

The importance of the regional context for the development of local smart tourism destinations: Spain as a case study

*Carmen Ramos-Carvajal**, *Lorena García-Alonso***, *Blanca Moreno-Cuarteras****

Received: 01 June 2026

Accepted: 03 September 2026

ABSTRACT:

This study examines how regional characteristics influence the development of local Smart Tourism Destinations (STDs) in its territory, highlighting that, beyond city level initiatives, regional contexts play a key role by shaping the enabling conditions for smart transformation. Despite this relevance, the extent to which regional strategies affect the development of local STDs remains largely unexplored in the existing literature, resulting in a gap that this research aims to address.

To capture the territorial factors that condition STD development, the study proposes a synthetic indicator: the Regional Index of Smart Destination Enablers. This index integrates information from a set of indicators aligned with the strategic pillars of SEGITTUR's model, which defines the essential dimensions of smartness in tourism destinations.

The resulting indicator is applied to Spain's Autonomous Communities to assess the suitability of the context they provide for the development of local STDs.

KEYWORDS: Principal component analysis; smart tourism destination; synthetic index.

JEL CLASSIFICATION: C38; L83; O33; R58.

La importancia del contexto regional para el desarrollo de destinos turísticos inteligentes locales: España como caso de estudio

RESUMEN:

Este estudio examina cómo las características regionales influyen en el desarrollo de los Destinos Turísticos Inteligentes (DTI) locales en su territorio, destacando que, más allá de las iniciativas a nivel de ciudad, los contextos regionales desempeñan un papel clave al configurar las condiciones que permiten la transformación inteligente. A pesar de esta relevancia, el grado en que las estrategias regionales afectan al desarrollo de los DTI locales sigue siendo en gran medida inexplorado en la literatura existente, generando un vacío que esta investigación pretende abordar.

Para captar los factores territoriales que condicionan el desarrollo de los DTI, el estudio propone un indicador sintético: el Índice Regional de Facilitadores de Destinos Inteligentes. Este índice integra información procedente de un conjunto de indicadores alineados con los pilares estratégicos del modelo de SEGITTUR, que define las dimensiones esenciales de la inteligencia en los destinos turísticos.

El indicador resultante se aplica a las Comunidades Autónomas de España para evaluar la idoneidad del contexto que proporcionan para el desarrollo de DTI locales.

* Department of Applied Economics, University of Oviedo and REGIOlab. Spain. cramos@uniovi.es

** Department of Applied Economics, University of Oviedo and REGIOlab. Spain. lorena@uniovi.es

*** Department of Applied Economics, University of Oviedo and REGIOlab. Spain. morenob@uniovi.es

Corresponding author: cramos@uniovi.es

PALABRAS CLAVE: Análisis de componentes principales; destino turístico inteligente; índice sintético.

CLASIFICACIÓN JEL: C38; L83; O33; R58.

1. INTRODUCTION

The concept of *smart tourist destination* (STD) derives from *smart city*, and could be understood as an extension of e-tourism as it uses the latest information and communication technologies (ICTs), big data, artificial intelligence, the Internet of Things (IoT), virtual reality and smart mobile devices to digitally connect with the physical tourism offer (Soares et al., 2022). Over time, smart cities have evolved into complex urban systems where intelligence stems from capabilities in governance, sustainability, mobility, the economy, social inclusion, quality of life, and innovation, among others. Additionally, several approaches extend...this urban perspective by emphasising that broader territorial scales shape and reinforce their implementation. Regional context plays a crucial role by inking the management strategies of each territory with its potential to promote measures that give rise to this type of tourism (Gretzel, 2018). Recent empirical evidence also shows that the tourism–development nexus is highly heterogeneous across regions, which supports the need for territorially disaggregated analysis (Brida et al., 2025). As pointed out by Ivars-Baidal et al. (2019), so that the transformation of a traditional tourist destination into an STD serves to increase its competitiveness, update supply and better meet demand, it is not enough to modernise its marketing through the use of ICTs, it is also necessary to look at its governance in order to increase sustainability and improve the quality of life of the local population. The sustainability of an STD is directly conditioned by local governance, and indirectly by regional governance. Therefore, a multilevel governance framework capable of coordinating actions across governmental tiers and involved stakeholders becomes essential, as noted by Shafiee et al. (2019). Gorelova et al. (2024) emphasise that digitalisation, governance, and regional innovation systems are key to understanding the evolution of intelligent territories. Regions also follow distinct paths of digitalisation and tourism transformation, generating differentiated innovation dynamics that extend beyond the local level (Esposito et al., 2021). This territorial perspective is crucial, as regions concentrate innovation capacities that shape the transition toward Smart Tourism Destinations. From a Regional Innovation Systems perspective (Cooke, 2008), factors such as environmental innovation, business digitalisation, and industrial investment constitute accumulated capabilities that determine both the feasibility and pace of adopting the STD model (Romão & Nijkamp, 2019; Williams et al., 2020).

Thus, the regional scale is not a secondary contextual layer but a structural determinant of the conditions enabling the emergence, consolidation, and diffusion of local Smart Tourism Destinations. Assessing the regional context is therefore essential to explain their development within a territory. While specific indicator systems can capture the multidimensionality of regional characteristics, a composite index makes it possible to integrate these factors into a synthetic and comparable measure.

The Regional Smart Destination Enablers Index (RSDEI) is proposed as a composite indicator that measures regional conditions enabling the development of smart tourism destinations, allowing comparisons across territories, the identification of gaps, and the support of evidence-based strategic decisions. The index is constructed using Principal Component Analysis (PCA), which reduces subjectivity in weighting and improves comparability by relying on a common component-based structure.

The general hypothesis of this study is that regional governance shapes the capacity of localities to develop initiatives related to innovation, technology, sustainability and accessibility, as these domains are also influenced by policies designed and implemented at the supra-municipal level.

From this overarching hypothesis, three specific hypotheses are derived:

H1: Significant differences exist among Spanish regions regarding the conditions that support the development of local Smart Tourism Destinations.

H2: Sustainability, innovation, accessibility, and digitalisation constitute relevant explanatory dimensions of these territorial differences.

H3: A composite indicator based on these dimensions provides an appropriate tool for assessing and comparing the potential of regions to foster the development of local Smart Tourism Destinations.

This study examines whether regional characteristics affect STD development within their borders. This perspective enables a more accurate assessment of each region's suitability to transform traditional local tourism destinations into smart ones and to identify which strategies best support this transition.

Accordingly, the study addresses the following research questions:

RQ1: Is it possible to construct a synthetic index that captures the regional potential for fostering local Smart Tourism Destinations?

RQ2: Which regional dimensions contribute most to the development of local Smart Tourism Destinations?

RQ3: Can the results of such an index provide useful guidance for the design and implementation of regional policies aimed at promoting Smart Tourism Destinations?

The RSDEI is calculated for Spain in 2023, using the Autonomous Communities (CC.AA.) as the spatial reference unit. The index is built from indicators aligned with the dimensions of the STD model developed for Spain by the State Mercantile Society for the Management of Innovation and Tourism Technologies S.A. (SEGITTUR). Spain offers a particularly relevant case study given its leading role in smart tourism development and the steady growth of destinations incorporated into the STD Network (SEGITTUR, 2024). Previous analyses have examined the Spanish case using the SEGITTUR model (e.g., Ivars-Baidal et al., 2023; Artal-Tur and Badillo-Amador, 2024). This study goes further by deepening the understanding of the regional role in shaping local STD development.

The work carried out is structured as follows: Section 2 reviews the existing literature on smart city indicator systems and examines approaches that extend the urban framework of STDs to broader territorial scales. Section 3 presents the Spanish Smart Tourism Destination Project. Section 4 analyses the potential of regions to enable local smart tourism destinations, and develops the Regional Smart Destination Enablers Index. Section 5 presents the main theoretical and practical contributions of the study. Section 6 includes the concluding remarks, as well as the study's limitations and future research directions.

2. REVIEW OF THE LITERATURE

The literature on Smart Tourism Destination (STD) assessment includes, on the one hand, studies that develop indicator systems to diagnose specific dimensions such as governance, digitalisation, or sustainability, and, on the other, works that design composite indices to synthesise multiple dimensions. This review shows that the RSDEI proposed here is grounded in an indicator system aligned with variables that capture the multidimensional nature of "smartness".

Within the literature focusing on indicator systems for STDs, Cohen (2014) evaluates 70 smart destinations, taking into account 74 variables related to: i) the Smart; ii) Smart People; iii) Smart Governance; iv) Smart Mobility; v) the Smart Environment; and vi) Smart Living. Buhalis (2000) proposes several variables related to six key components of a smart tourism destination: attractions, services, availability of packages, activities and auxiliary services. As explained by Tavitiyaman et al (2021), the concept of smart tourism seeks to take advantage of advances in information technologies to facilitate interactions between tourists and promote the internationalisation and quality of the tourist experience. Therefore, it is important to take into account variables related to information and communication technologies, cloud computing, the Internet of Things, social networks or the use of Big Data, among others. Lai and Cole (2023) offer a wide range of variables associated with smart cities: the use of smartphones, the deployment of sensors and cameras in public spaces, the implementation of technologies that address energy efficiency and mobility infrastructure in the city, among others. Ivars-Baidal et al. (2021) design a framework of indicators for smart tourism destinations aimed at assessing the current status of several destinations in Valencia (Spain) that are implementing smart tourism strategies. Their

work develop and implement a system of indicators relating to connectivity and online marketing, accessibility, innovation and sustainability. Ivars-Baidal et al. (2023) analyse the contribution of smart cities and destinations to the design and implementation of sustainable tourism indicators for destinations. They have proposed a mixed method approach that includes analysis of multiple scales including the international perspective, the national reality of Spain and a system of regional-local tourism indicators. In Foronda-Robles (2023), a Smart Coastal Management System is designed. This study considers 30 indicators, organized in six dimensions (smart governance, smart environment, universal access, smart business, smart technology and innovation). Gómez-Bruna and Thiel-Ellul (2024) propose a set of indicators to evaluate governance, highlighting the usefulness of composite indicators for monitoring and assessment purposes. Finally, Artal-Tur and Badillo-Amador (2024) analyze tourism sustainability indicator systems, including the Spanish Smart Tourism Destination model, and compare it with other international frameworks.

These works do not develop an integrated synthetic index, although some, such as Gómez-Bruna and Thiel-Ellul (2024), include a limited set of composite indicators within their proposed systems. The advantage of a synthetic index is that it condenses the entire indicator framework into a single measure, providing a comprehensive overview of the STD under analysis. The indices developed in the smart tourism destination literature vary according to the local context, the selected variables (combining both objective indicators and perception-based measures) and the dimensions examined, such as governance, sustainability, innovation, accessibility, connectivity, Intelligence, Information, or Online Marketing. In this regard, Chung, et al. (2021) develop an index on the systematic flow and integration between smart tourism technologies and other components of destination competitiveness. The aim of this index is to diagnose the level of smart tourism in cities and measure their future competitiveness. Blancas and Lozano-Oyola (2022) develop a composite indicator to assess sustainable tourism in Andalusia (Spain). Using PCA, they construct an index that enables measurement and comparison of sustainability levels across destinations, overcoming the limitations of analysing isolated indicators. In addition, numerous organisations produce indices for different cities (such as the A.T. Kearney Global Cities Index, IESE Cities in Motion Index, EasyPark Cities of the Future Index, Mori Memorial Foundation Global Power City Index, Smart EcoCity Index, Digital City Index, Global E-Government Survey, Innovation Cities Index, Smart City Governments Index, and the Smart City Index) each based on its own indicator system. For example, the latest version of the The Smart City Index (IMD World Competitiveness Center, 2024) compiles 39 indicators for each city related to residents' perceptions of issues about their city.

Sharifi (2019) provides a comprehensive review of Smart City Assessment (SCA) tools, including those based on extensive indicator systems and those that construct composite indices. His analysis highlights the limited integration of stakeholders, which affects the transparency and legitimacy of assessments, and the presence of lengthy indicator lists or thematic imbalances that overemphasise technological dimensions while downplaying governance or sustainability. Methodologically, he criticises the use of arbitrary weighting schemes and heterogeneous normalisation techniques, which hinder comparability across territories. Toh (2022) examines six major smart city indexes and shows that they differ substantially in methodology, number of criteria and dimensions, and indicators employed. Similarly, Lai and Cole (2023) through a comparison of six smart city indices, demonstrate differences not only on to spatial scope, but also in underlying smart city strategies or conceptualisations, dimensions included, methodologies applied, and variables considered. Karal and Soyer (2024) conduct a systematic review of 90 articles evaluating smart, sustainable, and smart sustainable cities. Their analysis compares indicators and ranking methods (such as PCA, cluster analysis, and Delphi) and underscores the need to combine technological information with environmental, social, and governance metrics, emphasising the importance of advancing towards composite indices that capture the multidimensional nature of STDs.

The previous literature review shows that indicator systems and indices are mostly designed at the local scale and therefore fail to capture the broader territorial levels that shape and enable the deployment of local STDs. To address this limitation, the RSDEI proposed in this study explicitly incorporates the regional context to assess each region's enabling potential for the emergence and development of STDs. This approach responds to the need to evaluate progress towards smart destinations from a multiscale perspective (Ivars-Baidal et al., 2021; Artal-Tur & Badillo-Amador, 2024).

Regional planning should not be understood as a sectoral tourism policy limited to promotional actions (Ivars-Baidal, 2004), but rather as a broader governance framework that shapes the dimensions upon which an STD is built. In this regard, Wray (2015) notes that major changes in tourism governance occur at the regional scale, a view reinforced by recent evidence. For instance, Bulchand-Gidumal (2022) shows that post-COVID tourism recovery in island territories depends critically on regional governance, digitalisation, and sustainability frameworks. From this perspective, STD development requires strengthening governance to enhance sustainability and improve residents' quality of life (Ivars-Baidal et al., 2019), who argue that supralocal strategies shape the core dimensions of STDs. Consequently, a multilevel governance framework capable of coordinating actions across government tiers and stakeholders becomes essential (Shafiee et al., 2019).

This governance-oriented view aligns with the broader evolution of the smart city paradigm, which has expanded towards wider territorial scales. This perspective emphasises that intelligence emerges from territorial ecosystems undergoing digital transformation. Destinations cannot be understood in isolation: their attractiveness depends on their position within the territorial network and on interactions with neighbouring destinations (Jiao et al., 2025). Accordingly, Tena et al. (2024), in their analysis of the STD model applied to the Valencian network, acknowledge that their study "responds to a specific reality and culture," implicitly recognising the relevance of the regional context. Local STDs therefore operate as interconnected ecosystems shaped by shared regional conditions and strategies.

Moreover, regions follow heterogeneous trajectories of digitalisation and tourism transformation, adapted to their own socio-economic characteristics. Esposito et al. (2021) show that regional governments tailor smart city policies to specific contexts, generating differentiated dynamics of urban and tourism innovation. More recently, Gorelova et al. (2024) propose a renewed framework for smart territories, highlighting that territorial intelligence arises from the interaction between infrastructure, governance, and regional capabilities rather than from isolated local initiatives. This view is consistent with Gretzel (2018), who argues that regions act as strategic units for the coordination of smart policies.

From the perspective of Regional Innovation Systems (Cooke, 2008), accumulated regional capabilities, such as environmental innovation, business digitalisation, and industrial investment, determine the feasibility and pace of adopting the STD model. Empirical evidence supports this relationship. For instance, Romão and Nijkamp (2019) show that regional productivity, innovation, and human capital directly explain tourism performance; Williams et al. (2020) highlight that tourism innovation depends on regional ecosystems comprising firms, institutions, and technological capabilities; and Luongo et al. (2023) underline that territorial collaboration and digital infrastructure are necessary conditions for tourism innovation.

Consistently, Ivars-Baidal et al. (2021) stress that assessing progress towards smart destinations requires considering multiple scales, particularly the regional one, across dimensions such as connectivity, sustainability, and innovation. Likewise, Bellini et al. (2017) note that regional governments often integrate smart tourism within broader innovation and territorial development strategies. Additionally, many environmental regulations and sustainability standards that directly affect STD performance are defined at the regional level (Escobar & Hall, 2025).

3. THE SPANISH SMART TOURISM DESTINATION PROJECT

In countries such as Spain, where the tourism sector has reached a mature stage, it is necessary to initiate a process of reconversion. Within the emerging paradigm of smart tourism, the traditional model, primarily supply-driven and grounded in the exploitation of natural, cultural or ethnographic resources, must be replaced by an alternative framework in which visitor satisfaction becomes the central axis of tourism strategy. Such a shift requires going beyond destination promotion through marketing campaigns and instead entails adapting destinations so that tourists can personalise their experience. In Spain, this adaptation is being pursued through the Smart Tourism Destinations project promoted by the Government of Spain. Its overarching aim is to foster destination sustainability through innovation and technology, ensuring that the expectations of both visitors and residents are met. This model, endorsed by

institutions such as the UNWTO, the IDB, the OECD and the WTTC (SEGITTUR, 2026), serves as a consolidated reference in the field.

The State Mercantile Society for the Management of Innovation and Tourism Technologies S.A. (SEGITTUR) introduced the concept of the “Smart Tourism Destination” (STD) in 2012, drawing directly on the “smart city” paradigm. Its development relied on guidelines issued by the International Telecommunication Union (ITU) and by the Technical Standardisation Committee 178 “Smart Cities” (CTN178). Whereas the ITU provided the conceptual foundations defining a smart city as one that employs ICTs to enhance inhabitants’ quality of life, CTN178 established the regulatory framework governing its implementation in Spain. This framework resulted in a catalogue of UNE standards (17850x), from which SEGITTUR designed a standardised, measurable and homologated protocol that led to the establishment of the Spanish STD network¹. Because it originates from an already consolidated smart city model and adheres to international formal standards, this framework can be replicated in other countries. Accordingly, it supports tourism transformation in alignment with the 2030 Agenda and the Sustainable Development Goals wherever it is adopted (SEGITTUR, 2024), and constitutes an appropriate starting point for our research.

A smart city is characterised by the intensive use of ICTs to improve service efficiency, promote sustainability, integrate infrastructures and facilitate citizen participation through collaborative governance. These same objectives, adapted to the tourism sphere and placing the visitor at the core of decision-making, inspired SEGITTUR’s model, which conceptualises Smart Tourism Destinations as structured around five key dimensions: innovation, technology, sustainability, accessibility and governance. Table 1 provides the rationale underpinning each of these dimensions.

As noted by Ivars-Baidal et al. (2019), transforming a traditional tourism destination into a Smart Tourism Destination (STD) requires more than modernising its marketing through the adoption of ICTs. In this context, the transformation also entails a shift towards the delivery of smart tourism experiences, characterised by personalisation, contextualisation and interactivity enabled by digital technologies (Femenia-Serra & Neuhofer, 2018). To effectively enhance competitiveness, update the tourism offer and better meet demand, it is also essential to strengthen governance so as to promote sustainability and improve residents’ quality of life. Nevertheless, despite the centrality of governance to any intelligence-based strategy (Escobar & Hall., 2025), this dimension has received comparatively limited academic attention (Ivars-Baidal et al., 2023).

It is well established that the success of an STD depends on its capacity to innovate and generate an optimal environment for tourists (Shin et al., 2023; Wang et al., 2020), as well as on its endowment of social and human capital (Boes et al., 2015; Ivars-Baidal et al., 2019). These factors rely directly on local governance and indirectly on regional governance, since it is at the regional level that the framework for tourism innovation is defined (Bellini et al., 2017). For this reason, the indicator proposed in this study is constructed on the basis of the first four dimensions of SEGITTUR’s STD model presented in Table 1. The fifth dimension, governance, is implicitly captured through the regional policies implemented in each case, as reflected in the variables used to quantify the remaining dimensions. These variables are detailed below.

¹ The Spanish (STD) network is a mechanism aimed to support the implementation of SEGITTUR’s Smart Tourism Destination management model. It brings together all destinations that have already begun their transformation process in accordance with this approach. Membership of the network facilitates this transition by promoting the exchange of experiences, providing methodological support, and fostering cooperation among public authorities, businesses, experts, and civil society. In short, the Spanish STD network serves as a support and guidance instrument. Consequently, the destinations included in the network do not yet hold the STD certification awarded by SEGITTUR, which is granted following a positive assessment of the degree to which the model has been implemented. Rather, they are in the process of achieving this distinction (SEGITTUR, 2024). At the time of writing, the Network comprised 440 destinations. The destinations that have already obtained official STD status are Barcelona, Bilbao, Benidorm, San Sebastián, Comarca de Somontano, Gijón, Lloret de Mar, Málaga, Santander, Valencia, and Vitoria-Gasteiz (SEGITTUR, 2026).

TABLE 1.
Origin and rationale of the dimensions of SEGITTUR's STD model

Innovation	Origin: the smart city is conceived as an innovative ecosystem, in which creativity constitutes the driving force behind social and economic transformation.
	Rationale: the tourism sector is highly competitive and dynamic, characterised by continuous evolution and confronted with challenges at the local, national and global levels.
Technology	Origin: ICTs are essential for monitoring flows, optimising resources, and managing information in real time...
	Rationale: it is necessary to endow the destination with intelligence in order to enhance and personalise the visitor experience.
Sustainability	Origin: the need to address the environmental crisis and increasing urban pressure gave rise to the development of smart cities.
	Rationale: tourism intensifies the pressure exerted on natural resources, cultural heritage, and the quality of life of residents.
Accessibility	Origin: social well-being and equal opportunities require universal accessibility to the resources offered by the city.
	Rationale: the tourism experience must be universally accessible.
Governance	Origin: a smart city requires citizen participation and transparency in the integrated management of its services.
	Rationale: tourism is a cross-cutting activity whose development requires the participation of local and regional administrations, as well as private stakeholders, all of whom must operate in an integrated manner and in adherence with their surrounding environment.

Source: authors' own elaboration based on SEGITTUR (2024).

4. ANALYSIS OF REGIONAL POTENTIAL FOR HOSTING SMART TOURISM DESTINATIONS

To carry out this analysis, a synthetic index summarising the information contained in a system of variables for each region is developed. Regional Smart Destination Enablers Index (RSDEI) orders regions according to their potential for local STD development.

The methodology used is PCA. This consists of constructing a synthetic indicator from a set of simple indicators, weighted according to their importance in the analysis (explanatory capacity).

4.1. VARIABLES ANALYSED

An initial selection of variables is necessary before the synthetic index RSDEI is compiled. A review of empirical work on the management of tourism destinations and smart cities provides us with a list of variables of interest.

Following the indicator systems critically examined in Section 2 (see especially Ivars-Baidal et al., 2021), the set of variables selected in this case study are also linked to the strategic lines considered by SEGITTUR to evaluate the destinations: accessibility², innovation, sustainability and digitalisation.

² The dimension accessibility considered in the evaluation of STD by SEGITTUR refers to the effort made to remove barriers for visitors. However, since the potential of the territories to favour a new tourist model is being analysed here, this dimension has been interpreted in its most classic sense, related to the ease of access to the STDs and their capacity to welcome tourists.

These variables are shown in Table 2.

TABLE 2.
Variables considered in the Regional Smart Destination Enablers Index

Variables	Acronym
Places in hotel establishments	PH
Places in apartments	PA
Places in campsites	PC
Km of road in the territory	KM
Distance between regional capitals	DIS
% of companies that have reduced their energy use or carbon footprint	RUEHC
% of companies that have reduced air, water, soil or noise pollution	RCAASA
% of companies that have facilitated the recycling of products after use	FRPDU
Environmental expenditure of the industry	GAI
Investment in environmental protection of biodiversity and landscapes	IPAI
Investment in air and climate protection by the industry	IPACI
% of Service companies with a privacy policy statement or website security certification	SDPI
% of Service companies that use Social Media	SMS
% of Service companies that analyze Big Data	SBD

The variables *Places in hotel establishments* (PH), *Places in apartments* (PA), *Places in campsites* (PC), reflect the number of places estimated per type of accommodation (hotels, tourist apartments and campsites, respectively) which appear in the Hotel Occupancy Survey published monthly by the National Institute of Statistics (NIS).

The variable *Km of road in the territory* (KM) includes the lengths of toll roads, freeways, dual carriageways and conventional roads. The data collected by the Observatory of Transport and the logistics in Spain come from the Statistical Yearbook of the Ministry of Transport and Sustainable Mobility, 2024. The variable *Distance between regional capitals* (DIS) was calculated using the Graphhopper route engine on the OpenStreetMaps road network.

The variables *Percentage of companies that have reduced their energy use or carbon footprint* (RUEHC), *Percentage of companies that have reduced air, water, soil or noise pollution* (RCAASA) and *Percentage of companies that facilitated the recycling of products after use* (FRPDU) measure the percentage of companies according to the type of innovation with environmental benefits, obtained during consumption or the use of goods or services for the end user published in the NIS Business Innovation Survey.

The variables *Environmental expenditure of the industry* (GAI), *Investment in Environmental protection of biodiversity and landscapes* (IPAI) and *Investment in air and climate protection by the industry* (IPACI) show the environmental expenditure and investment of regional industry, published in the NIS Business Innovation Survey.

The variables related to the digitalisation of companies, *Percentage of service companies with a privacy policy statement or website security certification* (SDPI), *Percentage of Service companies that use Social Media* (SMS) and *percentage of Service companies that analyse Big Data* (SBD) measure the use of technologies and communication (ICT) of companies in the service sector with more than 10 employees published in the Survey on the use of ICT and Electronic Commerce in Enterprises of the National Institute of Statistics.

The selection of variables is also supported by the broader literature on Smart Tourism Destinations, as highlighted in the previous literature review, which identifies accessibility, sustainability, innovation and digitalisation as key dimensions shaping the capacity of territories to foster smart tourism development (Boes et al., 2015; Shafiee et al., 2019; Ivars-Baidal et al., 2021). Accordingly, accessibility is represented through accommodation capacity (PH, PA and PC) and territorial connectivity indicators (KM and DIS), since the ability to host visitors and facilitate access to destinations constitutes a prerequisite for tourism development (Buhalis, 2000; Della Corte et al., 2017). Sustainability is captured through environmental expenditure and environmental protection investments (GAI, IPAI and IPACI), reflecting territorial commitment to environmental preservation and climate action, both recognised as fundamental pillars of smart destinations (Gretzel & Jamal, 2020; Shafiee et al., 2019). Innovation is measured through environmentally beneficial innovations implemented by firms (RUEHC, RCAASA and FRPDU), as the adoption of eco-innovative practices reflects the innovative capacity of regional production systems and their ability to generate new solutions (Romão & Nijkamp, 2019; Williams et al., 2020; Luongo et al., 2023). Finally, digitalisation is represented through indicators related to the use of information and communication technologies by service firms (SDPI, SMS and SBD), including digital security, social media and Big Data analytics, which are widely recognised as enabling factors for the development of smart tourism ecosystems (Tavitiyaman et al., 2021; Soares et al., 2022).

4.2. EMPIRICAL ANALYSIS

Principal Component Analysis is used to construct a synthetic index that summarizes the information from the selected variables and enables a hierarchical ranking of Spanish regions based on their potential as smart tourism destinations.

4.2.1. VARIABLE SELECTION AND DATA TREATMENT

The data refers to 2023 given that it represents the last year for which nearly the full set of variables is available. The variables such as *Environmental expenditure of the industry* (GAI), *Investment in Environmental protection of biodiversity and landscapes* (IPAI) and *Investment in air and climate protection by the industry* (IPACI), the interval of the 2018-2023 excluding 2020 (given that it constituted an atypical year marked by the effects of the pandemic) was considered.

The value of some of the variables considered depends on the measures of regional size (such as GDP or total regional area). In these cases, relative measures were used to establish a realistic inter-regional comparison.

It should be noticed that the composite index requires a harmonised set of regional indicators across the four dimensions. Two accessibility measures, distance between regional capitals (DIS), and territorial road connectivity (KM), presuppose a continuous land network. In archipelagic regions (Balearic and Canary Islands), these metrics are not computable on a conceptually equivalent basis, as inter-regional land distances and within-territory continuity do not exist in the same sense as on the mainland. To avoid structural incomparability that would bias factor loadings and synthetic scores, island regions were excluded from the PCA sample.

4.2.2. PRINCIPAL COMPONENT EXTRACTION

The PCA transforms multiple indicators into a smaller set of “principal components” that capture the most relevant information (Nardo, et al. 202; Domínguez et al., 2011; Karamizadeh et al., 2013). With the application of PCA technology³, four principal components are extracted, each associated with eigenvalues greater than one (meaning their inertia exceeds the average) and together they provide the

³ Previously, to determine the adequacy of the data to the applied methodology, the Kaiser-Meyer-Olkin (KMO) contrasts and the Bartlett sphericity test were performed, obtaining results of 0.709 and 152.98 (p=0.000), respectively. Both provide clear evidence of the adequacy of the data.

highest explanatory power for the analyzed problem, accounting for 73.22% of the variance in the original variables.

4.2.3. ASSESSMENT OF THE FACTOR SOLUTION

In order to verify that the factors obtained correctly represent the variables considered, the so-called communalities were determined. A communality is the proportion of a variable's variance that is explained by the extracted factors or components in the model. These allow us to know how well the initial variables are represented by the principal factors. Table 3 shows that, in general terms, they are correctly represented⁴. The best explained are: percentage of Service companies that use Social Media (SMS), 91.2%, percentage of companies that have facilitated the recycling of products after use (FRPDU), 86.7%, and Environmental expenditure of the industry (GAI), 86.1%.

TABLE 3.
Communalities

Variables	Extraction
SMS	0.912
FRPDU	0.867
SBD	0.862
GAI	0.861
PC	0.855
PH	0.841
DIS	0.802
RUEHC	0.800
SDPI	0.758
RCAASA	0.718
IPAI	0.717
IPACI	0.673
KM	0.664
PA	0.621

Method of extraction: analysis of principal components

Source: authors' own elaboration.

4.2.4. INTERPRETATION OF THE DIMENSIONS

Once the adequacy of the factor solution was verified, the rotated component matrix was examined to identify the variables associated with each component and facilitate their interpretation.

As can be seen in Table 4, the definition of factors is consistent with the dimensions established: sustainability (C1), innovation (C2), accessibility (C3) and digitalisation (C4), and the rotated factors are shown.

⁴ In general terms, the initial variables are considered to be adequately represented by the principal factors if their communality exceeds 70 or 75%.

TABLE 4.
Matrix of rotated components

Variables	C1	C2	C3	C4
GAI	0.888	0.087	0.047	0.029
IPACI	0.657	0.283	0.579	-0.139
IPAI	0.623	0.168	-0.040	0.005
FRPDU	-0.145	0.915	-0.013	0.064
RCAASA	-0.517	0.691	0.689	-0.131
RUECH	-0.580	0.581	0.262	-0.065
DIS	0.086	-0.073	0.854	0.243
PH	0.381	0.236	0.768	0.754
KM	-0.006	-0.128	0.732	-0.106
PC	0.646	-0.146	0.670	0.586
PA	0.109	-0.116	0.611	0.533
SBD	-0.359	0.260	0.034	0.689
SMS	-0.316	0.541	0.016	0.684
SDPI	0.150	0.291	0.216	0.647
% of explained variance	27.57%	22.43%	14.19%	9.03%

Extraction method: analysis of major components.

Rotation method: Varimax⁵ with Kaiser normalisation Kaiser.^a

Source: authors' own elaboration.

The first component (C1) is made up of the following variables: environmental expenditure by the industry (GAI), investment in environmental protection of biodiversity and landscape (IPAI) and investment in air climate and climate protection by the industry (IPACI). This first component we associate with the dimension of sustainability, and its level of explanation is 27.57%. For each variable, the average of the years 2018-2023 (excluding 2020 due the pandemic) is taken into account (in €) and relativised by the size of the industry in the region (GDP of the industry published in the Spanish Regional Accounts (Contabilidad Regional de España, 2019) by the National Institute of Statistics (2023).

The second component (C2) entails the following variables: percentage of companies that have reduced their energy use or carbon footprint (RUEHC), percentage of companies that have reduced air, water, soil or noise pollution (RCAASA) and percentage of companies that facilitated the recycling of products after use (FRPDU). This second component is associated with innovation, and explains 22.43% of the behaviour of the initial variables. Here the data considered were published in the Business Innovation Survey of the NIS (Encuesta sobre Innovación en las Empresas 2020-2022).

The component (C3) is related to the variables: places in hotel establishments (PH), places in apartments (PA), places in campsites (PC), Km of road in the territory (KM) and distance between regional capitals (DIS). We associate this first component with accessibility. This is a component which explains the dimension in terms of both accommodation and infrastructure. Its explanatory capacity is high, since alone it manages to explain 14.195% of the object analysed. Since the variables kilometres of road that each community has and distances of each region relative to the rest of the territory depend on the size of the region, they have been relativised in relation to the area of the region. The variables relating to places in different establishments show the average of 2023 and are relativised according to the total population of each region (National Institute of Statistics).

⁵This matrix presents the rotated factor loadings, meaning the strength of the relationship between each original variable and each extracted component after the components have been reorganized to improve interpretability. Varimax rotation is a method used in PCA to make the factors or components easier to interpret. It reorganizes the components so that each variable has a high loading on one factor and low loadings on the others, making it clearer what each component represents.

Finally, the fourth component (C4) constitutes the following variables: percentage of Service companies with a privacy policy statement or website security certification (SDPI), percentage of Service companies that use Social Media (SMS) and percentage of Service companies that analyse Big Data (SBD). This fourth component is associated with digitalisation, and its explicative capacity is 9.03%. The data considered is related to the year 2022 as SDPI and SBD have been removed from the questionnaire in the latest editions of the Survey on the use of ICT and Electronic Commerce in Enterprises of the National Institute of Statistics.

By way of synthesis, Figure 1 shows the variables classified in their corresponding dimension according to the results obtained.

FIGURE 1.
Dimensions and variables considered in the Regional Smart Destination Enablers Index

<p>Sustainability (dimension 1)</p> <ul style="list-style-type: none"> • Environmental expenditure of industry (GAI) • Investment in environmental protection of biodiversity and landscapes (IPAI) • Investment in air climate protection by the industry (IPACI) 	<p>Innovation (dimension 2)</p> <ul style="list-style-type: none"> • % of companies that have reduced their energy use or carbon footprint (RUEHC) • % of companies that have reduced air, water, soil or noise pollution (RCAASA) • % of companies that have facilitated the recycling of products after use (FRPDU)
<p>Accessibility (dimension 3)</p> <ul style="list-style-type: none"> • Places in hotel establishments (PH) • Places in apartments (PA) • Places in campsites (PC) • Km of road in the territory (KM) • Distance between regional capitals (DIS) 	<p>Digitalization (dimension 4)</p> <ul style="list-style-type: none"> • % of service companies with a privacy policy statement or website security certification (SDPI) • % of service companies that use Social Media (SMS) • % of service companies that analyze Big Data (SBD)

4.2.5. CONSTRUCTION OF THE REGIONAL SMART DESTINATION ENABLERS INDEX

The next step in developing the synthetic indicator is to determine the so-called factor score matrix, from which the position of each region (NUTS 2) can be ascertained and compared with the rest, since it allows an index value to be assigned to each. The factor scores matrix shows the value obtained by each unit of analysis (such as a region) for each extracted factor or component. The factorial scores for each variable of the synthetic indicator are given in Table 5.

The factor scores were weighted according to the explanatory capacity of each dimension, obtaining equation (1), which provides the value of the synthetic index in each autonomous community.

$$IS_j = 0.0960PH_j - 0.0247PA_j - 0.0158KM_j - 0.0289DIS_j + 0.1750PC_j - 0.1417RUEHC_j + 0.1492RCAASA_j + 0.06245FRPDU_j + 0.3296GAI_j - 0.2031IPAI_j + 0.2631IPACI_j + 0.1380SDPI_j - 0.1022SMS_j - 0.1560SBD_j \quad (1)$$

TABLE 5.
Factor score matrix

Variables	C1	C2	C3	C4
PH	0.096	0.019	0.073	0.303
PA	-0.025	-0.143	0.070	0.269
PC	0.175	-0.028	-0.131	0.255
KM	0.016	0.078	-0.337	-0.031
DIS	-0.029	-0.215	0.429	0.120
SDPI	0.138	0.376	-0.041	-0.054
SMS	-0.102	0.143	-0.080	0.286
SBD	-0.156	-0.015	-0.019	0.332
RUEHC	-0.142	0.190	0.046	-0.065
RCAASA	-0.149	0.033	0.287	-0.079
FRPDU	0.062	0.455	-0.165	-0.087
GAI	0.330	0.149	-0.024	-0.074
IPAI	-0.203	0.013	-0.028	0.032
IPACI	0.267	0.151	0.212	-0.166

Method of extraction: Principal Component Analysis.

Method of rotation: Varimax with Kaiser normalisation.

Source: authors' own elaboration

4.3. RESULTS

The Regional Smart Destination Enablers Index gives a single value for each region, which can be interpreted as a measure of the potential of each territory to develop STDs. The higher the value of the index, the better positioned the region will be to facilitate the development of local STDs in its territory. As can be seen, the regions whose index is above average are Andalusia, Galicia, Asturias, Murcia, Catalonia and Cantabria.

Similarly, and with a view to analysing the relationship between the value of the index and the number of destinations included in the STD network existing in each region, this information has been incorporated into Table 6. Given the very diverse size of the Spanish regions, the number of STDs has been relativised by reference to the number of provinces (NUTS 3) in each region.

TABLE 6.
Value of the synthetic indicator for the peninsular Spanish regions

Spanish regions	RSDEI ⁶	STDs (relative number)
Andalusia	2.098	10.63
Galicia	2.081	4
Asturias	2.032	24
Murcia	1.491	21
Catalonia	1.422	6
Cantabria	1.401	7
Castile and Leon	1.310	4.33
Valencia	1.228	9

⁶ The Balearic and Canary Islands have been removed from the analysis, as lack of data for some of the variables distorted results.

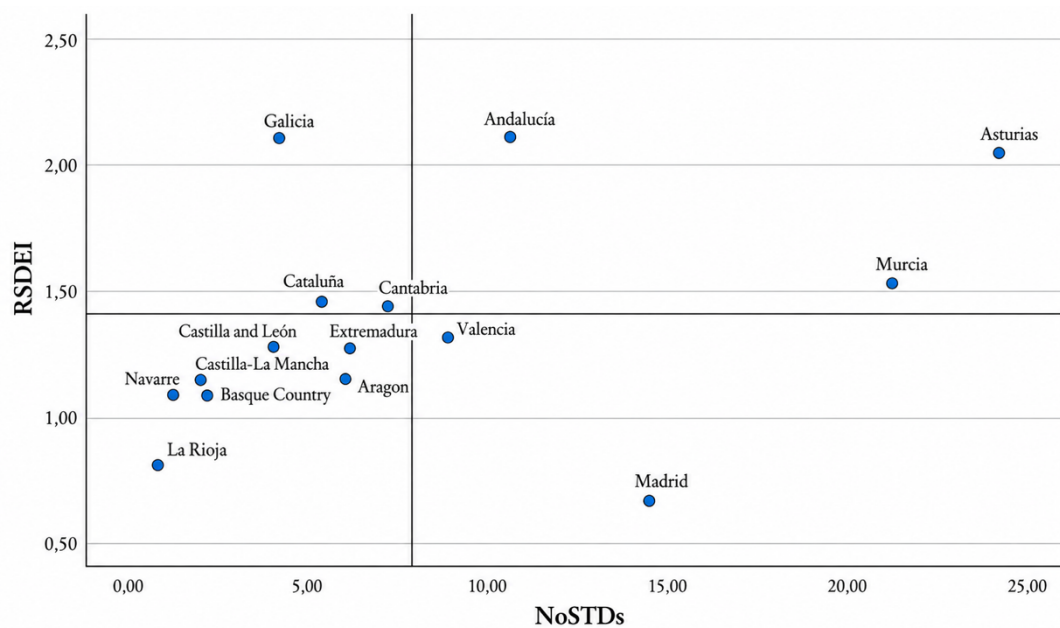
TABLE 6. CONT.
Value of the synthetic indicator for the peninsular Spanish regions

Spanish regions	RSDEI ⁷	STDs (relative number)
Extremadura	1.205	6.5
Navarre	1.135	2
Aragon	1.105	6
Castile-la Mancha	1.086	2.2
Basque Country	1.067	3
La Rioja	0.797	1
Madrid	0.632	14

Source: authors' own elaboration.

Figure 4 shows the synthetic indicator values in relation to the number of destinations belonging to the STD network included in each region.

FIGURE 2.
Regional Smart Destinations Enablers Index vs number of STDs per region



Source: authors' own elaboration.

Regions in the first quadrant (Andalusia, Asturias and Murcia) combine high synthetic indicator values with an above-average number of STDs. Their strong performance across the assessed dimensions and their existing initiatives give them a favourable starting point to transition towards a more advanced tourism model. The most influential variables are *industry investment in air* and *climate protection, environmental expenditure* (sustainability), the *share of service firms using social media* (digitalisation), and the *proportion of companies reducing pollution or facilitating product recycling* (innovation).

⁷ The Balearic and Canary Islands have been removed from the analysis, as lack of data for some of the variables distorted results.

Regions in the second quadrant (Catalonia, Galicia and Cantabria) show high capacity according to the synthetic indicator but have accredited fewer destinations. They therefore retain significant potential for further STD development.

The third quadrant comprises regions with low indicator values and a limited number of STDs (Extremadura, Navarre, La Rioja, Castile and León, Castile-La Mancha, the Basque Country and Aragon). In particular, especially low values are observed in *investment in environmental protection of biodiversity and landscape* (sustainability dimension) and in the *percentage of service companies with a privacy policy statement or website security certification* (digitalisation dimension). These regions will require an initial boost to strengthen their performance and expand their number of destinations.

Finally, Madrid and Valencia, despite having many STDs, display lower synthetic indicator values, suggesting that their potential is not fully captured by the selected variables.

5. DISCUSSION

One of the main academic contributions of this article lies in its focus on the regional context, whereas most existing studies remain confined to the local scale (Gretzel, 2018; Otowicz et al., 2022). As the success of an STD depends on its ability to provide an optimal environment tailored to tourists' needs (Shin et al., 2023; Wang et al., 2020), governance becomes a critical determinant. As noted by Shafiee et al. (2019, p. 298), "Policymakers are advised to pay attention to all economic, social, environmental, and technological strategies and substructures for the effective fulfillment of smart tourism destination strategies".

To the best of the authors' knowledge, the impact of the regional context on local STD development has not yet been examined. This study contributes to the literature by specifically analysing the regional scale and its influence on the capacity of local tourist destinations to evolve into STDs. In line with Cerdá-Mansilla et al. (2024), the aim is to support regional policymakers in identifying the strategic measures required to lay the foundations that enable STD implementation within their territories. A key advantage of this regional perspective is that it incorporates additional factors of relevance, particularly those related to transport and interregional mobility (Della Corte et al., 2017; Bulchand-Gidumal, 2022).

This study shows that, although the initiative to transform into an STD is taken at the local level, each locality's starting point is shaped by the characteristics of the region in which it is embedded. As noted by Ivars-Baidal et al. (2019), progress in sustainability and in improving residents' quality of life is directly linked to regional policies that extend beyond the tourism sector. In other words, marketing campaigns designed to highlight the appeal of a smart destination represent the final layer of a much more ambitious regional tourism strategy, in which innovation at all levels must serve as the guiding principle.

The second major academic contribution of this study concerns the introduction of the RSDEI, which jointly and appropriately weights the dimensions underpinning an STD, following the Spanish SEGITTUR model. The RSDEI provides several improvements over previous approaches. First, it avoids partial assessments (Ivars-Baidal, 2021; Liu et al., 2024). It is grounded in an indicator system aligned with the dimensions that capture territorial "smartness," thereby addressing the thematic imbalances highlighted by Sharifi (2019), who criticises the excessive emphasis on technological indicators at the expense of other key dimensions of territorial intelligence. Second, the index summarises each region's potential to foster the development of local STDs into a single value.

The RSDEI responds to the need to develop composite indices capable of capturing the multidimensional nature of smart destinations (Karal and Soyer, 2024). It uses PCA to derive non-arbitrary weights and improve comparability across territories, overcoming previous methodological limitations (Sharifi, 2019; Toh, 2022). Additionally, it explicitly incorporates the regional level as the unit of analysis, in line with recent multilevel approaches (Ivars Baidal et al., 2021; Artal Tur & Badillo Amador, 2024), and integrates key factors still underexplored in the literature, synthesizing territorial potential for the development of smart tourism destinations.

As defined, the index facilitates the identification of those regional strategies that most effectively contribute to the modernisation of the sector by revealing the variables that are most influential in each case. In this way, by using a tool that can be easily adapted to the reality of different national contexts (the RSDEI), regional managers can guide their strategies with far greater precision. That is, regional governance will more effectively support the local transformation of traditional tourist destinations into smart tourism destinations.

The empirical contributions of this study lies in confirm that the regional context is relevant to the development of STDs at local level. In this line, Johnson et al. (2023), after recognising the need to stimulate innovation in the tourism sector, confirm that the context in which an STD is developed is decisive. In this regard, Ivars-Baidal et al. (2019) note that a lack of strategy, limited public-private cooperation, or insufficient economic resources can hinder the development of a smart tourism destination. However, contextual influences may also be positive, which reinforces the relevance of the environment in which an STD is promoted. The results obtained here confirm the importance of regional policy. In Andalusia, Asturias and Murcia, the three regions in the first quadrant of Figure 2, ecosystems were created and intersectoral collaboration was encouraged. In the former case, this occurred through the Andalucía Smart 2020 initiative (Government of Andalucía, 2020), which aimed to achieve a sustainable “Smart Region” by integrating information and communication technologies across various sectors, including tourism; in the second, through the Smart City Cluster Asturias Programme (Government of the Principado of Asturias, 2022); and in the last one, through the 2020 signing of the Collaboration Agreement between the Tourism Institute of the Region of Murcia (ITREM) and SEGITTUR (ITREM, 2026).

The proposed methodology enables the comparison of different regional trajectories in terms of how effectively they support the transformation of traditional local tourist destinations into local STDs. As defined, it not only identifies the territories that offer the most favourable conditions for this transition but also detects the specific dimensions/variables responsible for each region's position. In the Spanish case study presented here, the key dimension is sustainability.

The RSDEI was developed for the Spanish case study and therefore draws on the four pillars of the SEGITTUR STD model. However, the items (and variables) used to construct the index can be selected according to the particularities of each context, as the development of STDs continues to evolve (Johnson et al., 2023).

One of the main practical contributions derived from the application of the index is that it allows for the assessment of the relative importance of the different dimensions considered and provides policymakers with useful information to foster more effective development of STDs. In this regard, as previously noted, the sustainability dimension has the highest weighting in the definition of the index (27.57%), followed by innovation (22.43%), accessibility (14.19%), and digitalisation (9.03%).

Another important practical contribution is the recognition of the relevance of the sustainability dimension. While sustainability is not usually a priority in tourism planning (Gretzel & Jamal, 2020), the results of this study place at the top of the Spanish regions with the greatest potential for local STD development the one that is making a significant investment effort in this area. This is a relevant finding, as it reinforces the arguments of scholars who stress the growing need to prioritise the sustainable management of tourist destinations (Shafiee et al., 2019).

6. CONCLUDING REMARKS

In this work, a synthetic indicator based on Principal Component Analysis was developed to assess the capacity of Spanish regions to support the emergence of local Smart Tourism Destinations. The application of this Regional Smart Destination Enablers Index reveals that Andalusia, Galicia, Asturias, Murcia, Catalonia and Cantabria score above the national average, indicating favourable regional conditions for facilitating smart tourism development. In addition, the graphical analysis comparing RSDEI values with the number of accredited STDs per region shows clear territorial patterns. These conclusions are derived from the application of the SEGITTUR model framework and from the use of

the variables available. It is important to bear in mind that a different methodological approach, or the inclusion of additional variables, could lead to different results. Therefore, the findings should be interpreted as an approximation to the regional conditions that favour the development of Smart Tourism Destinations rather than as a definitive or exhaustive measurement of this phenomenon.

The main limitation of this study concerns data availability. Although the literature identifies a wide range of indicators that are relevant for assessing Smart Tourism Destinations, many of these variables are not available in a homogeneous and comparable manner at the regional scale and therefore could not be incorporated into the analysis. This limitation could explain the modest RSDEI values observed in regions such as Madrid and Valencia, despite both regions having a notable number of destinations included in the STD Network. Future research could benefit from the progressive expansion of destination-level databases and monitoring systems, allowing for the incorporation of new variables.

Another limitation of the study relates to the exclusion of island regions. The accessibility dimension includes indicators based on road connectivity and territorial continuity, which are not directly comparable between mainland and archipelagic territories. For this reason, the Balearic and Canary Islands were not included in the analysis, as their incorporation would have required a different methodological treatment. Future research could address this issue by complementing the accessibility dimension with indicators of air and maritime connectivity, thereby allowing the inclusion of island regions under a comparable analytical framework.

ACKNOWLEDGEMENTS

This research was supported by the Chair SEKUENS for the Analysis of the Innovation effect on the Territorial Development - University of Oviedo.

REFERENCES

- Artal-Tur, A., & Badillo-Amador, L. (2024). Systems of tourism sustainability indicators: A comparative analysis of the international, European, and Spanish proposals. *Smart Tourism*, 5(2), 2800.
- Bellini, N., Grillo, F., Lazzeri, G., & Pasquinelli, C. (2017). Tourism and regional economic resilience from a policy perspective: lessons from smart specialization strategies in Europe. *European Planning Studies*, 25(1), 140-153.
- Blancas, F. J., & Lozano-Oyola, M. (2022). Sustainable tourism evaluation using a composite indicator with different compensatory levels. *Environmental Impact Assessment Review*, 93, 106733.
- Boes, K., Buhalis, D., and Inversini, A. (2015). Conceptualising smart tourism destination dimensions. In Tussyadiah, I. and Inversini, A. (eds.). *Information and communication technologies in tourism*. Springer, 391-403.
- Brida, J. G., Cárdenas-García, P., Mejía-Alzate, M. L., & Segarra, V. (2025). An empirical examination of the dynamics of tourism, growth, and economic development at a regional level. The Colombian departments. *Investigaciones Regionales - Journal of Regional Research*, 64, 175-195.
- Buhalis, D. (2000). Marketing the competitive destination of the future. *Tourism management*, 21(1), 97-116.
- Bulchand-Gidumal, J. (2022). Post-COVID-19 recovery of island tourism using a smart tourism destination framework. *Journal of Destination Marketing & Management*, 23, 100689.
- Cerdá-Mansilla, E., Tussyadiah, I., Campo, S., & Rubio, N. (2024). Smart destinations: A holistic view from researchers and managers to tourists and locals. *Tourism Management Perspectives*, 51, 101223.
- Chung, N., Lee, H., Ham, J., & Koo, C. (2021). Smart tourism cities' competitiveness index: a conceptual model. In *Information and Communication Technologies in Tourism 2021: Proceedings of the ENTER 2021 eTourism Conference, January 19-22, 2021* (pp. 433-438). Springer International Publishing.

- Cohen, B. (2014). The smartest cities in the world 2015: Methodology. *Fast Company*, 11(20).
- Cooke, P. (2008). Regional Innovation Systems: origin of the species. *International Journal of Technological Learning, Innovation and Development*, 1(3), 393-409.
- Della Corte, V., D'Andrea, C., Savastano, I., & Zamparelli, P. (2017). Smart cities and destination management: Impacts and opportunities for tourism competitiveness. *European Journal of Tourism Research*, 17, 7-27.
- Domínguez Serrano, M., Blancas Peral, F. J., Guerrero Casas, F. M., & González Lozano, M. (2011). Una revisión crítica para la construcción de indicadores sintéticos. *Revista de Métodos Cuantitativos para la Economía y la Empresa*, 11, 41-70.
- Escobar, S. D., & Hall, C. M. (2025). Integrating Smart Cities and Tourism Systems: A Critical Review. *International Journal of Public Sector Management*, 38(2), 196-212.
- Esposito, G., Clement, J., Mora, L., & Crutzen, N. (2021). One size does not fit all: Framing smart city policy narratives within regional socio-economic contexts in Brussels and Wallonia. *Cities*, 118, 103329.
- Femenia-Serra, F., & Neuhofer, B. (2018). Smart tourism experiences: Conceptualisation, key dimensions and research agenda. *Investigaciones Regionales-Journal of Regional Research*, (42), 129-150.
- Foronda-Robles, C., Galindo-Pérez-de-Azpillaga, L., & Fernández-Tabales, A. (2023). Progress and stakes in sustainable tourism: indicators for smart coastal destinations. *Journal of Sustainable Tourism*, 31(7), 1518-1537.
- Gómez-Bruna, D. y Thiel-Ellul, D. (2024). Gobernanza en destinos turísticos: el caso de los destinos turísticos inteligentes (DTIs) en España. *Investigaciones Turísticas* (27), 203-223.
- Gorelova, I., Bellini, F., & D'Ascenzo, F. (2024). Understanding smart territories: A conceptual framework. *Cities*, 152, 105146.
- Government of Andalucía (2020). Plan de Acción Andalucía Smart 2020, de impulso al Desarrollo Inteligente de las Ciudades y Municipios de Andalucía. <https://www.juntadeandalucia.es/export/drupaljda/2016-08-30%20PAAS2020.pdf>
- Government of Principality of Asturias (2022). Instituto de Desarrollo Económico del Gobierno del Principado de Asturias IDE/2022/000825 Project title: Creation in Asturias of a new cluster called "Smart City Asturias". www.innovasturias.org/cluster-smart-city
- Gretzel, U. (2018). From smart destinations to smart tourism regions. *Investigaciones Regionales-Journal of Regional Research*, (42), 171-184.
- Gretzel, U., & Jamal, T. (2020). Guiding principles for good governance of the smart destination. En C. M. Paris & S. Benjamin (Eds.), Proceedings of the 2020 TTRA International Conference. Travel and Tourism Research Association. https://scholarworks.umass.edu/ttra/2020/research_papers/42/
- IMD World Competitiveness Center (2024). IMD Smart City Index 2024. Available at: [20240412-SmartCityIndex-2024-Full-Report_4.pdf](https://www.imd.org/SmartCityIndex-2024-Full-Report_4.pdf) (imd.org).
- ITREM (2026): https://www.itrem.es/itrem/destino_turistico_inteligente. Accessed April 2026.
- Ivars-Baidal, J. A., Celdrán-Bernabeu, M. A., Mazón J. N., & Perles Ivars, A. (2019). Smart destinations and the evolution of ICTs: a new scenario for destination management? *Current Issues in Tourism*, 22(13), 1581-1600.
- Ivars-Baidal, J. A., Celdrán-Bernabeu, M. A., Femenia-Serra, F., Perles-Ribes, J. F., & Giner-Sánchez, D. (2021). Measuring the progress of smart destinations: The use of indicators as a management tool. *Journal of Destination Marketing and Management*, 19, 100531.

- Ivars-Baidal, J. A., Vera-Rebollo, J. F., Perles-Ribes, J., Femenia-Serra, F., & Celdrán-Bernabeu, M. A. (2023). Sustainable tourism indicators: what's new within the smart city/destination approach? *Journal of Sustainable Tourism*, 31(7), 1556-1582.
- Jiao, X., Chen, J. L., Li, G., & Liu, T. (2025). From tourism demand to destination competitiveness: A spatial spillover perspective. *Tourism Management*, 111, 105236.
- Johnson, A. G., Rickly, J. M., & McCabe, S. (2023). Suppliers' perceptions on engaging in smart destinations: Evidence from Ljubljana. *Tourism Management Perspectives*, 47, 101125.
- Karal, F. S., & Soyer, A. (2024). A systematic literature review: Setting a basis for smart and sustainable city performance measurement. *Sustainable Development*, 32(1), 555-573.
- Karamizadeh, S., Abdullah, S. M., Manaf, A. A., Zamani, M., & Hooman, A. (2013). An overview of principal component analysis. *Journal of signal and information processing*, 4(3B), 173.
- Lai, C. M. T., & Cole, A. (2023). Measuring progress of smart cities: Indexing the smart city indices. *Urban Governance*, 3(1), 45-57.
- Liu, J., Hall, C. M., Zhu, C., & Ting Pong Cheng, V. (2024). Redefining the concept of smart tourism in tourism and hospitality. *Anatolia*, 35(3), 566-578.
- Luongo, S., Sepe, F., & Del Gaudio, G. (2023). Regional innovation systems in tourism: The role of collaboration and competition. *Journal of Open Innovation: Technology, Market, and Complexity*, 9(4), 100148.
- Ministry of Transport and Sustainable Mobility (2024). *Anuario estadístico*.
- Nardo, M., Saisana, M., Saltelli, A., & Tarantola, S. (2021). *Tools for composite indicators building*. EUR 21682 EN. JRC31473.
- National Institute of Statistics (2019). Contabilidad Regional de España.
- National Institute of Statistics (several months). Encuesta de Ocupación Hotelera.
- National Institute of Statistics (several years). Encuesta sobre Innovación en las Empresas.
- National Institute of Statistics (several years). Uso de TIC y comercio electrónico en las empresas.
- Otowicz, M. H., Macedo, M., & Biz, A. A. (2022). Dimensions of smart tourism and its levels: an integrative literature review. *Journal of Smart Tourism*, 2(1), 5-19.
- Romão, J., & Nijkamp, P. (2019). Impacts of innovation, productivity and specialization on tourism competitiveness—a spatial econometric analysis on European regions. *Current Issues in Tourism*, 22(10), 1150-1169.
- SEGITTUR (2024). *The Spanish Model for Smart Tourism Destination Management. A Methodological Approach*. Springer.
- SEGITTUR (2026). <https://www.segittur.es/destinos-turisticos-inteligentes/>. Last access 22-07-2026.
- Shafiee, S., Rajabzadeh Ghatarib, A., Hasanzadeha, A., & Jahanyanc, S. (2019). Developing a model for sustainable smart tourism destinations: A systematic review. *Tourism Management Perspectives*, 31, 287-300.
- Sharifi, A. (2019). A critical review of selected smart city assessment tools and indicator sets. *Journal of cleaner production*, 233, 1269-1283.
- Shin, H. H., Kim, J., & Jeong, M. (2023). Memorable tourism experience at smart tourism destinations: Do travelers' residential tourism clusters matter? *Tourism Management Perspectives*, 46, 101103.
- Soares, J. C., Domareski Ruiz, T. C., & Ivars-Baidal, J. A. (2022). Smart destinations: a new planning and management approach?. *Current Issues in Tourism*, 25(17), 2717-2732.

- Tavitiyaman, P., Qu, H., Tsang, W. S. L., & Lam, C. W. R. (2021). The influence of smart tourism applications on perceived destination image and behavioral intention: The moderating role of information search behavior. *Journal of Hospitality and Tourism Management*, 46, 476-487.
- Toh, C. K. (2022). Smart city indexes, criteria, indicators and rankings: An in-depth investigation and analysis. *IET Smart Cities*, 4(3), 211-228.
- Wang, J., Xie, C., Huang, Q., & Morrison, A. M. (2020). Smart tourism destination experiences: The mediating impact of arousal levels. *Tourism Management Perspectives*, 35, 100707.
- Williams, A. M., Rodriguez, I., & Makkonen, T. (2020). Innovation and smart destinations: Critical insights. *Annals of Tourism Research*, 83, 102930.
- Wray, M. (2015). Drivers of change in regional tourism governance: A case analysis of the influence of the New South Wales Government, Australia, 2007-2013. *Journal of Sustainable Tourism*, 23(7), 990-1010.

ORCID

<i>Carmen Ramos-Carvajal</i>	https://orcid.org/0000-0002-5273-866X
<i>Lorena García-Alonso</i>	https://orcid.org/0000-0001-8318-2492
<i>Blanca Moreno-Cuartas</i>	https://orcid.org/0000-0002-1530-4977

