart tourism cannot be achieved through a single technology or unilateral project; cross-sectoral collaboration is essential (Pencarelli, 2020). Notably, smart tourism prioritises public–private partnerships, distinguishing it from e-tourism, primarily driven by business interests (Gretzel and Scarpino-Johns, 2018).

The importance of social aspects in implementing advanced technologies supports understanding smart tourism transition as a *socio*-technical transformation, as proposed by Gelter *et al.* (2022). This approach situates smart tourism within the broader framework of technological transitions as socio-technical reconfiguration processes (Geels, 2002). The framework suggests that technological transitions fundamentally concern changes in the structure and configuration of a destination's socio-technical system, representing a complex interplay of actors and technologies. To understand this transition, it is essential to map and monitor ecosystem components, as even minor shifts in composition can trigger significant transformations.

Digital network-based integration is a defining process of smart ecosystems, established through collaborative networks that facilitate intensive data sharing and value co-creation via technological infrastructure (Baggio *et al.*, 2020; Buhalis *et al.*, 2022; Ivars-Baidal *et al.*, 2024; Pencarelli, 2020). Actors directly and indirectly involved in tourism integrate into these digital networks through their digital representations and technological infrastructures, designed to foster an environment that encourages collaboration and knowledge sharing (Baggio and Del Chiappa, 2014).

The connectivity enabled by smart technologies makes smart ecosystems far more permeable than traditional tourism systems, allowing non-tourism companies to become key players (Gretzel and Scarpino-Johns, 2018; Jovičić, 2019). Alongside tourism suppliers, tourists, residents, and governmental agencies, researchers highlight the relevance of non-tourism businesses, including ICT suppliers, media organisations, investors, financial companies, universities, research centres, consulting firms, and civil society (Gretzel *et al.*, 2015; Ivars Baidal *et al.*, 2017; Ivars-Baidal *et al.*, 2024; Jovičić, 2019; Vaz Serra *et al.*, 2025). However, empirical evidence on the integration of non-tourism actors into destination ecosystems remains limited, and perspectives on smart tourism ecosystem structures vary significantly (see Annexe 1 in the supplementary material). While smart tourism largely focuses on ICT, integrating institutional and socio-economic non-tourism actors—whose roles include regulating, financing, educating, and coordinating—is essential to capture the interdependencies that sustain system viability.

A unique study on smart tourism ecosystems examines interconnections of a broad range of stakeholders, including public administration, the tourism industry and related sectors, mobility and transport, technology companies, other businesses, research and academia, and civil society (Ivars-Baidal *et al*., 2024). The analysis shows that connections with ICT actors still are not fully developed in destination ecosystems, and stakeholder networks across several cities reveal a minimal presence of tourism companies in smart initiatives and limited involvement of technology companies in tourism governance (Ivars-Baidal *et al*., 2024). However, these results are constrained by the researchers' focus on formal participation networks arising from tourism governance, planning, and smart city initiatives, whereas integration levels and patterns among a broader range of actors in informal contexts may differ.

The high relevance of ICT actors to tourism destinations in the context of socio-technical transformations is evident due to their technological capacity and influence on ecosystems, which reshape ecosystem connections and power dynamics (Buhalis, 2020; Buhalis *et al*., 2024; Werthner, 2022). Distinguishing tourism actors' connections with ICT actors is particularly important, as an efficient transition to smart destinations depends not only on the quantity and quality of technology but also on the roles and contributions of those who supply technology and those who utilise it (Baggio, 2022; Boes *et al.*, 2016).

However, the integration strategies of different ICT actors—defined as "manufacturing and services industries whose products capture, transmit or display data and information electronically" (Partnership on Measuring ICT for Development, 2005, p. 39)—within destination ecosystems remain somewhat unclear. Limited evidence suggests that such strategies range from collaboration with leading ICT firms to engaging multiple public and private stakeholders in ICT adoption (Nachira *et al.*, 2007). The position of transversal ICT applications (those supporting a broad range of users) also remains unclear in relation to the travel tech sector, where entrepreneurs develop sector-specific digital solutions aimed at streamlining travel experiences and addressing industry challenges such as payments and marketing (Mizrachi and Gretzel, 2020).

Digital networks have been proliferating along the links of the underlying social and business networks, leading to a convergence of ICT networks, social networks, and knowledge networks (Nachira *et al.*, 2007). As a result of digital network-based integration, physical and digital networks become deeply interconnected and co-evolve, enabling the assessment of ecosystem relationships through digital networks (Baggio, 2022; Baggio and Del Chiappa, 2014; Werthner, 2022). This capability is particularly valuable, as data collection remains challenging when applying a network perspective to destination ecosystems. Traditional methods such as surveys and document analysis are time-consuming, often yield low response rates, and struggle to provide consistently updated data on network relations (Gajdošík and Valeri, 2022).

Given the involvement of numerous and diverse stakeholders, achieving a holistic understanding of a destination ecosystem is both challenging and essential for governing integration processes effectively (Gretzel *et al.*, 2015; Ivars-Baidal *et al*., 2024). The structure and configuration of socio-technical systems are critically important for small and medium-sized enterprises, as larger, dominant companies can hinder their growth and shape online cooperation spaces into a "monoculture" that disproportionately serves their interests (Stanley and Briscoe, 2010, p. 2). Specifically, tourism destinations may need to limit the influence of powerful entities such as major booking platforms and support the roles of certain tourism organisations, such as Destination Management Organisations (Gretzel *et al*., 2015).

3. Methodology

3.1 Research design

An exploratory and inductive research approach was adopted, as it is well suited to generating innovative insights into the tourism field (McKercher, 2024). This research focuses on tourism suppliers and governmental agencies, alongside institutions and organisations from other industries. It examines the destination ecosystem through digital networks of web pages and

hyperlinks. To aggregate web pages, the concept of a "web entity" (Jacomy *et al.*, 2016) was introduced to represent a flexible grouping of web pages, for example, when a single actor maintains multiple websites (e.g. google.com and google.es). Web entities, such as organisational websites (e.g. companies, associations) and institutional websites (e.g. government agencies, cultural institutions), were chosen as digital representations of tourism actors. Hyperlinks, being key instruments of connectivity in digital networks (Ooghe-Tabanou *et al.*, 2018), were used as proxies for relationships within the ecosystem. This study employs two complementary methodologies of network analysis: Hyperlink Network Analysis (HNA) and webometrics. Technical details are provided in the supplementary material (Annexe 2).

3.2 Data collection

A convenience sample was used primarily due to its accessibility, cost-effectiveness, and time efficiency. Data were collected in Gipuzkoa province, Spain, in 2023. This is a regional-level destination comprising multiple subregional tourism destinations, at least three of which were participating in Smart Destination certification by SEGITTUR, a Spanish state-owned organisation. The capital, Donostia/San Sebastián, achieved the Smart Tourism Destination distinction in 2022, reaching an advanced stage in the certification process.

An initial dataset comprising 1,199 tourism actors of key tourism sectors of the destination was sourced from the Gipuzkoa Provincial Council's databases, a governmental and administrative agency, in 2021 and updated by the authors in 2022 and 2023. Only 58% of tourism actors ($n = 690$) had organisational or institutional websites. The identified websites were crawled to a depth of three clicks from the initial pages using the web crawler Hyphe (Jacomy *et al.*, 2016; Ooghe-Tabanou *et al.*, 2018). Some websites ($n = 20$, 2.9%) could not be accessed and were excluded from the final sample ($n = 670$). Web crawling collected data on the connections of tourism actors: among themselves and to other entities. The web crawler identified approximately 37,000 web entities (hereafter "discovered entities") connected to the initial sample of tourism actors ($n = 670$) via over 47,000 links. Annexe 3 of the supplementary material illustrates the main data collection steps.

Since not all discovered entities were equally significant, the analysis focused on those most frequently linked, meaning entities more closely connected to core actors and therefore considered more critical for detailed examination. Specifically, only entities with five or more links from core actors were selected ($n = 447$). Although these represented just 1% of the discovered ecosystem, they were highly significant: on average, core actors established 12.4 connections with each of these key entities. Their importance is further underscored by their proximity to tourism actors within the ecosystem (see Annexe 4 of the supplementary material).

To ensure each actor appeared only once among entities with five or more links, those with multiple web domains were merged into single entities (e.g. Santelmomuseoa.com and Santelmomuseoa.eus; Tripadvisor.com and Tripadvisor.es, see Annexe 2 of the supplementary material for more details). The initial tourism actors ($n = 670$) and the discovered entities ($n = 447$) comprised an approximation of the extended ecosystem ($n = 1{,}117$). Additional webometrics data regarding ecosystem leadership ("Domain Rating") were obtained from Ahrefs.com.

Finally, a typology of the discovered ecosystem was developed (Table 1), using both deductive and inductive coding methods, relying on the UN Tourism methodology (World Tourism Organization, 2021), previous research (Raisi *et al.*, 2018; Ying *et al.*, 2016), and accounting for local specifics. The initial tourism actors ($n = 670$) were classified deductively into six sectors ("primary sectors" in Table 1). These types were complemented by creating 13 types inductively for discovered entities ($n = 447$). Two researchers independently assigned final types to each of the 447 entities. The inter-rater reliability test was acceptable at the subcategory level (Cohen's Kappa = 0.83). Disagreement cases were discussed between the researchers, and the final type was assigned. ICT actors were additionally classified by location and subtypes. The supplementary material provides detailed typology development procedures (Annexe 5).

Table 1. Typology of actors in the extended ecosystem of a tourism destination (n = 1,117*)

Internal actors	External actors	
Tourism actors (n = 738)	ICT actors (n = 101)***	Institutional and socio-economic non-tourism (ISEN) actors (n = 184)**
Primary sectors (Initially sampled "core actors," n = 670, and the entities discovered via web crawling, n = 68**) • Accommodations • Destination management organisations • Natural and cultural resources • Tourism-related public bodies • Travel agencies and other reservation services • Sports and recreation service companies	• General ICT (n = 66)** ▪ *Content technology* ▪ *ICT providers* ▪ *Mapping and localisation technology* ▪ *Marketing tools* ▪ *Multifunctional web portals* ▪ *Social media* ▪ *Software development and eectronics* ▪ *Video conferencing and instant messaging* ▪ *Web browsing* ▪ *Web development* • Travel tech (n = 35)** ▪ *Leisure platforms* ▪ *Tourism management software* ▪ *Travel platforms*	• Development actors • Governmental and intergovernmental agencies • Non-tourism information services • Research and education • Retail services, banks, and other businesses
Added sectors (n = 88)** • Annual events • Food and beverage serving activities • Production and tourism • Sports facilities and organisations • Tourism information • Transport services		

Note(s): • Main subtypes of tourism, ICT, and institutional and socio-economic non-tourism actors. ▪ Subtypes of general ICT and travel tech actors *(in italics)*. *Entities for which no type could be assigned were excluded from the table (n = 6). **The types were developed based on the entities identified through web crawling. ***Additional subtypes were elaborated: "domestic" (headquartered within Spain) and "foreign" (headquartered outside Spain)

Source(s): Created by authors

3.3 Analytical procedures

The study utilised a mixed-method approach to analyse the ecosystem's structures and behaviours. The research combines network analysis, clustering techniques, descriptive statistics, statistical correlation analysis, and non-parametric tests. Network analysis was used to quantify relationships among ecosystem entities, identify structural components of the ecosystem, and assess their integration levels. K-means clustering was applied to identify connectivity patterns, categorising actors based on their linking behaviours. Differences across clusters were analysed using non-parametric tests, including the Kruskal–Wallis and Mann–Whitney tests. Spearman's correlation analysis assessed the relationship between actors' networking behaviours and the extent of their leadership in the ecosystem. The variables are described in Table 2.

4. Results

4.1 To what extent are actors beyond the core tourism sectors relevant to a tourism destination ecosystem?

The core tourism actors within the destination (n = 670) maintained significantly more connections with a broader network of entities than among themselves (n = 36,813 entities). There were 40 connections per tourism actor beyond the core and only about three internally.

Table 2. Description of variables

Variable	Description
Structural characteristics	
Ecosystem presence	A quantitative representation of the types of actors within the extended ecosystem. This variable reflects the structural dimension of the ecosystem and the presence of diverse actors within its networks
Integration level	The number of incoming links (indegree) received by an entity within the extended ecosystem from core tourism actors ($n = 670$). This variable reflects a relational dimension of the ecosystem and the frequency of connections in its networks
Ecosystem leadership	The extent to which a tourism actor ($n = 670$) plays a prominent role within the ecosystem, characterised by a high or low web authority—that is the influence, trust, and credibility associated with the website on the Web. This variable is measured using the Domain Rating of Ahrefs.com, which evaluates the strength of a website's (domain's) backlink profile relative to other domains in its database, on a 100-point scale. A higher rating corresponds to a higher level of leadership
Mediation	The extent to which a tourism actor ($n = 670$) connects other tourism actors within the network. It reflects the actor's role as a critical element on the shortest way connecting pairs of actors, thereby facilitating information flow. This variable is assessed using the betweenness centrality measure, which quantifies the number of times a node functions as a bridge on the shortest paths between other nodes. The normalised scale of betweenness centrality adjusts the measure to a 0–1 range, where 1 indicates the maximum possible intermediary strength within the network
Networking behaviours	
External index	The disposition of core tourism actors[a] to link to external actors as opposed to internal actors, i.e. primary and added tourism sectors. For each actor, the index is calculated[b] by subtracting the number of links to internal actors from the number of links to external actors and then dividing this difference by the total number of links to both categories. Scores range from −1.0 to +1.0, where +1.0 represents complete linkage to external actors, −1.0 represents exclusive linkage to internal actors, and 0 indicates a balanced state of linking to both categories
ICT index	The disposition of core tourism actors[a] to link to ICT actors as opposed to institutional and socio-economic non-tourism (ISEN) actors. For each actor, the index is calculated[b] by subtracting the number of links to ISEN actors from the number of links to ICT actors and then dividing this difference by the total number of links to both categories. Scores range from −1.0 to +1.0, where +1.0 represents complete linkage to ICT actors, −1.0 represents exclusive linkage to ISEN actors, and 0 indicates a balanced state of linking to both categories
T-Tech index	The disposition of core tourism actors[a] to link to travel tech actors as opposed to general ICT actors. For each actor, the index is calculated[b] by subtracting the number of links to general ICT actors from the number of links to travel tech actors and then dividing this difference by the total number of links to both categories. Scores range from −1.0 to +1.0, where +1.0 represents complete linkage to travel tech actors, −1.0 represents exclusive linkage to general ICT actors, and 0 indicates a balanced state of linking to both categories
Connecting activity	The number of outbound links placed by a core tourism actor ($n = 670$) within the extended ecosystem ($n = 1{,}111$[c]) to tourism actors, ICT actors, and institutional and socio-economic non-tourism actors
Variety of connections	The number of different types of actors linked by a tourism actor ($n = 670$) in the extended tourism ecosystem ($n = 1{,}111$[c]). Actor types include: accommodations; destination management organisations; natural and cultural resources; tourism-related public bodies; travel agencies and other reservation services; sports and recreation service companies; general ICT; travel tech; development actors; governmental and intergovernmental agencies; non-tourism information services; research and education; retail services, banks, and other businesses (as one category)

Note(s): [a]The index accounts for the links placed by primary "core" tourism actors ($n = 670$) among themselves and to the classified actors of the discovered ecosystem ($n = 447$). The index is not calculated for actors without outgoing links to the relevant categories of actors (e.g. without outgoing links to both internal and external actors in the case of the External index). [b]The index is calculated similarly to the E-I index of Krackhardt and Stern (1988). [c]Actors that could not be classified were excluded

Source(s): Created by authors

This asymmetry underscores the importance of considering the extended ecosystem, encompassing entities and relationships beyond the core actors.

An analysis of the extended ecosystem (n = 1,117, including core actors, n = 670, and key discovered entities, n = 447) revealed that a wide variety of actors were significant to the ecosystem, not by their broad presence but through their high involvement in network relations. While tourism actors formed the fundamental structural component of the ecosystem, constituting the majority, other actors played an important role by leading in the relational dimension and having higher integration levels (Figure 1). Tourism actors represented 74% of all entities (n = 827); however, they accounted for only 39.5% of incoming links, highlighting their relatively limited role in relational terms.

Despite being smaller, the groups of ICT actors and institutional and socio-economic non-tourism (ISEN) actors were highly integrated, having numerous links from core tourism actors (Figure 1). Although comprising only 25% of the ecosystem (n = 284), ICT and ISEN actors attracted 60% of the links from tourism actors, exceeding the connections established internally among tourism actors. Such high integration of ICT and ISEN actors in destination ecosystem networking highlights their critical role in maintaining the networks' integrity. This suggests that non-tourism actors were so important that their removal would disrupt over half of the destination ecosystem's connections.

Although representing the smallest group of actors (9%), ICT actors were a crucial ecosystem component, attracting as many connections as tourism actors (37%). While ISEN actors were also closely linked to the ecosystem, they did not reach the same level of integration as ICT actors, obtaining a smaller share of links (23%). The general ICT subgroup (n = 66) was the most significant within the ecosystem, accounting for 32% of all links. In contrast, the travel tech subgroup, which provides targeted services to the tourism sector, had less influence within the destination ecosystem, both numerically (3%) and relationally (5%). Thus, general ICT actors were the primary contributors to the ecosystem's connectivity,

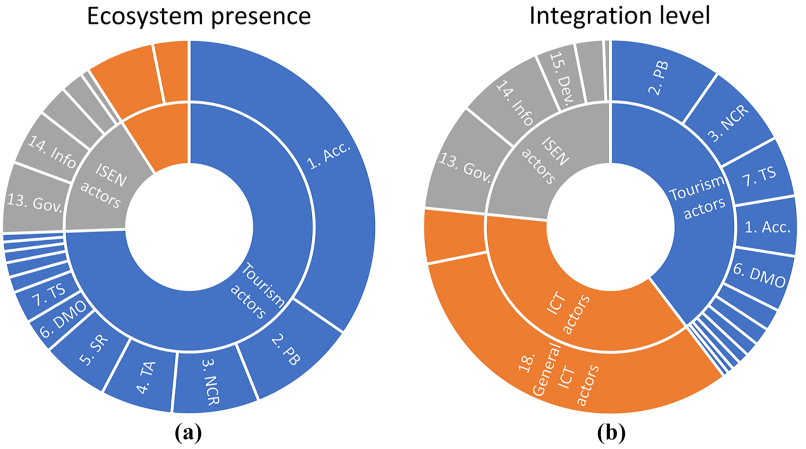

Figure 1. Presence of varying types of actors in the extended destination ecosystem (a) and their integration levels into ecosystem networks (b). *Note.* Actors whose type could not be identified were excluded (n = 6; 1%). *The total number of actors:* 1,111. *Colours:* Blue – tourism actors. Orange – ICT actors. Grey – institutional and socio-economic non-tourism (ISEN) actors. *Types of actors:* (1) Accommodations, (2) Tourism-related public bodies, (3) Natural and cultural resources, (4) Travel agencies and other reservation services, (5) Sports and recreation service companies, (6) Destination management organisations, (7) Transport services, (8) Food and beverage serving activities, (9) Tourism information, (10) Annual events, (11) Production and tourism, (12) Sports facilities and organisations, (13) Governmental and intergovernmental agencies, (14) Non-tourism information services, (15) Development actors, (16) Research and education, (17) Retail services, banks, and other businesses, (18) General ICT actors, (19) Travel tech. Source: Created by authors

whereas travel tech actors had comparatively limited influence despite their tourism-specific focus.

Foreign ICT actors, headquartered outside Spain, played a greater structural and relational role in the extended tourism ecosystem than domestic actors. Notably, they received 33% of all links from tourism actors, underscoring their integration and influence. Foreign ICT actors represented 61% of ICT actors and dominated 89% of the links directed to them. A more detailed analysis of the extended ecosystem is provided in the supplementary material (Annexe 6).

4.2 What patterns characterise tourism actors' connections in the extended ecosystem of a tourism destination?

A comparison of different types of connecting activities, measured through indices, revealed that tourism actors tended to form more connections with external rather than internal actors. This tendency is reflected in a positive average External index (0.44, $n = 631$, representing actors with a calculable index; see Annexe 7 of the supplementary material). On average, tourism actors were linking more to non-tourism entities, such as ICT and institutional and socio-economic non-tourism (ISEN) actors, than to other tourism actors. Although linking behaviours varied considerably (SD = 0.55), most actors (75%, $n = 473$) had a positive External index. Moreover, nearly half of the actors with a positive index (45%) connected exclusively to external actors. However, DMOs diverged from this "external" linking pattern, showing a disposition to connect to internal actors rather than external. This is evidenced by their negative average External index (−0.41) and the absence of actors with a positive index. This inward focus underlines their integrative role in the tourism ecosystem, complementing other sectors' efforts to foster cross-sectoral linkages.

Linking to external actors was characterised by a notable inclination towards ICT actors, as reflected in the positive average ICT index of 0.54 ($n = 622$, representing actors with a calculable index). This indicates that, in general, tourism actors placed more links to ICT actors than to ISEN actors. This pattern is visually apparent in the scatter plots, where most actors cluster towards the upper sections of the graphs (Annexe 8 of the supplementary material). Although indices varied considerably (SD = 0.52), most actors had a positive ICT index (79%, $n = 494$). Furthermore, over half of the entities with a positive ICT index (52%) linked exclusively to ICT actors, further underscoring the crucial role of ICT actors in the destination ecosystem. However, tourism-related public bodies diverged from this tendency, prioritising connections to ISEN actors, as indicated by their negative ICT index (−0.25). This distinct pattern underscores their unique role in fostering diverse links with ISEN actors, contrasting markedly with other sectors' emphasis on ICT connections.

Tourism actors were mainly connected to general ICT actors rather than travel tech actors, as indicated by the negative T-Tech index of −0.72 ($n = 613$, representing actors with a calculable index). Notably, 91% of tourism actors had a negative T-Tech index, with over half (54%) linking exclusively to general ICT actors. Travel tech connections were most relevant for DMOs and accommodations. DMOs had a T-Tech index closest to zero (−0.46), indicating a more balanced connection to travel tech and general ICT actors. Accommodations uniquely included a notable 6% of entities with a positive T-Tech index (see Annexe 8 of the supplementary material for the visual representation).

The ecosystem also exhibited "passive" behaviours, characterised by tourism actors (6% of the total of 670) that did not create any outgoing links to either internal or external actors, although they could still be connected to the network through links created by others (see Annexe 9 of the supplementary material). Such passive behaviours were absent among general and specific destination management and governance actors, including DMOs, tourism-related public bodies, and natural and cultural resources. These behaviours suggest that while most tourism destination actors tend to establish connections with other actors, a small

proportion, primarily from the private sector, do not actively participate in building the destination ecosystem's relationships.

A comparison between sectors revealed that actors from different sectors exhibited distinct connection patterns within the ecosystem, as indicated by the Kruskal–Wallis test (Table 3) and the Mann–Whitney test (Annexe 10 of the supplementary material). Actors representing tourism management and governance (DMOs and tourism-related public bodies) had significantly more connections to tourism and ICT actors than business-oriented sectors such as accommodations, sports and recreation service companies, and travel agencies and other reservation services (hereafter "travel agencies"). These results highlight their strong tourism focus and integration with technological actors. However, DMOs and public bodies differed in their specific connection patterns: DMOs had significantly more links to tourism and travel tech actors than public bodies and any other sector, whereas public bodies had significantly more links to ISEN actors than DMOs and any other sector.

The natural and cultural resources sector, a specialised domain within tourism management, occupied an intermediary position between general destination governance/management and private-sector companies. Actors in this sector maintained high levels of connections to ICT actors, comparable to DMOs and public bodies, and outperformed accommodation providers as well as sports and recreation service companies. Furthermore, they resembled public bodies in their connections to tourism actors. However, they had significantly fewer links to ISEN actors than public bodies. While the natural and cultural resources sector was better connected to tourism actors than accommodation providers and sports and recreation service companies, its actors did not reach the high connectivity level of DMOs with tourism actors. At the same time, they had considerably fewer connections to travel tech actors compared to DMOs.

Private-sector actors (accommodation providers and sports and recreation service companies) were generally less connected to all types of actors than those involved in tourism management and governance. Accommodations stood out for significantly higher levels of linking to travel tech compared to other businesses, including sports and recreation service companies and travel agencies. The connection patterns of travel agencies resembled those of the natural and cultural resources sector; however, they were more dissimilar to those of the governance and management sectors. Travel agencies were similar to DMOs in their connections to ISEN actors but were significantly less connected to tourism and ICT actors than DMOs and public bodies.

Table 3. Connecting activity of tourism sectors

	Tourism sectors						
Connecting activity with particular types of actors	DMOs Rank	Tourism-related public bodies Rank	Natural and cultural resources Rank	Accommodations Rank	Sports and recreation service companies Rank	Travel agencies and other reservation services Rank	Kruskal-Wallis H
Tourism actors[a]	615	518	433	295	233	264	184.554*
ISEN actors	427	609	444	252	313	363	303.389*
ICT actors	518	484	436	284	276	359	117.835*
General ICT	475	490	455	276	296	379	129.171*
Travel tech	575	369	278	352	238	262	78.805*

Note(s): Kruskal-Wallis test. *df = 5, $p < 0.001$. [a] Connecting activity to other members within the same sector and to actors from other tourism sectors

Source(s): Created by authors

4.3 How do tourism actors' networking behaviours, leadership roles, integration levels, and mediation engagement relate to one another?

According to Spearman's correlation analysis, higher levels of connecting activity and greater variety of connections of tourism actors were associated with stronger ecosystem leadership, integration, and mediation. Specifically, the variety of connections of tourism actors ($n = 670$) showed significant moderate positive correlations with ecosystem leadership ($\rho = 0.460$, $p < 0.01$), integration level ($\rho = 0.454$, $p < 0.01$), and mediation ($\rho = 0.505$, $p < 0.01$). Similarly, connecting activity of tourism actors ($n = 670$) showed significant moderate positive correlations with these structural characteristics: ecosystem leadership ($\rho = 0.502$, $p < 0.01$), integration level ($\rho = 0.469$, $p < 0.01$), and mediation ($\rho = 0.518$, $p < 0.01$) (Annexe 11 of the supplementary material).

Connections to internal and external actors played different roles within the ecosystem. Ecosystem leadership was more strongly associated with establishing connections to external actors than with linking to internal ones. Specifically, ecosystem leadership showed a stronger correlation with connecting activity to ICT actors ($\rho = 0.488$, $p < 0.01$) and institutional and socio-economic non-tourism actors ($\rho = 0.455$, $p < 0.01$) than tourism actors ($\rho = 0.401$, $p < 0.01$). Connecting activity to general ICT actors ($\rho = 0.487$, $p < 0.01$) was more closely associated with ecosystem leadership than connecting activity to travel tech actors ($\rho = 0.192$, $p < 0.01$).

In contrast, integration level showed a moderate correlation with connecting activity to tourism actors ($\rho = 0.457$, $p < 0.01$) while connections to ICT and institutional and socio-economic non-tourism actors had only weak positive correlations. This suggests that the more links tourism actors placed internally, the more they received from their colleagues, thereby increasing their integration level.

Cluster analysis provides a detailed perspective on the relationships between networking behaviours, ecosystem leadership, integration, and mediation (Table 4). Using K-means clustering on External, ICT, and T-Tech indices, 613 actors (excluding 9% with incomplete data) were classified into four clusters representing general networking patterns across sectors. All three indices significantly contributed to the differentiation. The differences between clusters were assessed using several variables and statistical tests, including the Kruskal–Wallis test (Table 4) and the Mann–Whitney test (Annexe 12 of the supplementary material).

The "Outward-ISEN" cluster ($n = 159$, 26%) was characterised by its external orientation, with members establishing more links to external actors than to tourism actors (mean External index = 0.45). Specifically, they connected more to institutional and socio-economic non-tourism (ISEN) actors than to ICT actors (ICT index = −0.14). Within ICT connections, they linked more to general ICT than to travel tech (mean T-Tech index = −0.88). This cluster stood out for having the highest ecosystem leadership scores, strong integration, and high performance in mediation, connections to tourism actors, and variety of connections. Additionally, it surpassed all other clusters in overall connecting activity and connections to ISEN and ICT actors.

The "Inward-ICT" cluster ($n = 169$, 28%) members uniquely prioritised connections to tourism actors over external actors (mean External index = −0.21). Within their external connections, they strongly preferred linking to ICT actors rather than to ISEN actors (mean ICT index = 0.73). Among ICT actors, they favoured general ICT connections over travel tech (mean T-Tech index −0.58). Alongside the "Outward-ISEN" cluster, the "Inward-ICT" group excelled in integration, mediation, variety of connections, overall connecting activity, and connecting to tourism actors. Although their connecting activity to ISEN actors was significantly lower than that of "Outward-ISEN" cluster, it still maintained higher connecting activity to these actors than the other two clusters. Additionally, they achieved high levels of connection to both general ICT and travel tech. However, their ecosystem leadership was significantly lower than that of the "Outward-ISEN" cluster and did not differ much from the leadership of the other two clusters.

Table 4. Clusters of connecting behaviours in the extended ecosystem of a tourism destination

Variables	Clusters				Kruskal-Wallis H
Clustering variables	Inward-ICT (n = 169) Mean	Outward-ISEN (n = 159) Mean	Outward-general-ICT (n = 252) Mean	Outward-travel-tech (n = 33) Mean	
External index	−0.21	0.45	0.89	0.59	N/A
ICT index	0.73	−0.14	0.86	0.87	N/A
T-Tech index	−0.58	−0.88	−0.86	0.46	N/A
Descriptive variables	Rank	Rank	Rank	Rank	
Ecosystem leadership	288	406	269	220	71.442*
Integration level	335	375	255	239	57.366*
Mediation	349	346	261	256	66.568*
Variety of connections	419	445	160	193	357.514*
Connecting activity (CA)	382	438	196	139	245.716*
CA: tourism actors	460	407	155	207	388.633*
CA: ISEN actors	275	512	217	175	330.482*
CA: ICT actors	301	369	292	150	47.545*
CA: general ICT	280	382	309	67	93.685*
CA: travel tech	386	279	248	483	116.115*
Composition of clusters according to tourism sectors	Row N %	Row N %	Row N %	Row N %	
DMOs	100%	0%	0%	0%	N/A
Tourism-related public bodies	2%	98%	0%	0%	N/A
Natural and cultural resources	26.5%	39%	34.5%	0%	N/A
Accommodations	35%	8%	48%	9%	N/A
Sports and recreation service companies	9%	22%	66%	4%	N/A
Travel agencies and other reservation services	16%	23%	58%	3%	N/A

Note(s): Clusters were formed based on the K-means clustering methodology. N/A refers to "not applicable." ISEN refers to "institutional and socio-economic non-tourism actors." *Significant at the level $p < 0.001$, df = 3

Source(s): Created by authors

The "Outward-general-ICT" cluster (n = 252, 41%) and *the "Outward-travel-tech" cluster* (n = 33, 5%) were characterised by external connectivity preferences. However, unlike the "Outward-ISEN" cluster, they focused more on connecting to ICT actors than ISEN actors. The key significant difference between these two clusters lay in their preferences for connecting to general ICT versus travel tech actors. Neither of these behaviours was associated with any beneficial outcomes: both clusters underperformed across most indicators, including ecosystem leadership, integration, connecting activity, and variety of connections.

In summary, the clusters with high connecting activity to tourism actors performed better in integration and mediation, regardless of whether they prioritised internal or external connectivity. However, a strong focus on external relations and ISEN actors, while maintaining high levels of connecting activity with general ICT actors, was associated with significantly higher ecosystem leadership. Relying solely on ICT connections, whether to general ICT or travel tech, appeared insufficient for higher levels of ecosystem leadership.

Tourism sectors had clear preferences for behaviours expressed through clusters. For instance, all DMOs belonged to the "Inward-ICT" cluster, while most tourism-related public bodies (98%) were in the "Outward-ISEN" cluster (Table 4). No sectors related to destination management and governance—DMOs and public bodies—belonged to the clusters characterised by an absence of focus on tourism actors or ISEN actors. The largest groups of accommodations belonged to the "Inward-ICT" (35%) and the "Outward-general-ICT" (48%) clusters, both of which demonstrated attention to general ICTs but differed in their focus on tourism actors and travel tech. This suggests that some accommodation providers prioritised connections to tourism actors alongside high ICT activity, positioning them within a more integrated cluster. The analysis sheds light on the "middle" position of natural and cultural resources, in between tourism management/governance and private companies, as its actors were distributed across clusters focused on tourism actors (26.5%), on ISEN actors (39%), and general ICT (34.5%). Such distributions further underscore sector-specific preferences for certain ecosystem behaviours.

5. Discussion and conclusions

5.1 Conclusions

This research reveals that adopting the extended ecosystem perspective is fundamental for understanding the complex and changing structures and relationships within tourism destinations undergoing smart transformations. Smart tourism should not be viewed as a technological end-state but as a continuous process of relational innovation, where transformation is driven by diverse, inclusive, resilient networks rather than digital tools alone. Leadership, networking, integration, and mediation within these ecosystems are central to this process.

The transformation relies on the ability of core tourism actors to connect with non-tourism sectors. This study establishes the importance of specific non-tourism actors and shows that their significance derives not only from their number but also from their level of network integration. Focusing exclusively on major sectors risks overlooking smaller yet influential actors. While tourism actors form the ecosystem's foundation, varying ICT, institutional, and socio-economic actors from outside tourism are essential due to their deep integration within the network of tourism actors; neglecting them would omit over half of the connections of tourism actors. Notably, the system is structurally dependent on ICT actors, especially those based abroad.

Ecosystem connections indicate that tourism actors tend to link more to external actors than to other tourism actors, showing a marked preference for ICT actors over institutional and socio-economic non-tourism actors. Links to ICT actors are primarily directed to general ICT actors rather than to travel tech, although DMOs and accommodations display a stronger tendency to connect with travel tech actors than other sectors. The main difference between tourism actors lies in their involvement in tourism management and governance. While tourism actors generally connect more to non-tourism actors, DMOs prefer linking to other tourism actors. Tourism-related public bodies, in contrast to the general tendency to engage with ICT actors, connect more frequently to institutional and socio-economic actors outside tourism sectors, highlighting their cross-sectoral role. Moreover, DMOs and public bodies appear in clusters characterised by strong leadership, integration, mediation, and connections with ICT actors, indicating their high performance and engagement within the ecosystem.

Conversely, businesses, such as accommodations, sports and recreation services, and travel agencies, did not achieve similar performance within destination networks, exposing a structural gap. Most businesses focus on connections to ICT actors. However, prioritising ICT connections without broadening ties to non-ICT actors limits the potential of tourism actors for ecosystem leadership and integration. Links to institutional and socio-economic actors, alongside connections to ICT actors, are highly relevant for ecosystem leadership, while connecting to tourism actors is associated with higher ecosystem integration and mediation. A specialised form of destination management, focused on natural and cultural resources,

differs from other sectors due to the diversity of networking behaviours, some akin to DMOs, others to public bodies or the private sector, reflecting varied approaches to management.

5.2 Theoretical implications

This study's results urge tourism scholars to reframe destinations undergoing smart transformations not as sector-bound systems but as complex socio-technical ecosystems shaped by non-tourism actors as well. The extended destination ecosystem perspective moves beyond frameworks that focus narrowly on core tourism sectors (e.g. Baggio, 2020) or specific actor types or relations (e.g. Ivars-Baidal *et al.*, 2024). Furthermore, this study complements broader conceptualisations of smart tourism ecosystems (e.g. Gretzel *et al.*, 2015; Jovičić, 2019) by empirically demonstrating the diversity of ecosystem actors and offering a nuanced view of how non-tourism actors integrate into destination networks. The results particularly enhance understanding of public-private cooperation by revealing the complementary functions of DMOs and public bodies in integrating diverse actors into the destination ecosystem.

The relevance of non-technological actors challenges a purely technology-centric view of smart tourism, underscores the importance of social aspects such as network governance for an effective transition (Boes *et al.*, 2016; Errichiello and Micera, 2021; Gajdošík, 2023), and supports framing of smart tourism as a socio-technical transformation (Gelter *et al.*, 2022). Such framing enables further integration of smart and sustainable transitions, grounded in socio-technical systems theory within sustainability research (Geels, 2002; Markard *et al.*, 2012), and addressing the need to develop a theoretical framework linking the technological, social, and environmental dimensions of smart tourism ecosystems (Csapó and Végi, 2025).

The study reinforces the recognised importance of ICT actors in the destination ecosystem (e.g. Leung, 2022). It advances existing research by revealing how these actors are integrated, distinguishing between general ICT and travel tech, foreign and domestic actors, and showing differences in their integration across tourism sectors. The central role of ICT actors, particularly foreign ones, supports the view of tourism as a "digitally mediated" sector and emphasises the significance of transboundary digital information flows and the governance of "digitally platformised" physical spaces, while also raising critical questions about digital sovereignty in the context of the smart tourism transition (Oakes, 2024, p. 862).

Revealing that general ICT actors are more integrated than those in travel tech, this study supports the argument that integrating travel tech remains strategically important, with DMOs playing a central mediating role in bridging this gap (Mizrachi and Gretzel, 2020). The DMO's key position in promoting cohesion among tourism actors, as well as its leadership in engaging with travel tech, further supports the theoretical understanding of the core functions of smart DMOs (Gretzel, 2022).

The methodological approach for analysing extended ecosystems, introduced in this study, supports more in-depth assessments for detailed integration strategies. Insights into networking, leadership, integration, and mediation contribute to refining network-based governance models in smart tourism (Gajdošík, 2023). Analysing digital networks complements insights from formal networks.

5.3 Practical implications

In the transition to smart destinations, tourism governance and management should engage a wider range of actors beyond core tourism sectors and promote their integration to foster efficient and resilient ecosystems, support technology adoption and innovation, enhance tourist experiences, and contribute to sustainable development (Csapó and Végi, 2025; Errichiello and Micera, 2021; Glyptou and Choi, 2021; Vaz Serra *et al.*, 2025). Analysing the extended tourism ecosystem offers a holistic perspective to enhance actor integration, tailored to each destination's needs. The following steps can help operationalise this approach:

(1) Identify actors: Compile a comprehensive list of tourism actors and their websites.

(2) Map connections: Extract hyperlinks from websites to visualise existing relationships.

(3) Analyse the network: Assess whether all relevant actors are included. Identify key ICT actors and explore opportunities to expand connections with travel tech to support digitalisation. Examine sectoral networking patterns and detect actors lacking outbound links.

(4) Implement actions aligned with diagnostic results and local priorities:

- Raise awareness among tourism actors regarding the importance of building connections across tourism and non-tourism sectors. Actors seeking greater integration and leadership should expand their networking strategies beyond ICT actors.
- Support the integration of disconnected actors and address digital divides.
- Increase DMO links with non-tourism actors to support cross-sectoral synergies. Broader engagement would enhance their role as smart DMOs, supporting mobilisation and matchmaking functions to access resources, generate opportunities, and drive innovation (Gretzel, 2022).
- Leverage connections of tourism-related public bodies with institutional and socio-economic non-tourism actors to build an innovation nexus. Connections with government agencies, city administrations, research institutions, technology companies, start-ups, and universities help destinations establish innovation hubs for collaborative solutions (Bingöl and Yang, 2025).
- Strengthen the network by incorporating local ICT actors. Oakes (2024) highlights the risks of overreliance on foreign ICT providers and the need for local digital capacity building and community-owned infrastructure.
- Recommend suitable travel tech tools to tourism actors to strengthen their digital capabilities.

These recommendations align with the resilience principles of smart tourism destinations, including "broaden participation," "maintain diversity and redundancy," "manage connectivity," and "foster complex adaptive systems thinking" (Glyptou and Choi, 2021).

5.4 Limitations and future research

The study's focus on Gipuzkoa (Spain) may limit the generalisability of its results to destinations with different governance models, tourism dynamics, or levels of smart tourism adoption. Comparative analyses of other destinations are needed, particularly to explore links between networking behaviours, economic performance, and destination structures. The methodology, based on hyperlink analysis, excludes actors without institutional websites or references from core tourism sectors, making it less suitable for low-digitalisation contexts. Hyperlinks also fail to capture the quality or nature of relationships. A mixed-methods approach could address this limitation but would require significant resources. Although digital networks offer rapid structural insights, classifying actors remains time-consuming; future studies could explore AI-based tools to streamline this task. The study's organisational focus excludes tourists and local consumers. Future research might integrate their digital traces from social media and blogs to enrich ecosystem analysis. Further investigation is also needed into the use of local versus foreign technologies and the limited role of travel tech compared to general ICTs. Finally, a longitudinal approach could track ecosystem changes over time.

Declaration of AI and AI-assisted technologies in the writing process

During the preparation of this work, the authors used ChatGPT (Open AI) to improve readability and language. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the content.

Supplementary material

The supplementary material for this article can be found online.

References

Baggio, R. (2020), "Tourism destinations: a universality conjecture based on network science", *Annals of Tourism Research*, Vol. 82, 102929, doi: 10.1016/j.annals.2020.102929.

Baggio, R. (2022), "Digital ecosystems, complexity, and tourism networks", in Xiang, Z., Fuchs, M., Gretzel, U. and Höpken, W. (Eds), *Handbook of E-Tourism*, Springer, Cham, pp. 1545-1564, doi: 10.1007/978-3-030-05324-6_91-1.

Baggio, R. and Del Chiappa, G. (2014), "Real and virtual relationships in tourism digital ecosystems", *Information Technology and Tourism*, Vol. 14 No. 1, pp. 3-19, doi: 10.1007/s40558-013-0001-5.

Baggio, R., Micera, R. and Del Chiappa, G. (2020), "Smart tourism destinations: a critical reflection", *Journal of Hospitality and Tourism Technology*, Emerald Publishing Limited, Vol. 11 No. 3, pp.407-423, doi: 10.1108/JHTT-01-2019-0011.

Bingöl, S. and Yang, Y. (2025), "Integrating smart technologies and artificial intelligence to build smart tourism destination ecosystems: a model for smart destination management", *Tourism Management Perspectives*, Vol. 58, 101380, doi: 10.1016/j.tmp.2025.101380.

Boes, K., Buhalis, D. and Inversini, A. (2016), "Smart tourism destinations: ecosystems for tourism destination competitiveness", *International Journal of Tourism Cities*, Emerald Group Publishing Limited, Vol. 2 No. 2, pp.108-124, doi: 10.1108/IJTC-12-2015-0032.

Buhalis, D. (2020), "Technology in tourism-from information communication technologies to eTourism and smart tourism towards ambient intelligence tourism: a perspective article", *Tourism Review*, Emerald Publishing Limited, Vol. 75 No. 1, pp.267-272, doi: 10.1108/TR-06-2019-0258.

Buhalis, D., O'Connor, P. and Leung, R. (2022), "Smart hospitality: from smart cities and smart tourism towards agile business ecosystems in networked destinations", *International Journal of Contemporary Hospitality Management*, Vol. 35 No. 1, pp.369-393, doi: 10.1108/IJCHM-04-2022-0497.

Buhalis, D., Efthymiou, L., Uzunboylu, N. and Thrassou, A. (2024), "Charting the progress of technology adoption in tourism and hospitality in the era of industry 4.0", *EuroMed Journal of Business*, Vol. 19 No. 1, pp.1-20, doi: 10.1108/EMJB-11-2023-0310.

Csapó, J. and Végi, S. (2025), "Navigating the nexus of innovation and insight: an umbrella review and thematic clustering of smart tourism evolution", *Current Issues in Tourism*, pp.1-19, doi: 10.1080/13683500.2025.2462973.

Errichiello, L. and Micera, R. (2021), "A process-based perspective of smart tourism destination governance", *European Journal of Tourism Research*, Vol. 29, p. 2909, doi: 10.54055/ejtr.v29i.2436.

Gajdošík, T. (2023), "Contribution of network approach to tourism destination governance", in Ferrer-Rosell, B., Massimo, D. and Berezina, K. (Eds), *Information and Communication Technologies in Tourism 2023*, Springer Nature Switzerland, Cham, pp. 179-191, doi: 10.1007/978-3-031-25752-0_21.

Gajdošík, T. and Valeri, M. (2022), "Complexity of tourism destination governance: a smart network approach", *new governance and management in touristic destinations*", *IGI Global*, pp. 119-132, doi: 10.4018/978-1-6684-3889-3.ch008.

Geels, F.W. (2002), "Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and a case-study", *Research Policy*, Vol. 31 No. 8, pp. 1257-1274, doi: 10.1016/S0048-7333(02)00062-8.

Gelter, J., Fuchs, M. and Lexhagen, M. (2022), "Making sense of smart tourism destinations: a qualitative text analysis from Sweden", *Journal of Destination Marketing and Management*, Vol. 23, 100690, doi: 10.1016/j.jdmm.2022.100690.

Glyptou, K. and Choi, M. (2021), "Conceptualising system resilience in smart tourism destinations", in Farmaki, A. and Pappas, N. (Eds), *Emerging Transformations in Tourism and Hospitality*, Routledge, pp.83-97.

Gretzel, U. (2022), "The smart DMO: a new step in the digital transformation of destination management organizations", *European Journal of Tourism Research*, Vol. 30 No. 30, p. 3002, doi: 10.54055/ejtr.v30i.2589.

Gretzel, U. and Scarpino-Johns, M. (2018), "Destination resilience and smart tourism destinations", *Tourism Review International*, Vol. 22 Nos 3-4, pp. 263-276, doi: 10.3727/154427218X15369305779065.

Gretzel, U., Werthner, H., Koo, C. and Lamsfus, C. (2015), "Conceptual foundations for understanding smart tourism ecosystems", *Computers in Human Behavior*, Vol. 50, pp. 558-563, doi: 10.1016/j.chb.2015.03.043.

Ivars Baidal, J., Celdrán Bernabeu, M.A. and Femenia Serra, F. (2017), "'Guía de implantación: DTI CV', – Agència Valenciana del Turisme", Invat.tur.

Ivars-Baidal, J., Celdrán-Bernabeu, M.A., Femenia-Serra, F., Perles-Ribes, J.F. and Giner-Sánchez, D. (2021), "Measuring the progress of smart destinations: the use of indicators as a management tool", *Journal of Destination Marketing and Management*, Vol. 19, 100531, doi: 10.1016/j.jdmm.2020.100531.

Ivars-Baidal, J., Casado-Díaz, A.B., Navarro-Ruiz, S. and Fuster-Uguet, M. (2024), "Smart tourism city governance: exploring the impact on stakeholder networks", *International Journal of Contemporary Hospitality Management*, Vol. 36 No. 2, pp. 582-601, doi: 10.1108/IJCHM-03-2022-0322.

Jacomy, M., Girard, P., Ooghe-Tabanou, B. and Venturini, T. (2016), "Hyphe, a curation-oriented approach to web crawling for the social sciences", in Gummadi, K.P. and Strohmaier, M. (Eds), *Proceedings of the International AAAI Conference on Web and Social Media*, Cologne, Germany, 1, Vol. 10, pp. 595-598, doi: 10.1609/icwsm.v10i1.14777.

Jovičić, D. (2019), "From the traditional understanding of tourism destination to the smart tourism destination", *Current Issues in Tourism*, Vol. 22 No. 3, pp. 276-282, doi: 10.1080/13683500.2017.1313203.

Krackhardt, D. and Stern, R.N. (1988), "Informal networks and organizational crises: an experimental simulation", *Social Psychology Quarterly*, Vol. 51 No. 2, pp. 123-140, doi: 10.2307/2786835.

Leung, R. (2022), "Development of information and communication technology: from e-Tourism to smart tourism", in Xiang, Z., Fuchs, M., Gretzel, U. and Höpken, W. (Eds), *Handbook of E-Tourism*, Springer International Publishing, Cham, pp. 23-55, doi: 10.1007/978-3-030-05324-6_2-1.

Markard, J., Raven, R. and Truffer, B. (2012), "Sustainability transitions: an emerging field of research and its prospects", *Research Policy*, Vol. 41 No. 6, pp. 955-967, doi: 10.1016/j.respol.2012.02.013.

McKercher, B. (2024), "Tourism research methodology: confessions of an inductive researcher", *Tourism Review*, Emerald Publishing Limited, doi: 10.1108/TR-08-2024-0659.

Mizrachi, I. and Gretzel, U. (2020), "Collaborating against COVID-19: bridging travel and travel tech", *Information Technology and Tourism*, Vol. 22 No. 4, pp. 489-496, doi: 10.1007/s40558-020-00192-0.

Nachira, F., Dini, P. and Nicolai, A. (2007), "A network of digital business ecosystems for Europe: roots, processes and perspectives", in Nachira, F., Nicolai, A., Dini, P., Le Louarn, M. and Rivera Leon, L. (Eds), *Digital Business Ecosystems*, Office for Official Publications of the European Communities, Luxembourg, pp. 1-20.

Oakes, T. (2024), "Toward a critical geopolitics of smart tourism", *Tourism Geographies*, Routledge, Vol. 26 No. 5, pp.862-873, doi: 10.1080/14616688.2024.2360633.

Ooghe-Tabanou, B., Jacomy, M., Girard, P. and Plique, G. (2018), "Hyperlink is not dead", in Reyes, E., Bernstein, M., Ruffo, G. and Saleh, I. (Eds), *WS.2 2018: Proceedings of the 2nd International Conference on Web Studies*, ACM, Paris, France, pp. 12-18, doi: 10.1145/3240431.

Partnership on Measuring ICT for Development (2005), "Core ICT indicators", available at: https://www.itu.int/ITU-D/ict/partnership/material/CoreICTIndicators.pdf

Pencarelli, T. (2020), "The digital revolution in the travel and tourism industry", *Information Technology and Tourism*, Vol. 22 No. 3, pp. 455-476, doi: 10.1007/s40558-019-00160-3.

Rafizal Adnan, H., Nizar Hidayanto, A., Purwandari, B., Achirul Awal Nazief, B. and Solikin (2020), "Rocky roads towards smart tourism: a multi-dimensional challenges review", *Presented at the 2020 Fifth International Conference on Informatics and Computing (ICIC)*, IEEE, Gorontalo, Indonesia, pp. 1-7, doi: 10.1109/ICIC50835.2020.9288514.

Raisi, H., Baggio, R., Barratt-Pugh, L. and Willson, G. (2018), "Hyperlink network analysis of a tourism destination", *Journal of Travel Research*, Vol. 57 No. 5, pp. 671-686, doi: 10.1177/0047287517708256.

Stanley, J. and Briscoe, G. (2010), "The ABC of digital business ecosystems", *arXiv, 11 May*, doi: 10.48550/arXiv.1005.1899.

Vaz Serra, P., Seabra, C. and Caldeira, A. (2025), "Smart tourism ecosystem: from connectivity to value Co-creation", in Guarda, T., Portela, F. and Augusto, M.F. (Eds), *Advanced Research in Technologies, Information, Innovation and Sustainability*, Springer Nature Switzerland, Cham, pp. 379-387, doi: 10.1007/978-3-031-83435-6_28.

Werthner, H. (2022), "e-Tourism: an informatics perspective", in Xiang, Z., Fuchs, M., Gretzel, U. and Höpken, W. (Eds), *Handbook of E-Tourism*, Springer International Publishing, Cham, pp. 3-22, doi: 10.1007/978-3-030-48652-5_1.

World Tourism Organization (2021), in *Methodological Notes to the Tourism Statistics Database, World Tourism Organization*, UNWTO, doi: 10.18111/9789284422517.

Ying, T., Norman, W.C. and Zhou, Y. (2016), "Online networking in the tourism industry: a webometrics and hyperlink network analysis", *Journal of Travel Research*, SAGE Publications Inc, Vol. 55 No. 1, pp.16-33, doi: 10.1177/0047287514532371.

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