PASOS Revista de Turismo y Patrimonio Cultural. ISSN 1695-7121
Vol. 24 N.º 4. octubre-diciembre 2026 | Ahead of print: 202624070 | https://doi.org/10.25145/j.pasos.2026.24.070

This article is published ahead of print. It has undergone peer review and has been accepted for a forthcoming issue. This version is citable, although the final version may include non-substantive formal revisions.

El artículo se publica como ahead of print. Ha superado la revisión por pares y ha sido aceptado para un número futuro. Esta versión es citable, aunque la versión final podrá incorporar ajustes formales no sustantivos.

Testing causal relationships of smart tourism destinations determinants: an application to an emerging tourism region, Extremadura (Spain)

Juan Carlos Díez-Apolo[1]; Marcelino Sanchez-Rivero[2]; Maria Cristina Rodríguez-Rangél[3]

[1] Universidad de Extremadura. diezapolo@unex.es. ORCID: 0009-0000-4120-0218

[2] Universidad de Extremadura. sanriver@unex.es. ORCID: 0000-0003-3988-6278

[3] Universidad de Extremadura. mcrisrod@unex.es. ORCID: 0000-0002-3526-5039

Cite: Díez-Apolo, J. C.; Sanchez-Rivero, M. & Rodríguez-Rangél, M. C. (2026). Testing causal relationships of smart tourism destinations determinants: an application to an emerging tourism region, Extremadura (Spain). *PASOS. Revista de Turismo y Patrimonio Cultural*, 24(4), 202624070. https://doi.org/10.25145/j.pasos.2026.24.070

Recibido: 26/10/2025 · Reenviado: 06/04/2026 · Aceptado: 09/04/2026 · Sometido a evaluación por pares anónimos

Abstract: This study empirically analyses the relationships among the five dimensions of the Smart Tourism Destination (STD) model—Governance, Innovation, Technology, Sustainability, and Accessibility—using Partial Least Squares Structural Equation Modelling (PLS-SEM). The research examines 28 micro-destinations in Extremadura (Spain), a region with relatively low tourism competitiveness, based on indicators derived from the UNE 178502 standard. Results indicate that governance is the only dimension with a positive and statistically significant effect on sustainability, while the remaining hypothesised relationships are not supported. These findings suggest that the impacts of technology and innovation on other STD dimensions are not automatic and may depend on the destination's level of development and maturity. The study contributes empirical evidence to a field largely dominated by theoretical approaches and highlights governance as a key driver of sustainable tourism development, particularly in emerging destinations. However, the results should be interpreted cautiously due to data limitations and the specific characteristics of the study area.

Keywords: Smart tourism destinations, indicators, measurement model, structural equations.

Análisis de las relaciones causales entre los determinantes de los destinos turísticos inteligentes: una aplicación a una región turística emergente, Extremadura (España)

Resumen: Este estudio analiza empíricamente las relaciones entre las cinco dimensiones del modelo de Destino Turístico Inteligente (STD) —Gobernanza, Innovación, Tecnología, Sostenibilidad y Accesibilidad— mediante el modelo de ecuaciones estructurales con mínimos cuadrados parciales (PLS-SEM). La investigación examina 28 microdestinos de Extremadura (España), una región con una competitividad turística relativamente baja, basándose en indicadores derivados de la norma UNE 178502. Los resultados indican que la gobernanza es la única dimensión con un efecto positivo y estadísticamente significativo sobre la sostenibilidad, mientras que las restantes relaciones hipotéticas no se ven respaldadas. Estos hallazgos sugieren que los impactos de la tecnología y la innovación en otras dimensiones del desarrollo turístico sostenible no son automáticos y pueden depender del nivel de desarrollo y madurez del destino. El estudio aporta evidencia empírica a un campo dominado en gran medida por enfoques teóricos y destaca la gobernanza como un motor clave del desarrollo del turismo sostenible, particularmente en destinos emergentes. Sin embargo, los resultados deben interpretarse con cautela debido a las limitaciones de los datos y a las características específicas del área de estudio.

Palabras Clave: Destinos turísticos inteligentes, indicadores, modelo de medida, ecuaciones estructurales.

---

1. INTRODUCTION

The concept of Smart Tourism Destination (STD) emerged in response to the need for tourism destinations to evolve and adapt to the changing demands of visitors, who increasingly prioritize personalized experiences tailored to their preferences.

The idea of smart tourism destinations began to consolidate in the early 21st century, with the introduction of concepts such as "smart cities" across various economic sectors, including tourism. This concept has been particularly useful in distinguishing destinations that integrate technological advancement and sustainable development into their management.

At a global level, the concept of smart tourism destinations gained relevance when international organizations such as the World Tourism Organization (UNWTO) and the European Union emphasized the importance of promoting strategies to help tourism destinations adapt to new technologies.

Among the countries that have most successfully implemented smart city initiatives, Spain stands out (Palomo & Parra, 2024). As a pioneer in tourism development since the mid-20th century, Spain has been able to develop the Smart Tourism Destination model and adapt it both to its main tourism destinations and to the evolving demands of visitors.

In this context, with the aim of implementing a national strategy to modernize and enhance the competitiveness of the Spanish tourism sector, the Smart Tourism Destination (STD) model was launched in 2012. This model is promoted by the Spanish Secretariat of State for Tourism and, specifically, by the State Company for the Management of Tourism Innovation and Technologies (SEGITTUR). According to SEGITTUR, an STD is defined as an innovative tourism destination, built on cutting-edge technological infrastructure, ensuring the sustainable development of the tourism territory, accessible to all, facilitating the interaction and integration of visitors with their environment, enhancing the quality of their experience, and improving the quality of life of residents (2012).

Within this framework, Extremadura represents a relevant case study. Located in southwestern Spain, this region, despite having 17 micro-destinations integrated into the STD network, shows low levels of tourism competitiveness at the national level.

To carry out the proposed analysis, a literature review was conducted to identify potential relationships between the different pillars of the STD model (Giffinger et al., 2007; Lamas et al., 2019; Joppe, 2018; Freund et al., 2022). The existing literature largely associates these pillars through purely theoretical approaches, without empirically testing whether statistically significant causal relationships exist among them in real-world destinations.

In this context, it becomes particularly relevant not only to identify these potential connections between the different pillars of the model, but also to analyze whether strategic investments in certain dimensions can generate measurable improvements in other components of the tourism system, thereby contributing to more efficient and evidence-based planning.

To address this gap in the literature, this study focuses on analyzing the interrelationships between the different pillars of the STD model in the specific context of Extremadura. This approach allows for the empirical testing of existing theoretical propositions, while also generating useful evidence for tourism management by identifying those factors with the greatest capacity to influence others and supporting a more efficient allocation of resources in tourism destinations.

Within this framework, the main objective of this study is to empirically analyze the causal relationships between the five pillars of the Smart Tourism Destination model (governance, innovation, technology, sustainability, and accessibility) through the estimation of a structural equation model applied to micro-destinations in the Autonomous Community of Extremadura. This analysis makes it possible to identify which dimensions act as driving factors for others and to assess their impact on the configuration of smart tourism destinations in regions with lower levels of tourism development.

To achieve these objectives, the paper is structured as follows. After this introductory section, which presents the research problem and establishes the objectives of the study, a comprehensive literature review is conducted in order to formulate the research hypotheses. Subsequently, the hypotheses to be tested are presented, followed by a case study providing a general context of Extremadura, the data used in the analysis, and the methodology applied. Finally, the results and the main conclusions of the study are presented.

2. DETERMINANTS OF TOURIST DESTINATION INTELLIGENCE

The STD model is presented as a new management approach, developed by Segittur and promoted by the Ministry of Industry, Energy and Tourism of the Spanish Government, aims to continuously improve the competitiveness of destinations in their process of becoming smart destinations. Through this model, it is possible to classify and differentiate between those tourist destinations which have the qualification of "smart"; and, therefore, comply with the parameters provided by Segittur for each of the five dimensions on which the model is based (Governance, Accessibility, Innovation, Technology and Sustainability), and remaining tourist destinations. In this section it can be seen the contribution of each of the aforementioned dimensions to tourism intelligence.

The term governance refers to decision-making and management processes that involve multiple stakeholders, both public and private, with the aim of optimising the administration of tourism resources and improving the management of conflicts of interest that arise in the tourism field (Llorca, 2017). This axis is fundamental to ensure effective collaboration and participation of all stakeholders in the tourism sector (Giner, 2017; Joppe, 2018).

Specifically, Segittur and Andrades (2024) explain that governance, by articulating technology and strategic planning, becomes an essential factor for tourism intelligence. For their part, authors such as Errichiello and Micera (2021) explain that the increased use of new information and communication technologies enriches the intelligence and competitiveness of the destination, but this can be frustrated by the lack of adequate governance structures. In this regard, Detotto et al. (2021) explain that higher quality governance and the ability of government to implement policies effectively has a significant and positive impact on tourism. Similarly, Gretzel et al. (2015) raise the major problem faced by the tourism destination that is not properly organised in terms of governance and data processing, they see the need for efficient governance that helps the correct use of available data to achieve proper data processing.

In terms of innovation, different authors define it as the process by which a place develops and applies new ideas, services or management models that help to improve the visitor experience, while optimising the use of resources and strengthening the competitiveness of the destination, (Trunfio and Campana, 2019; Gardiner and Scott, 2018).

Marakova and Medvedova (2016) explain innovation as the prerequisite for a destination to successfully implement tourism by offering novel products and unique experiences that attract the attention of tourists. Ozseker (2019) speaks of innovation as the process of generating and applying new ideas, approaches, products or services that improve the tourism experience, boost competitiveness and create added value in the destination. Recently, Segittur and Andrades (2024) go a step further when considering the contribution of innovation to tourism intelligence, explaining that innovation not only optimises resources and services, but also transforms the way in which destinations manage their offer, promoting smarter and more competitive management.

Regarding technology, it can be stated that the use of technology is essential to improve the management of tourist destinations, optimise the services offered and enrich the tourist experience. The integration of new technologies allows for a more efficient and sustainable approach to tourism activity, in addition to improving the competitiveness of the destination (Palomo and Parra, 2024), offering new ways of accessing tourism services (Ukpabi and Karjaluoto, 2017), and improving the quality of life of citizens (Boes et al, 2015).

Koo et al. (2015) and Dorcic et al. (2019) argue that technologies have become a vital factor in promoting tourism and improving the traveller experience, as well as in creating new tourism production systems with more modernised products and services. Furthermore, in recent years, metaverse-based technology has emerged, in this sense, Buhalis et al. (2023) explain that technological progress based on the metaverse offers immersive, personalised and accessible experiences, increasing the competitiveness of destinations and promoting a more inclusive tourism model that is accessible to all.

Accessibility refers to the conditions that tourism destinations must meet to ensure that all individuals, including those with disabilities, can fully enjoy the destination's tourism offer (Porto et al, 2018).

Despite being the least explored factor in the literature and the one that receives the least investment by destinations (Michopoulou et al., 2007; Gillovic and McIntosh, 2020; Buhalis and Michopoulou, 2011), accessibility is key to expanding demand and reducing tourism seasonality (Liasidou et al., 2022; Machado, 2020). Therefore, the implementation of accessible measures leads to improved destination intelligence, leading to a more balanced and efficient management of resources throughout the year. Moreover, by attracting tourists with accessibility needs, the destination can better understand the preferences and behaviours of different types of tourists, which facilitates much more accurate and sophisticated planning.

Finally, sustainability is a factor centred on tourism development, which combines the objectives of economic viability with the preservation of the natural environment and social cohesion, ensuring that tourism resources are used responsibly to guarantee their future availability. In recent years, in the wake of COVID 19, a new trend has emerged within tourism development in which it is crucial that new technologies implemented within destinations must have a positive impact on the environment and local communities (Streimikiene et al, 2021).

On the other hand, Go and Kang (2023) explain that the birth of the metaverse allows tourists to enjoy the tourist environment of a destination virtually. These measures favour the sustainability of the tourism environment, preserving natural resources and thus reducing the impact of tourism overtourism (Segittur and Andrades, 2024). Similarly, Xue et al. (2023) stress that sustainability is not only a priority for the tourism development of a destination, but also for ensuring that this tourism development is viable in the long term. By including factors such as rural development or clean energy, a more equitable, environmentally friendly and time-efficient tourism model can be developed.

Despite the extensive body of literature on each of the pillars of the Smart Tourism Destination (STD) model, most studies have focused on their individual and theoretical analysis, paying limited attention to the potential empirical relationships among them. This limitation justifies the need to adopt a comprehensive approach that allows for the assessment of the interrelationships between the different pillars of the model.

3. HYPOTHESES, CASE STUDY, DATA AND METHODOLOGY

3.1. Hypothesis

The analysis of the five dimensions of the STD model (Governance, Innovation, Technology, Sustainability and Accessibility) has been approached in the literature from an eminently theoretical perspective, including definitions and justifying why an improvement in any of these factors would translate into greater intelligence of the tourist destination, and independently, as watertight dimensions that do not relate to each other. In fact, very little research has attempted to establish a causal link between these factors. And in these few studies, these relationships have been presented in a purely theoretical way, without any empirical confirmation of this relationship.

This section presents the starting hypotheses on the different causal relationships between the determinants of the model found in the literature. These hypotheses set out in this section are subsequently used to check whether they are verified in the region studied in this paper.

H1: the use of technology in tourism destinations results in smarter destination governance (Giffinger et al, 2007; Yigitcanlar et al, 2018).

H2: smart governance of tourism destinations makes them more sustainable territories (Lamas et al, 2019; Bramwell and Lane, 2011; Joppe, 2018; Sharpley, 2022).

H3: innovation in tourism destinations leads to more sustainable tourism management (Loureiro, 2019; Del Vecchio et al, 2018).

H4: technological improvements in tourist destinations result in more sustainable destinations (Loureiro, 2019; Errichiello and Micera, 2021; Martin and Salinas, 2022; Go and Kang, 2023; Palomo and Parra, 2024).

H5: innovation in tourist destinations improves accessibility (Rucci et al, 2021; Szymanska et al, 2021; Freund et al, 2022; Buhalis et al, 2023).

3.2. Case study

The analysis carried out in this paper focuses on the micro-destinations located in the autonomous region of Extremadura (Spain), which is located in the southwest of the Iberian Peninsula, bordering the Portuguese region of Alentejo to the west, Andalusia to the south, Castilla-La Mancha to the east and Castilla y León to the north.

In order to be able to analyse the characteristics of each tourist destination in Extremadura, the regions has been divided into 28 micro-destinations, 4 of which are the main cities of the region (Badajoz, Cáceres, Mérida and Plasencia) and the remaining 24 are made up of the local action groups (non-profit associations, with a regional scope, where public and private entities are integrated) that make up the Extremadura territory.

When comparing Extremadura's tourism data with the remaining Spanish regions, it can be seen that, over the last 10 years, Extremadura is the third region in Spain with the lowest average stay of tourists, the fifth region with the lowest number of tourists and the third with the lowest number of overnight stays. Furthermore, in the latest MONITUR tourism competitiveness report, carried out for the Spanish autonomous communities, which dates from June 2024, Extremadura is the Spanish region with the lowest tourism competitiveness index.

The above data show some shortcomings that affect the competitiveness and development of tourism in Extremadura. Among the main limitations is the lack of tourism infrastructure, which has negatively impacted both accessibility and the ability to offer more complete experiences (or comprehensive) experiences that motivate tourists to extend their stay in the region. In addition, the region's limited tourism development suggests that it has not been well promoted and positioned within national and international tourism markets, which diminishes its visibility.

However, despite the challenges that the region must face to become more competitive in the tourist markets, Extremadura has different strengths as a tourist destination which, if exploited, could differentiate and develop in terms of tourism. These strengths include its cultural and natural heritage, notably the Monfragüe National Park, the Tajo Internacional biosphere reserve and the Villuercas Ibores Jara Geopark, as well as historic cities such as Mérida and Cáceres, and the Monastery of Guadalupe, all of which have been declared World Heritage Sites by UNESCO. It is also worth mentioning that, of the 17 inland beaches in Spain, 9 are located in Extremadura, making it the region with the largest inland beach area in Spain, favouring a more sustainable and economic type of beach tourism and helping to keep the rural environment alive.

With an appropriate promotion strategy and a major commitment to the development of innovation and technology, together with the adaptation of tourism to people with accessible needs and a major commitment to sustainable tourism, the region's tourist attractiveness and the revitalisation of rural areas would be improved, leading to the positioning of its micro-destinations as benchmark tourist destinations.

3.3. Data

To obtain the data used in this research, the indicators included in the UNE 178502 standard of January 2022 were initially used, all the data for each dimension were collected through personal interviews with the tourism agents of each of the 28 microdestinations, and these data were refined through subsequent revisions. Once a solid database has been obtained, in order to guarantee the correct use of the methodology employed in this research, indicators of a qualitative nature have been discarded.

Next, an exploratory Principal Component Analysis was carried out to verify whether all the indicators of each dimension are valid for measuring each of the latent variables represented by each dimensions or whether, on the contrary, there are redundant indicators. In this way, only those indicators with a high correlation with the principal components to be extracted according to the criterion of eigenvalues greater than 1 have been considered. Therefore, although, once the qualitative indicators have been discarded, information is available on 8 governance indicators, 5 innovation indicators, 9 technology indicators, 18 sustainability indicators and 6 accessibility indicators, not all of them have been used in the estimation of the structural equation model, especially to measure the dimensions of technology and innovation, which have clearly been the two dimensions that have posed the greatest problems for their quantification. Table 1 below shows each of the indicators used in the estimations carried out, together with a brief definition of each of them that may help the reader to better understand the results obtained in this research.

Table 1. Breakdown of indicators for each dimensions and their definition

AXIS	INDICATOR	DEFINITION
GOVERNANCE	**G3**	Degree of tourist satisfaction with the destination
	G4	Degree of resident satisfaction with the destination
	G5	Stakeholder satisfaction with the destination
	G7	Average occupancy rate of tourist accommodations
	G8	Total expenditure per person per night
INNOVATION	**I2**	Implementation of novel and valuable ideas
	I3	Profitability of the innovations implemented
TECHNOLOGY	**T1**	Percentage of territory with high-speed mobile coverage
	T3	Number of data sources used by the destination
ACCESSIBILITY	**A2**	Number of accessible tourism resources in the destination
	A3	Campaigns to promote accessible tourism at the destination
	A4	Degree of compliance with proposed accessibility measures
	A5	Number of public transports adapted to people with accessibility needs
SUSTAINABILITY	**S1**	Percentage of actions carried out in the destination that are related to the achievement of the SDGs
	S3	Electric vehicle charging points available at the destination
	S4	Percentage of waste that is recycled and reused
	S5	Percentage of the destination's public car parks managed with sensors and parking meters
	S10	Percentage of total destination resources that are considered as resources with distinction
	S11	Percentage of tourist participation in local events and activities
	S13	Percentage of local unemployment in high tourist season
	S15	Percentage contribution of tourism to the economy of the destination
	S16	Percentage of destination resources, infrastructure or services generated and maintained by tourism
	S18	Percentage of tourist accommodation in the destination that would remain open in emergency situations, pandemics, crises, etc.

Source: own elaboration.

3.4. Methodology

To analyze the relationships between the latent variables in this study, Structural Equation Modeling (SEM) was employed, as it allows for the simultaneous estimation of dependency relationships among unobservable variables measured through indicators. Specifically, the Partial Least Squares approach (PLS-SEM) was selected, given its suitability for exploratory contexts and relatively small sample sizes.

The analysis was conducted in two stages. First, the measurement model was evaluated by examining the relationships between the latent variables and their observed indicators. To this end, widely accepted reliability and validity criteria were applied. Internal consistency was assessed using Cronbach's alpha and composite reliability (rho_a and rho_c), with threshold values above 0.7 considered acceptable (Hair et al., 2016). In this study, priority was given to rho_a (Dijkstra & Henseler, 2015), while rho_c was used only in cases where minimum threshold values were not achieved.

Convergent validity was assessed through the Average Variance Extracted (AVE), which should exceed the threshold of 0.5 (Fornell & Larcker, 1981). Discriminant validity was evaluated using the Fornell and Larcker criterion, which requires that the square root of the AVE of each latent variable be greater than its correlations with the remaining variables.

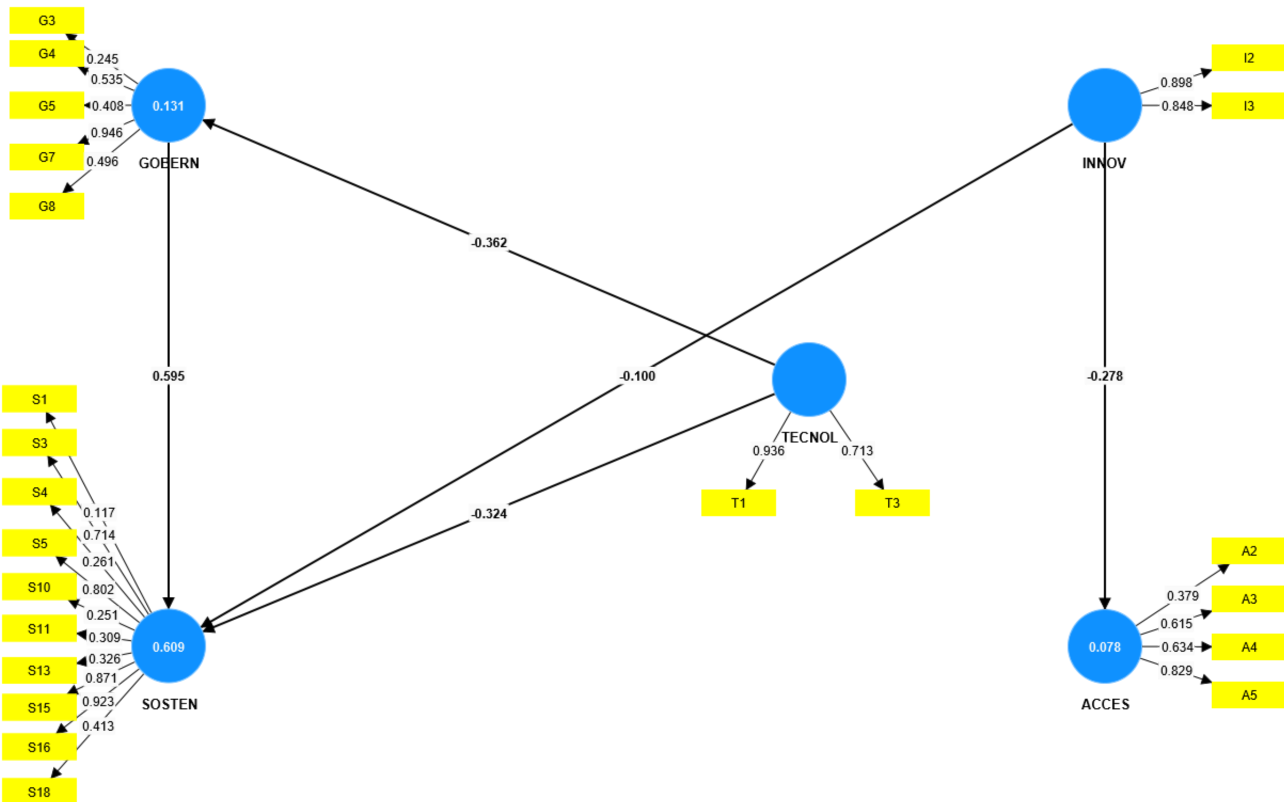
In the second stage, the structural model was estimated in order to test the proposed hypotheses. The significance of the relationships between latent variables was assessed through the estimated path coefficients, their corresponding t-statistics, and p-values.

Additionally, multicollinearity was assessed using the Variance Inflation Factor (VIF), with values below 5, and preferably below 3, considered acceptable (Becker et al., 2015). Finally, the explanatory power of the model was evaluated using the coefficient of determination (R^2), which measures the proportion of variance explained in the dependent variables. Following Hair et al. (2011), values of 0.75, 0.50, and 0.25 can be interpreted as substantial, moderate, and weak, respectively.

4. RESULTS

Figure 1 presents the estimated SEM model, based on the proposed theoretical framework that includes the five research hypotheses put forwardin this study. Focusing first on the factor loadings—that is, the correlations between each latent variable and its corresponding observed indicators—the figure shows that all estimated loadings are positive and, in general, exceed the recommended thresholds of 0.60–0.70 (Vinzi et al., 2010). This result indicates an adequate relationship between the selected indicators and the latent dimensions they are intended to measure.

Figure 1. SEM model estimation



Source: own elaboration based on SmartPLS 4 calculations.

To verify the reliability and validity of the model estimated above, Table 2 presents the Cronbach's test, the composite reliability and the average explained variance of the five latent variables considered in this study. As can be easily observed, Cronbach's is above 0.7 for two of the latent variables and is very close to this value for two other latent variables, while only for the technology variable this statistic is slightly below 0.6. The same applies to the composite reliability measured through the rho_a statistic, which reaches a value above 0.7 for four of the five variables, while for the only latent variable for which this statistic is below 0.7, accessibility, its rho_c value is equal to 0.716, thus exceeding the minimum value required in the literature. Consequently, and in general terms, the reliability of the model is relatively good.

Table 2. Reliability and convergent validity of the estimated SEM model.

Latent variable	Cronbach' s	Composite reliability (rho_a)	Average variance extracted (AVE)
GOVERNANCE	0.664	1.279	0.331
INNOVATION	0.690	0.706	0.762
TECHNOLOGY	0.592	0.784	0.692
SUSTAINABILITY	0.728	0.871	0.328
ACCESSIBILITY	0.754	0.290	0.402

Source: own elaboration based on calculations made with SmartPLS 4.

Regarding convergent validity, assessed through the Average Variance Extracted (AVE), the results reported in Table 2 show that only two of the five latent variables exceed the recommended threshold of 0.5. The dimensions of governance, sustainability, and accessibility fall below this criterion, suggesting a limited ability of the indicators to explain the variance of these latent variables.

This result constitutes a relevant limitation of the model and should be taken into account when interpreting the findings. However, this situation may be associated with the nature of the indicators used, which are derived from the UNE 178502 standard, thus limiting the possibility of redefining the latent variables through alternative indicator selection. In this context, and given the exploratory nature of the study, convergent validity can be considered improvable, although it does not invalidate the estimation of the structural model, provided that the results are interpreted with caution.

To complete the assessment of the measurement model, the results for discriminant validity using the Fornell and Larcker (1981) criterion are reported in Table 3. The diagonal of the table shows the square root of the AVE for each latent variable, while the off-diagonal elements represent the correlations between pairs of latent variables. As can be observed, with the exception of the relationship between governance and sustainability, no correlation exceeds the corresponding diagonal values. Therefore, the estimated model shows, in general terms, an adequate level of conceptual differentiation.

Table 3. Discriminant validity (Fornell & Larcker criterion) of estimated SEM model

	GOB	INN	TECH	SOST	ACCE
GOB	***0,575***				
INN	0,016	***0,873***			
TECH	-0,362	0,035	***0,832***		
SOST	0,710	-0,102	-0,543	***0,573***	
ACCE	0,231	-0,278	-0,059	0,408	***0,634***

Source: own elaboration based on calculations made with SmartPLS 4.

Note: GOB: Governance; INN: Innovation; TECH: Technology; SOST: Sustainability; ACCE: Accessibility.

Additionally, to rule out the presence of collinearity in the estimated models, Table 4 reports the Variance Inflation Factor (VIF) for the five structural models considered in this study. As can be observed, all VIF values are well below the threshold of 5. Therefore, collinearity issues can be ruled out in the estimated structural models, and consequently, the presence of bias in both the estimated coefficients and their corresponding standard errors can be dismissed, reinforcing the stability of the structural model estimates.

Table 4. Variance Inflation Factor (VIF)

	GOB	INN	TECH	SOST	ACCE
GOB				1,152	
INN				1,002	1,000
TECH	1,000			1,153	
SOST					
ACCE					

Source: own elaboration based on SmartPLS 4 calculations.

Overall, the results of the measurement model indicate acceptable levels of reliability and validity, although there are some limitations in convergent validity that suggest caution when interpreting the findings. Under these conditions, the analysis proceeds with the estimation of the structural model, whose purpose is to test the proposed hypotheses.

The results of the structural model estimation are reported in Table 5, allowing for the assessment of the five proposed hypotheses. The findings reveal a clear predominance of non-significant relationships, as only one of the five hypotheses is empirically supported.

Table 5. Estimation of the coefficients of the structural model

Hypotheses	Relationship	Coefficient	S.D.	t-value	p-value	Decision
H1	TECH→GOB	-0,362	0,371	-0,977	0,331	Rejected
H2	GOB→SOST	0,595	0,237	2,510	0,014	Accepted
H3	INN→SOST	-0,100	0,270	-0,369	0,713	Rejected
H4	TECH→SOST	-0,324	0,253	-1,280	0,203	Rejected
H5	INN→ACCE	-0,278	0,437	-0,637	0,525	Rejected

Source: own elaboration based on calculations made with SmartPLS 4.

Specifically, hypothesis H2 (Governance → Sustainability) shows a positive and statistically significant coefficient ($\beta = 0.595$; $p = 0.014$), indicating that higher levels of governance quality in the analyzed destinations are associated with greater levels of sustainability.

In contrast, the remaining relationships are not statistically significant, implying that, in the context analyzed, there is no empirical evidence supporting the influence of technology on governance (H1), nor of innovation and technology on sustainability (H3 and H4), nor of innovation on accessibility (H5).

Overall, the results reveal a limited empirical interrelationship between the pillars of the STD model in the analyzed context, highlighting the central role of governance as the only factor with significant explanatory power.

Finally, regarding the explanatory power of the model, the values of the coefficient of determination (R^2), reported in Table 6, show a moderate level for the sustainability variable ($R^2 = 0.609$), while the values for governance ($R^2 = 0.131$) and accessibility ($R^2 = 0.078$) indicate limited explanatory capacity. These findings suggest that, although the model reasonably explains sustainability, its ability to explain other dimensions is more limited.

Table 6. Explanatory power of the SEM model

Latent variable	
Governance	0,131
Sustainability	0,609
Accessibility	0,078

Source: own elaboration based on SmartPLS 4 calculations.

Based on the results obtained, the following section discusses the findings in order to interpret their theoretical and practical implications.

5. DISCUSSION AND CONCLUSIONS

The methodology applied in this study provides empirical evidence on the interrelationships between the pillars of the Smart Tourism Destination (STD) model, in a field where the literature has traditionally been dominated by theoretical approaches. In this sense, the results contribute to a better understanding of how these dimensions interact and offer relevant insights both from an academic perspective and for decision-making in tourism management.

The analysis shows that only one of the five proposed hypotheses is empirically supported. Specifically, the relationship between governance and sustainability (H2) is the only one that is positive and statistically significant, indicating that higher levels of governance quality lead to improvements in sustainable practices in the destinations analyzed. This finding confirms the importance of institutional coordination, stakeholder participation, and management capacity as key elements for advancing sustainable tourism development, in line with previous studies (Joppe, 2018; Sharpley, 2022; Detotto et al., 2021). In this regard, effective governance not only facilitates decision-making but also acts as a key mechanism for articulating the different dimensions of the tourism destination, enabling the implementation of policies aimed at the responsible use of resources and the balanced development of the territory.

In contrast, the remaining hypotheses are not empirically supported in the analyzed context, which constitutes one of the main findings of the study. In particular, the absence of a significant relationship between technology and governance (H1) is especially relevant, as it contrasts with part of the literature suggesting that technological development enhances management processes and decision-making. This result suggests that, in destinations with a low level of technological development, the mere availability of technological tools is not sufficient to improve governance unless it is accompanied by adequate organizational capacities, training, and institutional structures (Buhalis et al., 2023).

Similarly, the lack of a significant relationship between innovation and sustainability (H3), as well as between technology and sustainability (H4), indicates that the incorporation of innovations or technologies does not automatically translate into improvements in sustainability. This finding nuances the prevailing view in the literature, which tends to assume a direct relationship between these factors, and suggests that such links may depend on the degree to which these investments are integrated into the overall destination strategy. In contexts such as the one analyzed, characterized by a lower level of tourism development, these initiatives may not reach the level of maturity required to generate indirect effects on other dimensions (Gutierriz et al., 2023; Jabeen et al., 2022).

Likewise, the lack of significance in the relationship between innovation and accessibility (H5) may be explained by the fact that the innovations implemented in the analyzed destinations are not specifically aimed at improving accessibility, but rather respond to other objectives, such as service digitalization or tourism promotion. This result highlights that improvements in accessibility require targeted policies and cannot be considered an automatic outcome of innovation processes.

Overall, these findings indicate that the relationships between the different pillars of the STD model are neither automatic nor universal, but are conditioned by the specific characteristics of the analyzed territory. This finding is consistent with previous studies that emphasize the need for context-sensitive approaches in the development of smart tourism destinations (Gretzel et al., 2018; Ndou et al., 2023), and suggests that the impact of technology and innovation largely depends on the existence of governance structures capable of channeling and leveraging these investments (Gretzel et al., 2015).

From a theoretical perspective, this study contributes to refining the prevailing view in the literature on smart tourism destinations, which tends to assume the existence of positive and generalized relationships between the different pillars of the model. The results suggest that such relationships should not be considered universal, but rather dependent on the level of development, institutional context, and specific characteristics of each destination. In this sense, the study reinforces the need to move toward more differentiated approaches that take into account the heterogeneity among destinations, particularly between those with lower levels of tourism development and more consolidated destinations.

From a practical perspective, the results provide relevant implications for tourism destination management. In particular, they show that the impact of investments in technology and innovation on other dimensions of the model is not automatic, but depends on their level of development and consolidation.

In the case of Extremadura, the findings suggest that strengthening governance can act as a key driver of sustainable development. Consequently, public policies should prioritize improvements in institutional coordination, stakeholder participation, and management capacity before promoting intensive investments in technology or innovation (Andrades, 2024). Furthermore, such investments should be integrated into coherent, long-term strategies to maximize their impact on the overall tourism system.

However, this study presents several limitations that should be considered when interpreting the results. Some indicators exhibit levels of convergent validity below the recommended thresholds, which suggests that the findings should be interpreted with caution. Furthermore, the analysis is based on data from a specific time period, which prevents the evaluation of the dynamic evolution of the relationships between the variables analyzed. Moreover, the availability of indicators has constrained the measurement of certain dimensions of the model, and the study focuses on a single region characterized by a lower level of tourism development, which limits the generalizability of the results to other contexts.

In this regard, future research should further explore the temporal dimension of these relationships by incorporating longitudinal approaches that allow for the assessment of how changes in investments across the different pillars of the STD model may alter the causal relationships over time. Moreover, extending the analysis to tourism destinations with different levels of maturity and technological development would be of great interest, as it would allow for the validation of the results and a deeper understanding of the role of each dimension in shaping smart tourism destinations. In particular, applying this methodology to regions with a higher level of STD development would enable meaningful comparisons and provide further insights into how the relationships between the model's pillars depend on the territorial context.

REFERENCES

Alwin, D. F., & Hauser, R. M. (1975). The decomposition of effects in path. *American Sociological Review, 40*, 36-47.

Andrades, L. (2024). The spanish model for smart tourism destination management. *Tourism, Hospitality & Event Management*. https://doi.org/10.1007/978-3-031-60709-7_6

Becker, J. M., Ringle, C. M., Sarstedt, M., & Völckner, F. (2015). How collinearity affects mixture regression results. *Marketing Letters, 26*(4), 643-659.

Boes, K., Buhalis, D., & Inversini, A. (2015). Conceptualising Smart Tourism Destination Dimensions. En I. Tussyadiah & A. Inversini (Eds.), *Information and Communication Technologies in Tourism 2015*. https://doi.org/10.1007/978-3-319-14343-9_29

Bollen, K. A. (1989). *Structural equations with latent variables*. Wiley.

Bramwell, B., & Lane, B. (2011). Critical research on the governance of tourism and sustainability. *Journal of Sustainable Tourism, 19*(4-5), 411-421. https://doi.org/10.1080/09669582.2011.580586

Buhalis, D., & Michopoulou, E. (2011). Information-enabled tourism destination marketing: addressing the accessibility market. *Current Issues in Tourism, 14*(2), 145-168. https://doi.org/10.1080/13683501003653361

Buhalis, D., Leung, D., & Lin, M. (2023). Metaverse as a disruptive technology revolutionising tourism management and marketing. *Tourism Management, 97*, 104724. https://doi.org/10.1016/j.tourman.2023.104724

Del Vecchio, P., Mele, G., Ndou, V., & Secundo, G. (2018). Open innovation and social Big Data for sustainability: Evidence from the tourism industry. *Sustainability, 10*(9). https://doi.org/10.3390/su10093215

Detotto, C., Giannoni, S., & Goavec, C. (2021). Does good governance attract tourists? *Tourism Management, 82*, 104155. https://doi.org/10.1016/j.tourman.2020.104155

Dijkstra, T. K., & Henseler, J. (2015). Consistent partial least squares path modeling. *MIS Quarterly, 39*(2), 297-316. https://doi.org/10.25300/MISQ/2015/39.2.02

Dorcic, J., Komsic, J., & Markovic, S. (2019). Mobile technologies and applications towards smart tourism- state of the art. *Tourism Review, 74*(1), 82-103. https://doi.org/10.1108/TR-07-2017-0121

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

European Commission. (2023). *Regional Innovation Scoreboard*. https://ec.europa.eu/assets/rtd/ris/2023/ec_rtd_ris-regional-profiles-spain.pdf

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research, 18*, 39-50. https://doi.org/10.1177/002224378101800104

Freund, D., Iñesta, A., & Castelló, M. (2022). Tourism for all. Educating to foster accessible accommodation. *Journal of Hospitality, Leisure, Sport & Tourism Education, 30*, 100370. https://doi.org/10.1016/j.jhlste.2022.100370

Gardiner, S., & Scott, N. (2018). Destination innovation matrix: A framework for new tourism experience and market development. *Journal of Destination Marketing & Management, 10*, 122-131. https://doi.org/10.1016/j.jdmm.2018.07.002

Gillovic, B., & McIntosh, A. (2020). Accessibility and Inclusive tourism development: current state and future agenda. *Sustainability, 12*(22), 9722. https://doi.org/10.3390/su12229722

Giner, D. (2017). Towards a new tourism destination governance: the smart destination management (STD) approach. *Oikonomics*.

Go, H., & Kang, M. (2023). Metaverse tourism for sustainable tourism development: Tourism Agenda 202030. *Tourism Review, 78*(2), 381-394. https://doi.org/10.1108/TR-02-2022-0102

Gretzel, U. (2018). From smart destinations to smart tourism regions. *Journal of Regional Research, 42*, 171-184.

Gretzel, U., Sigala, M., Xiang, Z., & Koo, C. (2015). Smart Tourism: foundations and developments. *Electron Markets, 25*, 179-188. https://doi.org/10.1007/s12525-015-0196-8

Gutierriz, I., Ferreira, J. J., & Fernandes, P. O. (2023). Digital transformation and the new combinations in tourism: A systematic literature review. *Tourism and Hospitality Research, 25*(2), 194-213. https://doi.org/10.1177/14673584231198414

Hair, J. F. (2006). *Multivariate Data Analysis*. Pearson Education.

Hair, J. F., Jr., Hult, G. T. M., Ringle, C., & Sarstedt, M. (2016). *A primer on Partial Least Squares Structural Equation Modeling (PLS-SEM)*. Sage Publications.

Hair, J. F., Ringle, C. M., & Sarstedt, M. (2011). PLS-SEM: Indeed a silver bullet. *Journal of Marketing Theory and Practice, 19*(2), 139-151.

Jabeen, F., Al Zaidi, S., & Al Dhaheri, M. H. (2022). Automation and artificial intelligence in hospitality and tourism. *Tourism Review, 77*(4), 1043-1061. https://doi.org/10.1108/TR-09-2019-0360

Joppe, M. (2018). Tourism policy and governance: Quo Vadis?. *Tourism Management Perspectives, 25*, 201-204. https://doi.org/10.1016/j.tmp.2017.11.011

Kaplan, D. (2000). *Structural equation modeling: foundations and extensions*. Sage.

Koo, C., Gretzel, U., Hunter, W. C., & Chung, N. (2015). The Role of IT in tourism. *Asia Pacific Journal of Information Systems, 25*(1), 99-104. http://dx.doi.org/10.14329/apjis.2015.25.1.099

Liasidou, S., Fella, K., & Stylianou, C. (2022). A sustainable destination is an accessible destination: examining the relationship as a remedy to seasonality. *Worldwide Hospitality and Tourism Themes, 14*(5), 481-491. https://doi.org/10.1108/WHATT-07-2022-0078

Llorca, J. (2017). Tourism governance and its importance in destination planning. *Revistadigital INESEM*.

Machado, P. (2020). Accessible and inclusive tourism: why it is so important for destination branding? *Worldwide Hospitality and Tourism Themes, 12*(6), 719-723. https://doi.org/10.1108/WHATT-07-2020-0069

Marakova, V., & Medvedova, M. (2016). Application of innovations in tourism destinations. *Forum Scientiae Oeconomia, 4*(1), 33-43.

Martín, J. M., & Salinas, J. A. (2022). The effects of technological improvements in the train network on tourism sustainability. An approach focused on seasonatily. *Sustainable Technology and Entrepreneurship, 1*(1), 100005. https://doi.org/10.1016/j.stae.2022.100005

Michopoulou, E., Buhalis, D., Michailidis, S., & Ambrose, I. (2007). Destination management systems: technical challenges in developing an eTourism platform for accessible tourism in Europe. En *Information and Communication Technologies in Tourism 2007*. https://doi.org/10.1007/978-3-211-69566-1_28

Ndou, V., Hysa, E., & Maruccia, Y. (2023). A methodological framework for developing a smart tourism destination in the southeastern Adriatic-Ionian Area. *Sustainability, 15*(3), 2057. https://doi.org/10.3390/su15032057

Ozseker, D. B. (2019). Towards a model of destination innovation process: an integrative review. *The Service Industries Journal, 39*(3-4), 206-228. https://doi.org/10.1080/02642069.2018.1491970

Palomo Santiago, M., & Parra López, E. (2024). Intellectual influence of smart tourism destinations 2000-2023. *Tourism and Hospitality Management, 30*(3), 301-316. https://doi.org/10.20867/thm.30.3.1

Porto, N., Rucci, A. C., & Ciaschi, M. (2018). Tourism accessibility competitiveness. A regional approach for Latin American countries. *Journal of Regional Research, 42*, 75-91.

Rigdon, E. E. (2012). Rethinking partial least squares path modeling: in praise of simple methods. *Long Range Planning, 45*(5-6), 341-358.

Ringle, C. M., Wende, S., & Becker, J. M. (2022). *SmartPLS 4*. SmartPLS GmbH. http://www.smartpls.com

Rucci, A. C., Moreno-Izquierdo, L., Perles-Ribes, J. F., & Porto, N. (2022). Smart or partly Smart? Accessibility and innovation policies to assess smartness and competitiveness of destinations. *Current Issues in Tourism, 25*(8), 1270-1288. https://doi.org/10.1080/13683500.2021.1914005

Sarstedt, M., & Mooi, E. (2019). *A concise guide to market research. The process, data, and methods using IBM SPSS statistics*. Springer.

Sharpley, R. (2022). Sustainable tourism governance: local or global? *Tourism Recreation Research, 48*(5), 809-812. https://doi.org/10.1080/02508281.2022.2040295

Shmueli, G., & Koppius, O. R. (2011). Predictive analytics in information systems research. *MIS Quarterly, 35*(3), 553-572.

Streimikiene, D., Svagzdiene, B., Jasinskas, E., & Simanavicius, A. (2021). Sustainable tourism development and competitiveness: The sustematic literature review. *Sustainable Development, 29*(1), 259-271. https://doi.org/10.1002/sd.2133

Szymanska, E., Panfiluk, E., & Kiryluk, H. (2021). Innovative Solutions for the Development of Sustainable Transport and Improvement of the Tourist Accessibility of Peripheral Areas: The Case of the Bialowieza Forest Region. *Sustainability, 13*(4), 2381. https://doi.org/10.3390/su13042381

Thurstone, L. L. (1931). *The theory of multiple factors*. Edwards Brothers.

Trunfio, M., & Campana, S. (2019). Drivers and emerging innovations in knowledge-based destinations: Towards a reserach agenda. *Journal of Destination Marketing & Management, 14*, 100370. https://doi.org/10.1016/j.jdmm.2019.100370

Tukey, J. W. (1964). *Causation, regression and path analysis*. En *Statistics and mathematics in biology*. Hafner.

Ukpabi, D. C., & Karjaluoto, H. (2017). Consumers' acceptance of information and communications technology in tourism: A review. *Telematics and Informatics, 34*(5), 618-644. https://doi.org/10.1016/j.tele.2016.12.002

Vinzi, V. E., Trinchera, L., & Amato, S. (2010). *PLS Path Modeling: from foundations to recent developments and open issues for model assessment and improvement. Hanbook of Partial Least Squares*. Springer.

Wold, H. (1982). *Soft modeling: the basic design and some extensions*. En K. G. Jöreskog & H. Wold (Eds.), *Systems under indirect observations*, Part II (pp. 1-54). North-Holland.

Wold, H. (1985). *Partial least squares*. En S. Kotz & N. L. Johnson (Eds.), *Encyclopedia of Statistical Sciences* (vol. 6, pp. 581-591). Wiley.

Xue, C., Tu, Y. T., Ananzeh, M., Aljumah, A., Trung, L., & Ngo, T. (2023). The role of economic conditions and sustainable rural development on the sustainability of tourism development: evidence from China. *Environ Sci Pollut Res, 30*, 30588-30602. https://doi.org/10.1007/s11356-022-24062-w

Yigitcanlar, T., Kamruzzaman, Dr., Buys, L., Ioppolo, G., Sabatini-Marquees, J., Moreira, E., & Yun, J. (2018). Understanding 'smart cities': Intertwining development drivers with desired outcomes in a multidimensional framework. *Cities, 81*, 145-160. https://doi.org/10.1016/j.cities.2018.04.003