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Article

Systems of tourism sustainability indicators: A comparative analysis of the international, European, and Spanish proposals

Andres Artal-Tur*, Lourdes Badillo-Amador

Technical University of Cartagena, 30201 Cartagena, Spain
*** Corresponding author:** Andres Artal-Tur, Andres.artal@upct.es

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Abstract: International tourism has become a global phenomenon, with over 1.3 billion arrivals recorded in 2023. However, this remarkable growth comes with significant economic, social, and environmental costs. In response, the adoption of sustainable tourism models has emerged as a key priority on international policy agendas. To support this effort, various indicator systems have been developed to define, measure, and manage tourism sustainability at destination levels. Despite a growing body of academic work on Systems of Tourism Indicators (STIs), comparative analyses of well-established frameworks remain limited. This study examines four leading STI frameworks: The Global Sustainable Tourism Council (GSTC) guidelines, the European Tourism Indicators System (ETIS) developed by the European Commission, the International Network of Sustainable Tourism Observatories (INSTO) led by the United Nations World Tourism Organization (UNWTO), and the Smart Tourism Destinations framework (DTI-Spain) promoted by Spain's Ministry of Tourism. Our methodology involves an initial review of the frameworks' design and content, followed by a comparative analysis highlighting areas of alignment and key divergences. The findings underscore a shared foundational structure across the four STIs, yet reveal notable differences in their overarching designs, particularly in the emphasis placed on specific components. In conclusion, while substantial progress has been made toward establishing a unified framework for assessing tourism sustainability, further work is needed to enhance practical implementation and address emerging challenges.

Keywords: system of indicators; destinations; tourism sustainability; governance; socio-cultural dimension; international proposals; comparative analysis

1. Introduction

Tourism impacts and system of indicators

The outstanding development of the international tourism industry in recent years has significantly enhanced its role as a driver of wealth and well-being for countries worldwide. Between 2010 and 2019, international tourist travel expanded at annual rates of 4% to 6%, consistently outpacing global GDP growth rates [1]. In 2019, prior to the global disruption caused by the COVID-19 pandemic, international tourism accounted for 28% of global service exports, with 1.4 billion international arrivals generating $1.5 trillion in revenues. This represented approximately 10% of global GDP and employment [2]. Four years later, 2024 is anticipated to mark the full recovery of international tourism from the pandemic crisis, as illustrated in **Figure 1**.

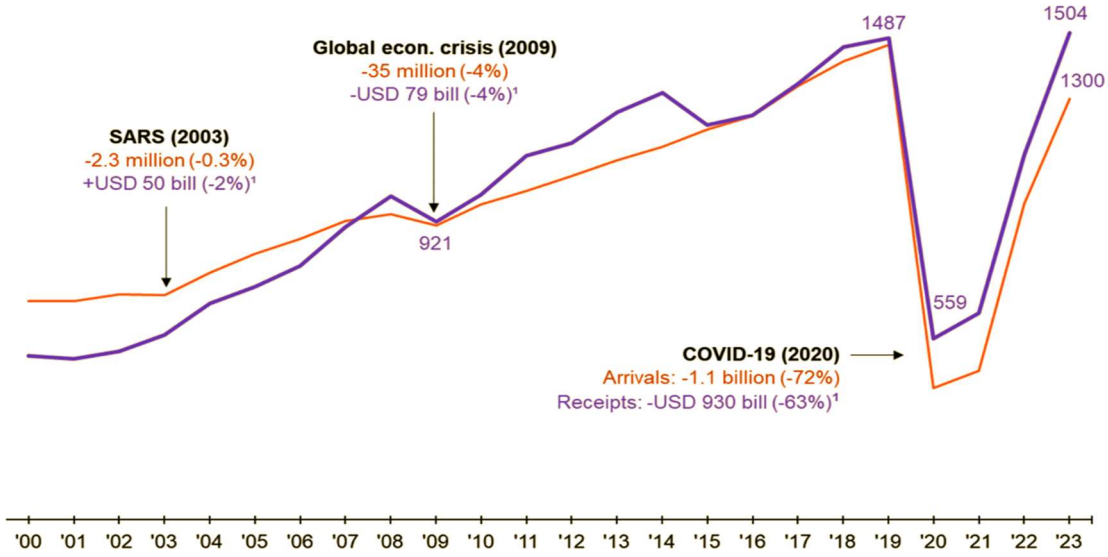

Figure 1. International tourism arrivals and receipts 2000–2023.
Receipts at current prices. Source: UNWTO. Tourism recovery tracker [1].

Amidst this context of rapid growth, the impact of the tourism industry on major destinations has become evident [3]. Challenges such as overcrowding in city centers (overtourism), its disruptive effects on real estate markets (gentrification), and the strained coexistence between tourists and residents during peak seasons have become widespread in popular destinations, often leading to episodes of tourismphobia [4,5]. In response, both policymakers and academics have developed proposals aimed at establishing Systems of Tourism Indicators (STIs) to design, measure, and manage the impacts of tourism on destinations [6–8]. Notable initiatives include those from international institutions, such as the UNWTO and OECD, which strive to build a globally informed consensus on how to structure indicators for sustainable tourism [9–11]. Similarly, the European Commission introduced the European Tourism Indicators System (ETIS) to guide member states in adopting sustainable practices [12,13]. At the national level, countries such as Spain, Denmark, Finland, and Portugal have developed customized models tailored to their specific tourism contexts [9]. Within academia, recent efforts have expanded the scope of STIs to include new areas of research, such as their alignment with the United Nations' Sustainable Development Goals (SDGs), a framework embraced by the UNWTO [14,15]. Other lines of inquiry explore the potential of smart tourism models to facilitate and enhance sustainable management in the sector [16,17], as well as a comprehensive redefinition of the purpose and content of sustainable STIs [18–20].

Despite the considerable efforts to enhance the design of STIs, most authors remain focused on analyzing individual proposals, with a lack of comparative studies that track the progress of well-established international systems. A few notable exceptions include compilatory studies [11,21–23]. This study aims to fill this gap by contributing to the comparative research in this area. Specifically, it examines four of the most prominent international tourism sustainability indicator proposals put forward by leading institutions. These proposals are analyzed in terms of their structure, content, and primary objectives. At the international level, the selected proposals include those from the Global Sustainable Tourism Council (GSTC) and the

World Tourism Organization (UNWTO), through its International Network of Sustainable Tourism Observatories (INSTO). The other two systems are the European Tourism Indicators System (ETIS), developed by the European Commission, and the Smart Tourism Destinations System (DTI-Spain), a notable Spanish initiative launched by the Ministry of Industry, Commerce and Tourism in collaboration with the State Mercantile Society for Innovation Management and Tourism Technologies (SEGITTUR).

The research is structured as follows: First, we introduce the four selected initiatives, defining each sustainable tourism indicator system, outlining the relevance of the institutions leading these efforts, their original objectives, and the frameworks employed in their respective sustainable models. Second, we characterize the proposals by identifying the main sections, individual indicators, and the overall approach within a global, regional, or national context. Third, we compare the four proposals based on their general focus, specific measures, and key differences and similarities. Several valuable insights emerge from the analysis. Along these lines, the present study proceeds as follows: After this introduction, the second section presents a literature review of indicator systems used to evaluate tourism sustainability at the destination level. The third section defines the methodological approach and describes the four selected proposals, while the fourth section offers a comparative analysis. Finally, the fifth section presents the conclusions of the study.

2. Literature review on tourism sustainability indicator systems

Initially, the use of indicators to measure sustainability was seen as a means to clarify this complex concept and facilitate its practical application [24,25]. As early as 1996, the United Nations introduced its Practical Guide for the Development and Use of Indicators of Sustainable Tourism [26]. In this context, Butler [24] made a significant contribution by highlighting the lack of clarity in the definition of sustainability, suggesting that this ambiguity could be addressed through effective indicators. Miller [25] further emphasized the need for both objective (quantitative) and subjective (qualitative) indicators to create a comprehensive measurement system. Later, in a 2007 manual, the United Nations reiterated that sustainable tourism indicators aim to simplify, clarify, and provide valuable information for both public and private stakeholders to manage destinations effectively [27]. As a result, indicator systems have become widely adopted tools in sustainable tourism.

However, the use of indicators is inherently complex. One major challenge is the difficulty in obtaining data for predefined concepts, either due to high acquisition costs or challenges in securing cooperation from industry stakeholders. Even when data is available, it may not be comparable due to the lack of a universally accepted methodology for the analyzed variables [11,18]. Furthermore, many indicators have been designed to address specific issues, limiting their generalizability to new situations [28]. In some cases, the available data may not be the most suitable for measuring theoretically defined concepts, prompting the need to reconsider whether the parameters used are truly appropriate or are simply used because they are the only available option [29,30]. In general, these challenges surrounding data availability and

appropriateness mean that indicator systems are not always optimal for practical implementation [18,31].

A second critical issue identified in the academic literature is the need to define sustainability thresholds once data has been gathered [32]. These thresholds should be scientifically rigorous and widely accepted by destination managers [6]. However, this is difficult due to the diversity of destinations and the range of methodologies used to measure sustainability [33]. Some researchers suggest analyzing the deviation of indicators from the theoretical concept of sustainability, citing successful case studies as references [34–37], or combining both approaches [38,39]. In some cases, thresholds are set based on the values of the indicators following agreements among stakeholders at the destination. Coccossis and Koutsopoulou [40] advocate this approach, as evidenced by their work within the European CO-EVOLVE INTERREG-Mediterranean project, where limited information required the involvement of stakeholders and experts in the decision-making and data-generation process.

Another key issue in developing a tourism sustainability indicator system is ensuring the number of indicators remains manageable. This is a primary concern for local managers when implementing these initiatives. Larger destinations typically have the resources to manage tourism sustainability, while emerging or smaller destinations often lack the financial and human resources needed to fully implement monitoring systems, including data collection, analysis, and policy recommendations [18].

As a result, while numerous sustainability evaluation proposals exist, destination managers will likely select one based on the specific sustainability concept being assessed or the proposal's utility and ease of use. This was examined in the context of the INTERREG-MED 2014–2020 programme, through a survey of researchers and managers involved in 14 European tourism sustainability projects [23]. The findings indicate the difficulty in evaluating tourism sustainability due to its broad and complex nature, leading to a variety of proposals with differing degrees of operationality in defining indicators and measurement areas. The study concludes that, internationally, the proposals from the Global Sustainable Tourism Council (GSTC[1] [41]) and the European Tourism Indicators System for the Sustainable Management of Destinations (ETIS[2]) stand out for their focus on three key dimensions: Economic, socio-cultural, and environmental. The UNWTO's initiatives are also relevant for their emphasis on socio-economic sustainability. The Tourism and Environment Reporting Mechanism (TOUERM[3]) focuses on environmental aspects, while the OECD's proposal promotes competitiveness as a pathway to sustainability. Finally, the Network of European Regions for a Sustainable and Competitive Tourism (NECSTouR[4]) adopts a broader concept of sustainability, aligned with the European Union's agenda for sustainable and competitive tourism.

The conclusions drawn from the 14 European INTERREG-MED projects on sustainable practices emphasize the importance of creating better experiences for recipients of tourism services. This can be achieved by offering authentic local experiences, innovative tourism models, and raising tourists' awareness and responsibility. Tourism sustainability is thus closely linked to key concepts such as "management and oversight", "preservation of local identity", "new tourism models", "development of the circular and green economy", "innovation", and "opportunities".

Furthermore, the most widely used and regarded initiative for measuring tourism sustainability among Mediterranean projects is the European Commission's European Tourism Indicators System (ETIS). This preference holds true across various spatial scopes (local, NUTS III regions, NUTS II regions, and inter-regional) and types of sustainability (destination, product, and model). Experts also recognize the relevance of the Global Sustainable Tourism Council (GSTC) proposal and some World Tourism Organization (UNWTO) initiatives, such as the International Network of Sustainable Tourism Observatories (INSTO[5] [42]).

In operational terms, the research underscores the European ETIS for its ease of use, applicability, guidance on evaluating sustainability, and flexibility. However, it also highlights that ETIS requires more information than other proposals. Additionally, it points out that the initiative demands a stronger commitment from stakeholders, especially when no statistical data is available for measurement. The conclusions of the 14 European projects also identify several challenges in measuring sustainable tourism, including data scarcity, difficulties in defining sustainability thresholds for selected indicators, the challenge of fostering effective stakeholder cooperation, and the lack of standardized data that would allow for rigorous comparative analysis at both the European and international levels.

3. Methodology and results

3.1. Indicator systems for measuring tourism sustainability in the international, European, and Spanish contexts

This section presents and describes four current proposals for indicators to measure tourism sustainability at destinations. These proposals are associated with four leading institutions in the international, European, and Spanish contexts: The Global Sustainable Tourism Council (GSTC), the UNWTO's International Network of Sustainable Tourism Observatories (INSTO), Eurostat's European Tourism Indicators System (ETIS), and the Smart Tourism Destinations System (DTI) by SEGITTUR. The goal of this section is to introduce the main approaches for measuring sustainability within a broad context, while highlighting Spain's position as a key international tourist destination and a relevant context for implementing advanced tourism sustainability policies. Although the selected proposals are well-established and recognized, they have continued to evolve since their inception, reflecting the dynamic nature of both the tourism sector and the concept of sustainability itself. Additionally, all four proposals are widely valued by destination managers for their practical and operational approach.

The methodology of this study consists of two key components:

1) Description of the nature and design of the indicator proposals: In Section 3.2, we present the origins of each initiative, updates over time, the background of the institution responsible, and the structure and content of the proposal.
2) Comparative analysis of the selected proposals: In Section 4, after defining and describing the four systems of tourism indicators (STIs), we analyze their similarities and differences, contextualizing each proposal based on the type of institution, and the specific goals and objectives pursued by each STI.

3.2. Definition and description of the four selected indicator systems

First, as an international benchmark, we present the initiative of the Global Sustainable Tourism Council (GSTC), established in 2010 with the goal of promoting sustainable tourism practices, setting universal principles, and endorsing sustainable tourism certifications, products, and services. The GSTC was formed through the merger of two private associations: The Sustainable Tourism Criteria Alliance, founded in 2007, and the Sustainable Tourism Stewardship Council, created in 2009—both dedicated to enhancing the sustainability of tourism at destinations. In 2016, the GSTC merged with the Tour Operators' Initiative (TOI), a coalition of major tour operators committed to sustainable tourism. In 2021, it became a member of the ISEAL[6] [43] community, an organization focused on promoting sustainability and the systems developed to certify it.

To further its mission, the GSTC published the third version of its sustainable tourism criteria for the industry in 2016 (GSTC-I[7]), specifically targeting hotels and tour operators. In 2019, it released the second version of the criteria for the sustainable management of destinations (GSTC-D[8], V2.0).

Table 1. Sections and analysis criteria of the GSTC for destinations (2019).

Section	Criteria		SDGs
A) Sustainable Management	A (a) Administrative and Management Structure	A1 Destination Management Responsibility	16, 17
		A2 Destination Management Strategy and Action Plan	17
		A3 Monitoring and Reporting	12
	A (b) Stakeholder Participation	A4 Business Participation and Sustainability Standards	12,17
		A5 Resident Participation and Feedback	11, 17
		A6 Visitor Participation and Feedback	11, 12
		A7 Promotion and Information	11, 12
	A (c) Pressure and Change Management	A8 Visitor and Activity Volume Management	11, 12
		A9 Land Use and Development Control Regulations	9, 11
		A10 Climate Change Adaptation	13
		A11 Risk and Crisis Management	11, 16
B) Socio-Economic Sustainability	B (a) Local Economic Benefits Contribution	B1 Understanding Tourism's Economic Contribution	1, 8, 9
		B2 Decent Work and Professional Opportunities	4, 5, 8, 10
		B3 Support for Local Entrepreneurs and Fair Trade	8, 12
	B (b) Social Wellbeing and Impacts	B4 Community Support	3, 4
		B5 Prevention of Exploitation and Discrimination	10, 16
		B6 Property Rights and Use	11, 16
		B7 Security and Surveillance	3, 16
		B8 Access for All	3, 10

Table 1. (*Continued*).

Section	Criteria		SDGs
C) Cultural Sustainability	C (a) Cultural Heritage Protection	C1 Protection of Cultural Assets	11
		C2 Cultural Artifacts	11
		C3 Intangible Heritage	11, 12
		C4 Local Access	11
		C5 Intellectual Property	16
	C (b) Visits to Cultural Sites	C6 Visitor Management at Cultural Sites	11, 12
		C7 Site Interpretation	4, 11
D) Environmental Sustainability	D (a) Natural Heritage Conservation	D1 Protection of Vulnerable Environments	14, 15
		D2 Visitor Management at Natural Sites	14, 15
		D3 Wildlife Interaction	14, 15
		D4 Species Exploitation and Animal Welfare	14, 15
	D (b) Resource Management	D5 Energy Conservation	7
		D6 Water Management	6
		D7 Water Quality	3
	D (c) Waste and Emissions Management	D8 Wastewater	3, 14
		D9 Solid Waste	12, 14, 15
		D10 Greenhouse Gas Emissions and Climate Change Mitigation	13
		D11 Low-Impact Transportation	9, 13
		D12 Light and Noise Pollution	3, 11

Source: Own elaboration based on Global Sustainable Tourism Council [41].

Focusing on destination sustainability, the GSTC-D identifies four key areas crucial for policymakers and destination managers: Sustainable management, socioeconomic sustainability, cultural sustainability, and environmental sustainability. In each of these areas, criteria are established that align with the United Nations' Sustainable Development Goals (SDGs) of the 2030 Agenda. The GSTC considers these criteria as the minimum threshold for destinations aiming to achieve sustainability (see **Table 1**).

In terms of content, the GSTC proposal for Section A—Sustainable Management—identifies three key areas: Establishing the necessary administrative structure for sustainability management, ensuring the involvement of all destination stakeholders—residents, tourists, the tourism industry, and local administrations—and preparing institutions to adapt the destination to climate change and the pressures of tourism development. Section B focuses on socioeconomic sustainability, addressing the need to generate economic benefits in terms of income, employment, and entrepreneurship opportunities for local residents. It also emphasizes improving social welfare and enhancing the local capacity to manage the impact of tourism on the population and municipal resources. This includes preventing labor exploitation, combating social discrimination, protecting property rights, and ensuring safety at the destination. Section C covers cultural sustainability, focusing on the preservation of tangible and intangible heritage, as well as promoting cultural site visits. Finally,

Section D deals with environmental sustainability, addressing the conservation of natural heritage, sustainable management of local energy and water resources, and waste and emissions management, in alignment with their impact on climate change and local quality of life.

The GSTC proposal, one of the earliest initiatives launched, incorporates a comprehensive set of 38 indicators, distributed across the economic, socio-cultural, and environmental dimensions, to monitor and implement a sustainability system at destinations. It highlights the critical role of governance in managing and controlling tourism development, while also emphasizing global sustainability issues such as climate change, social inclusion, fair labor practices, local community support, and the preservation of cultural, natural, and environmental heritage.

Next, we examine the proposal by the World Tourism Organization (UNWTO), a globally recognized institution for its contributions to sustainable tourism development. The UNWTO plays a pivotal role both from a normative perspective, as a United Nations-affiliated organization responsible for global tourism management, and in terms of operational initiatives. In 2004, the UNWTO introduced a framework of indicators[9] [44] for measuring sustainable development and established the International Network of Sustainable Tourism Observatories (INSTO[10]). The main purpose of INSTO is to improve the sustainability of the tourism sector by regularly analyzing its evolution and impact, drawing conclusions that inform sustainable development policies and strategies at destinations. To achieve this, the observatories within INSTO monitor 11 specific areas, though they can expand their analysis to include other aspects unique to each destination. Currently, there are 42 observatories within the INSTO network, six of which are located in Spain (see **Table 2**).

As outlined, the INSTO proposal includes eleven mandatory areas covering economic aspects (seasonality, employment, and economic impact), social and management factors (local satisfaction, governance, accessibility), and environmental issues (water management, waste management, and climate change). In addition to these mandatory areas, destinations are also free to define specific areas of concern, such as cultural, social, or particular environmental impacts. While the initial mandatory framework of the INSTO may seem more limited, its subsequent development and customization by each destination significantly expand the range of indicators and measures, creating a more extensive and comprehensive indicator system. As a result, the UNWTO proposal tends to focus less on governance and stakeholder coordination and more on international coordination within the network of destinations, establishing a global perspective on tourism sustainability. Southern European countries, such as Portugal and Spain, are well-represented within this network, alongside Asian nations like China and Indonesia. Notably, the UNWTO's role as a unifying force for these destinations is particularly important, as it helps ensure their receptiveness to advancements in tourism policies and regulations, including the definition and development of the SDGs framework.

Table 2. Mandatory monitoring areas of the INSTO-UNWTO proposal and state members by world region.

11 Mandatory Areas	World Region	Countries
1.Tourism Seasonality 2.Employment 3.Economic Benefits of the Destination 4.Energy Management 5.Water Management 6.Wastewater Management 7.Solid Waste Management 8.Climate Action 9.Accessibility 10.Local Satisfaction 11.Governance	North America	Canada: The Thompson Okanagan Sustainable Tourism Observatory (2019), The Yukon Sustainable Tourism Observatory (2022). USA: The Sonoma County Sustainable Tourism Observatory, California (2017). Mexico: Nuevo León (undated), Guanajuato Tourism Observatory (2015), Tlaxcala Sustainable Tourism Observatory (2023), Yucatán Peninsula (2023).
	Central America	Guatemala: Petén Department (undated), Antigua Guatemala Sustainable Tourism Observatory (2019).
	South America	Colombia: Bogotá (2022), Cali Tourism Observatory - SITUR Valle del Cauca (2023). Brazil: The Tourism and Events Observatory of the City of São Paulo (2016), State of São Paulo (2022).
	Europe	Portugal: The Alentejo Sustainable Tourism Observatory (2018), Azores Tourism Observatory (2020), Centro de Portugal (undated), Algarve Sustainable Tourism Observatory (2020). Spain: Tourism Observatory of the Canary Islands (2020), Sustainable Tourism Observatory of Mallorca (2021), Biscay (2022), Navarre monitoring area (undated), Barcelona Tourism Observatory (2022). Sustainable Tourism Observatory of Malaga (2022). Ireland: Atlantic Coast Ireland (undated). Italy: The Observatory of South Tyrol (2018). Croatia: The Croatian Observatory (2016). Greece: The Aegean Islands Observatory (2013).
	Asia	China: The Yangshuo Observatory (2006), The Zhangjiajie Observatory (2011), The Huangshan Observatory (2011), The Kanas Observatory (2012), The Henan Observatory (2015), The Changshu Observatory (2015), The Xishuangbanna Observatory (2015), The Jiangmen Observatory (2017). Japan: Gifu Sustainable Tourism Observatory (2023). Philippines: Batanes Tourism and Hospitality Monitoring Center (2023). Indonesia: Pangandaran Tourism Observatory (2016), Sleman Tourism Observatory (2016), Lombok Tourism Observatory (2016), Toba Lake Tourism Observatory (2017), Sanur Tourism Observatory (2017).
	Oceania	Australia: Australia's Southwest Tourism Observatory (2019).

Source: Own elaboration based on UNWTO-INSTO [42].

Thirdly, within the European Union, the European Commission, in collaboration with the Tourism Sustainability Group, introduced the European Tourism Indicators

System (ETIS) in 2013 to promote the sustainable management of destinations and coordinate these efforts within the European context. The ETIS proposal represents a significant step in establishing a common methodology for measuring the sustainability of destinations, with the first version released in 2013 and an updated version in 2016. Its primary objective is to offer an information framework, monitoring system, and management tool. The ETIS framework consists of four main sustainability sections: Destination management, economic value, social and cultural impact, and environmental impact. These sections are further subdivided into a total of 18 specific criteria (see **Table 3**).

The sections defined in the ETIS proposal incorporate elements already addressed by earlier initiatives, such as the GSTC and INSTO, as it was developed later. Its main aim is to provide a clear context for measuring tourism sustainability within the European framework, standardizing the process without overcomplicating its recommendations. The accompanying tables at the time of implementation were designed to make the system operational, user-friendly for destination managers, and effective in transmitting information between local and European supranational authorities. A key factor in its success is its ability to offer a unified framework for European tourism in the pursuit of sustainability, paired with regulatory simplicity.

Table 3. Sections and mandatory criteria of the ETIS (European Commission).

Section	Criteria
Section A: Destination Management	A.1. Public policy for sustainable tourism
	A.2. Customer satisfaction
Section B: Economic Value	B.1. Tourist flow (volume and value) in the destination
	B.2. Performance of tourism business(es)
	B.3. Quantity and quality of employment
	B.4. Tourism sector supply chain
Section C: Social and Cultural Impact	C.1. Community social impact
	C.2. Health and safety
	C.3. Gender equality
	C.4. Inclusion and accessibility
	C.5. Protection and valorisation of cultural heritage, identity, and assets
Section D: Environmental Impact	D.1. Reduction of transportation impact
	D.2. Climate change
	D.3. Solid waste management
	D.4. Wastewater treatment
	D.5. Water management
	D.6. Energy consumption
	D.7. Protection of biodiversity and landscape

Source: Own elaboration based on European Commission [12,13].

Finally, at the national level[11] and within Spain's regions, the State Society for the Management of Innovation and Tourism Technologies (SEGITTUR[12] [45]), under the State Secretariat for Tourism, aims to drive innovation in the Spanish tourism

sector and enhance the competitiveness of destinations through sustainability and accessibility, within the framework of the Smart Tourism Destination (DTI-Spain[13]) model. On 11 October 2018, the Network of Smart Tourism Destinations was officially established to foster synergies and facilitate knowledge transfer among its members. To join the DTI Network, destinations must commit to implementing actions that will help them achieve the DTI distinction, which is granted once they meet at least 80% of the criteria defined in the methodology[14]. After obtaining this distinction, destinations enter a continuous process of monitoring and renewing their DTI status.

The DTI management system is structured around five strategic pillars (see **Table 4**): Governance, innovation, technology, accessibility, and sustainability. Within the sustainability pillar, there are four sub-pillars: Environmental, socio-cultural, economic, and post-COVID safety, with an additional fifth sub-pillar that links these to the UN Sustainable Development Goals (SDGs). The initiative is currently seeking international recognition by publishing its methodological content through a coordinated effort between SEGITTUR and various universities in Spain. This effort is captured in the publication The Spanish Model for Smart Tourism Destination Management: A Methodological Approach, scheduled for release by Springer in 2024 [16].

Given the significant role of tourism in Spain—one of the world's leading destinations, where it accounts for approximately 12% of national GDP and employment, with more than 85 million international tourists and 70 million domestic tourists expected in 2024—the primary task for public managers has been to develop a clear, operational, and applicable methodology for measuring tourism indicators. This framework aims to ensure both present and future sustainability in tourism development. Key aspects include measuring the impact on local populations, preserving cultural heritage and vital environmental resources, and creating local economic opportunities. Additionally, coordination with other destinations in the DTI-Spain Network, through annual meetings, is vital for showcasing best practices and building a shared national vision for tourism development.

To operationalize the evaluation of tourism sustainability in the DTIs, SEGITTUR has defined a set of indicators for each sustainability sub-axis. These indicators specify not only their designation but also their description, justification, objectives, sources, measurement methods, calculation formulas, units, periodicity, and maturity level. The designation of each indicator outlines the aspects to be addressed within each sustainability sub-axis, aligning with the "criteria" used in the GSTC and ETIS systems and the "areas of analysis" in the INSTO framework. Consequently, the description of the sustainability strategic axis in the DTI management system, as shown in **Table 4**, is further detailed in **Table 5**, following a similar structure to that of the other initiatives described.

Although the DTI-Spain initiative is newer than the other three analyzed systems, its development has been rapid and effective, with 440 destinations and 619 network members, including businesses, local governments, and international collaborators.

Table 4. Strategic axes and sub-axes of the DTI-Spain model.

Strategic Axis	Sub-Axis/Area of Analysis
Governance	Government and management
	Planning
	Cross-sectional and coherent management
	Transparent management
	Performance evaluation
Innovation	Strategy
	Resources
	Identification and analysis of risks and opportunities
	Planning and evaluation
	Data protection and exploration
	Private involvement
	Identification of new tourist offers, promotion plans/actions, and destination tourism development
Technology	Telecommunications infrastructure
	Strategies and tools for smart DTI management
	Tools for promotion and interaction with tourists
	Technological tools and solutions for tourist interaction with the DTI
	Security and comfort of the DTI
Universal Accessibility	Public management
	Planning, information, and communication
	Transport (mobile equipment, vehicles)
	Tourist routes or itineraries
	Development of infrastructure, devices, or instruments that allow tourists to explore the destination
	Information and communication with the environment
Sustainability	Socio-cultural/Environmental/Economic
	Environmental
	Socio-cultural
	Economic
	Safe destination

Source: based on UNE [46].

A detailed analysis of **Table 5** reveals 31 indicators aligned with the UNE 178501 and UNE 178502 certification standards, which define the DTI model [46]. These indicators cover the economic, socio-cultural, and environmental dimensions of the model, as well as two complementary sub-axes: Safe destination and alignment with the SDG objectives. The economic sub-axis includes measures of tourism's impact on employment, local GDP, and contributions to local infrastructure and resources. It also addresses key aspects influenced by the global pandemic, such as safety plans and local healthcare capacity, which are critical to the resilience of the tourism and hospitality sectors.

The environmental sub-axis is extensive, comprising 18 detailed indicators focused on resource management and protection. It also incorporates contributions from the Smart City model in tourism, including the use of sensor technologies, human flow measurement, urban pedestrianization, and sustainable transportation options like bicycles. Additionally, it covers local environmental impacts such as noise, waste generation, climate change adaptation, green spaces, landscape conservation, water quality for bathing, and the use of renewable energy.

Table 5. Aspects considered in the sustainability axis of the DTI-Spain model.

Sustainability Strategic Axis	
Sub-Axis/Area of Analysis	**Indicators**
Socio-cultural/Environmental/Economic	S1 Achievement of the SDGs
Environmental	S2 Energy efficiency
	S3 Charging stations for electric vehicles
	S4 Waste management
	S5 Water management
	S6 Climate Change Adaptation Plan
	S7 Pollution map
	S8 Noise map
	S9 Water consumption in hotels
	S10 Bicycle lane
	S11 Bicycle use points
	S12 Urban pedestrianisation
	S13 Public parking sensorization
	S14 Water treatment and recycling
	S15 Green areas
	S16 Landscape protection
	S17 Protected natural areas
	S18 Quality of bathing waters
	S19 Energy consumption from renewable sources
Socio-cultural	S20 Heritage protection
	S21 Distinguished destination resources
	S22 Tourist participation in local activities
Economic	S23 Tourism employment
	S24 Unemployment rate
	S25 Impact on the local community
	S26 Tourism contribution to GDP
	S27 Tourism contribution to local infrastructure
	S28 Common resources, infrastructure, and/or services generated and maintained by tourism
	S29 Safety/Contingency/Resilience Plans
	S30 Healthcare capacity
Safe destination	S31 Degree of openness of DTI tourist accommodations

Source: Own elaboration based on UNE [46].

The socio-cultural sub-axis is more limited, although it can be expanded as destinations implement the model, as seen with the INSTO framework. Notably, this sub-axis includes indicators related to tourist care and healthcare capacity, particularly in the context of health emergencies like those experienced during the pandemic.

4. Discussion

Comparative analysis of the four indicator systems

This section provides a comparative analysis of the four proposed systems for tourism sustainability indicators, highlighting their similarities, key differences, and their capacity to address the needs identified in the literature review. Overall, there is significant alignment across the four proposals in terms of the areas and concepts covered by their indicators. As shown in **Table 6**, while the INSTO proposal defines more specific mandatory monitoring areas than the GSTC-D, ETIS, and DTI-Spain frameworks, all share notable similarities in their broad definitions of the objectives and aspects they analyze.

All four proposals emphasize destination management and governance, though with varying levels of detail. The GSTC outlines three key criteria: The administrative and management structure, stakeholder participation, and the management of pressure and change. The UNWTO-INSTO proposal includes a general governance criterion and another related to local satisfaction, while the ETIS focuses on public policy for sustainable tourism and customer satisfaction. In contrast, the DTI does not treat governance as a specific element of sustainability; instead, it addresses this dimension as part of an entire strategic axis separate from the sustainability axis.

The four proposals also explicitly cover the three main dimensions of tourism sustainability: Economic, socio-cultural, and environmental. The GSTC model stands out for its comprehensive approach, guiding destinations across all three areas of sustainability. However, it requires more extensive data for evaluation, including both tangible aspects and intangible ones, such as the economic contribution of tourism. The ETIS framework aims to provide a standardized approach for measuring sustainability across Europe, including additional relevant issues such as health and safety, gender equality, and reducing transportation-related emissions.

The DTI model is particularly detailed in the environmental and economic dimensions, though it is more limited in addressing socio-cultural aspects. It places significant emphasis on preserving and valuing cultural heritage and local resources but is less specific about actions related to social sustainability. On the other hand, the UNWTO-INSTO proposal, which may be simpler in terms of measurement, offers a more flexible framework, allowing destinations to expand their focus based on local characteristics. Notably, the socio-cultural dimension is one of the least emphasized in the initial UNWTO-INSTO proposal. It only considers accessibility within the social domain, excluding cultural aspects as mandatory, despite the 2004 UNWTO indicators guide stressing their importance (UNWTO) [44]. However, the socio-cultural dimension is expanded by observatories within the INSTO network, which develop additional monitoring areas tailored to their specific needs.

In general, the economic and environmental sustainability dimensions are more clearly defined across all four proposals, with a higher number of indicators and

greater specificity. In contrast, the socio-cultural aspects, beyond the preservation and valorization of tangible heritage, are often left to the discretion of individual destinations, with more emphasis in the GSTC and ETIS proposals. Similarly, governance, institutional management, and coordination are more clearly defined in the GSTC and DTI models, with the DTI including a separate axis for governance, although some of its governance indicators overlap with those focused on economic sustainability in other frameworks.

Accessibility is recognized as a strategic axis in the DTI system, but is not explicitly included within the sustainability domain, unlike the other proposals which integrate it as a social aspect for achieving more sustainable tourism. Additionally, the DTI management system is unique in considering a sustainability sub-axis called "safe destination", which addresses the destination's preparedness for emergencies, pandemics, and other crises. The DTI proposal also stands out for including a sub-axis titled "socio-cultural/environmental/economic sustainability", designed to measure progress toward achieving the United Nations' SDGs.

It is noteworthy that, although the four proposals for measuring tourism sustainability diverge in certain aspects, these differences are largely due to their launch timing—some being introduced earlier, such as the INSTO—and their specific focus, like the GSTC's industry-centered approach. Despite these variations, all four share common criteria for destination management, governance, and the economic, socio-cultural, and environmental dimensions. They also emphasize the need for continuous adaptation to sustainability in response to emerging challenges and advancements in the global tourism sector. The four proposals (GSTC, INSTO, ETIS, and DTI) all aim to support policymakers in enhancing the sustainability of tourism destinations. To achieve this, it is crucial that the indicators strike a balance between operability and rigor [17], while also allowing for ongoing adaptation of the measurement tools. For example, the GSTC plans to release a new version in December 2024, while ETIS implements a triennial data review with improvements and additional indicators. The DTI-Spain system conducts diagnostic reviews every two years, incorporating new contributions to its indicator system through integration with other areas of national tourism policy, such as tourism quality evaluation. Likewise, the European ETIS proposal is periodically updated with new, specific indicators for destinations. As for INSTO, it proposes reviews during the first three years of observatory membership, allowing destinations to monitor only nine of the eleven mandatory areas in the first year.

Additionally, the GSTC proposal sets a clear minimum performance threshold that destinations must meet to be considered sustainable. In contrast, DTI-Spain provides specific achievement ranges for each indicator. However, this threshold is less defined in the other two initiatives. ETIS aims to establish a path towards a sustainable framework at the EU level, while the INSTO model offers greater flexibility in defining certain indicators, allowing each destination to customize them. Therefore, it is crucial to establish target values for each destination, so that the threshold for achieving sustainable destination status and evaluating sustainability actions is clearly identifiable. Jurado-Rivas and Sánchez-Rivero [47] emphasize this point, outlining criteria for selecting indicators that should provide reliable, credible information, allow for spatial and temporal comparisons, reflect the interests of

political representatives, highlight weak points, offer an intermediate view of the examined issue, and be representative of the concepts being analyzed.

In conclusion, the four proposals analyzed converge towards a methodology for measuring tourism sustainability that is becoming more consensual and is reflected in international frameworks. All identify data generation challenges in their implementation, with significant gaps in data availability at the local level. There is also a continuing need to improve coordination among key destination stakeholders through stronger Destination Management Organizations (DMOs), and to enhance participation and communication channels between residents—who directly experience the impacts of tourism development—and the local administration and industry, who are ultimately responsible for the destination's sustainable development.

Table 6. Relationship of the main sustainability evaluation lines considered in GSTC-D, INSTO, ETIS, and DTI model.

Sections/Criteria of GSTC-D	Areas of INSTO	Sections/Criteria of ETIS	DTI-Spain
Section: A) Sustainable Management		**Section: Destination Management**	
A (a) Administrative and Management Structure			
A1 Destination Management Responsibility			Present in the Governance Axis
A2 Destination Management Strategy and Action Plan	Governance	A.1. Public policy for sustainable tourism	
A3 Monitoring and Reporting			
A (b) Stakeholder Participation			
A4 Business Participation and Sustainability Standards			
A5 Resident Participation and Feedback	Local satisfaction		
A6 Visitor Participation and Feedback		A.2. Customer satisfaction	
A7 Promotion and Information			
A (c) Pressure and Change Management			
A8 Visitor and Activity Volume Management			
A9 Land Use and Development Control Regulations			
A10 Climate Change Adaptation			
A11 Risk and Crisis Management			

Table 6. (*Continued*).

Sections/Criteria of GSTC-D	Areas of INSTO	Sections/Criteria of ETIS	DTI-Spain
Section: B) Socio-Economic Sustainability		**Section: Economic Value**	**Sub-axis: Economic**
B (a) Local Economic Benefits Contribution			
B1 Understanding Tourism's Economic Contribution	Tourism Seasonality	B.1. Tourist flow (volume and value) in the destination	S24 Unemployment rate S26 Tourism contribution to GDP
	Economic Benefits of the Destination	B.2. Performance of tourism business(es) B.4. Tourism sector supply chain	S29 Safety/Contingency/Resilience Plans S30 Healthcare capacity S28 Common resources, infrastructure, and/or services generated and maintained by tourism S26 Tourism contribution to GDP S27 Tourism contribution to local infrastructure S25 Impact on the local community
B2 Decent Work and Professional Opportunities	Employment	B.3. Quantity and quality of employment	S23 Tourism employment
B3 Support for Local Entrepreneurs and Fair Trade			
		Section: Social and Cultural Impact	**Sub-axis: Socio-cultural**
B (b) Social Wellbeing and Impacts			
B4 Community Support		C.1. Community social impact	
B5 Prevention of Exploitation and Discrimination		C.3. Gender equality	
B6 Property Rights and Use			
B7 Security and Surveillance		C.2. Health and safety	
B8 Access for All	Accessibility	C.4. Inclusion and accessibility	

Table 6. (*Continued*).

Sections/Criteria of GSTC-D	Areas of INSTO	Sections/Criteria of ETIS	DTI-Spain
Section: C) Cultural Sustainability			
C (a) Cultural Heritage Protection			
C1 Protection of Cultural Assets		C.5 Protection and valorisation of cultural heritage, identity, and assets	S20 Heritage Protection
C2 Cultural Artifacts			S21 Distinguished destination resources
C3 Intangible Heritage			
C4 Local Access			
C5 Intellectual Property			
C (b) Visits to Cultural Sites			
C6 Visitor Management at Cultural Sites			S22 Tourist participation in local activities
C7 Site Interpretation			
Section: D) Environmental Sustainability		**Section: Environmental Impact**	**Sub-axis: Environmental**
D (a) Natural Heritage Conservation			
D1 Protection of Vulnerable Environments		D.7. Protection of biodiversity and landscape	S15 Green Areas
			S16 Landscape Protection
			S17 Protected Natural Areas
D2 Visitor Management at Natural Sites			
D3 Wildlife Interaction			
D4 Species Exploitation and Animal Welfare			
D (b) Resource Management			
D5 Energy Conservation	Energy Management	D.6. Energy consumption	S2 Energy efficiency
			S19 Energy consumption from renewable sources
D6 Water Management	Water Management	D.5. Water management	S5 Water management: Loss of potable water from the DTI supply network
			S9 Water consumption in hotels
D7 Water Quality			S18 Quality of bathing waters

Table 6. (*Continued*).

Sections/Criteria of GSTC-D	Areas of INSTO	Sections/Criteria of ETIS	DTI-Spain
Section: D) Environmental Sustainability		**Section: Environmental Impact**	**Sub-axis: Environmental**
D (c) Waste and Emissions Management			
D8 Wastewater	Wastewater Management	D.4. Wastewater treatment	S14 Water treatment and recycling
D9 Solid Waste	Solid Waste Management	D.3. Solid waste management	S4 Waste management
D10 Greenhouse Gas Emissions and Climate Change Mitigation	Climate Action	D.2. Climate change	S6 Climate Change Adaptation Plan
			S7 Pollution map
D11 Low-Impact Transportation		D.1. Reduction of transportation impact	S3 Electric vehicle charging points
			S10 Bicycle lane
			S11 Bicycle use points
			S12 Urban pedestrianisation
			S13 Public parking sensorization
D12 Light and Noise Pollution			S8 Noise map
			Sub-axis: Safe Destination
			S31 Degree of openness of DTI tourist accommodations
			Sub-axis: Socio-cultural/Environmental/Economic
			S1 Achievement of the sustainable development goals

Source: Own elaboration based on Global Sustainable Tourism Council [41], UNWTO-INSTO [42], European Commission [12,13], and UNE [46].

5. Conclusions

The tourism industry has grown significantly since the late 20th century, becoming the third-largest sector in global exports by 2019. However, the COVID-19 pandemic in 2020 severely impacted the sector, closing national borders and restricting global mobility. By 2023 and 2024, international tourism has rebounded, reaching levels similar to those before the pandemic. Yet, the movement of one billion international travelers annually—whether for leisure or business—presents a significant challenge for tourist destinations. This has brought the debate around sustainable tourism to the forefront, urging not only future generations but also current ones to consider its implications.

To address this challenge, various key sector forums have developed systems for measuring tourism sustainability, focusing on three main dimensions: Economic, socio-cultural, and environmental. This study examines four prominent proposals at the international, European, and Spanish levels: The Global Sustainable Tourism Council (GSTC), the UNWTO's International Network of Sustainable Tourism Observatories (INSTO), the European Tourism Indicator System for Sustainable Destination Management (ETIS) developed by the European Commission, and the DTI Model from the Spanish Ministry of Tourism.

One key observation is the high complexity involved in implementing tourism sustainability indicator systems (STIs) at destinations by both public and private managers. The first critical issue that arises is the need to identify and accurately define

the issues to be measured—a task primarily led by international public institutions such as the UNWTO under the United Nations, and the European Commission. There are also significant private initiatives in this area, such as the GSTC. The contributions of these institutions in establishing a universally accepted model of sustainability indicators are invaluable, as they have laid the groundwork for creating a framework that can be applied across the global tourism sector. Efforts at the national and regional levels are also evident, including the work of Spain's Ministry of Tourism, whose DTI model is featured in this study.

The next challenge is generating or identifying the appropriate data to measure these indicators at each destination. Public and private leadership plays a crucial role in this process, requiring skilled professionals and financial investment. However, collaboration among stakeholders is essential—both in data generation and in its effective application through public policies or private best practices in businesses. This underscores the importance of developing indicator systems that are not only understandable for those who implement them but also balanced to ensure they are effective tools for measuring sustainability. This remains a critical issue, as recent studies highlight that the practical applicability of STIs is still incomplete and has only been partially addressed by local destination managers [18,28,48]. Furthermore, monitoring of recent applications reveals a need to simplify data frameworks and the information request process, while also enhancing the training of public servants responsible for their implementation [9,11].

All four proposals analyzed reveal significant informational demands. The INSTO and ETIS frameworks provide greater flexibility for destinations to define their own structure, allowing stakeholders to participate in the design of the tourism sustainability indicators (STIs). This participatory approach, highlighted in the literature, is a key factor for ensuring the successful performance of the process [49–51]. The DTI-Spain model also incorporates a collaborative approach, particularly within the governance axis of its proposal. Similarly, the GSTC-D introduces a feedback mechanism for business, resident, and visitor participation within the stakeholder engagement criteria. Thus, each proposal includes a collaborative management dimension to ensure effective and inclusive governance, though each follows a unique focus. For example, the DTI model links governance not only to sustainability but also to other critical factors, such as innovation, technology, and universal accessibility.

In the second phase of the comparative analysis, we observed a growing international consensus and maturity in the approach to defining concepts and indicators. All four proposals effectively define the four core sections of STIs: Governance or management systems, and the economic, socio-cultural, and environmental sustainability dimensions. While economic and environmental issues are consistently addressed across all proposals, cultural and social aspects are sometimes less clearly defined or absent. For instance, the INSTO and DTI systems allow destinations the flexibility to identify and address gaps in these areas. Additionally, all four proposals identify data sources clearly, which is another key challenge for the successful application of STIs today. The DTI-Spain model provides destinations with specific data sources and definitions for the indicators to be computed, a practice also followed by the other three frameworks. Moreover,

thresholds for value of indicators are clearly defined in the DTI-Spain and GSTC models, while ETIS adopts a more flexible range, focusing on sustainability as a broader goal rather than as a strict measurement framework. The INSTO approach offers greater flexibility for destinations, allowing them to customize several indicators based on local needs.

Overall, the present study has shown a clear convergence towards a shared model of STIs at the international level. The nature and consistency of this model have significantly improved over the past decade, with rigorous proposals developed to address the critical task of ensuring the sustainability of current tourism destinations [9]. These systems continue to evolve to meet the demands of a constantly changing global landscape. For example, DTI-Spain introduced an analysis area called "Safe Destinations", which became especially relevant during the COVID-19 pandemic, highlighting the importance of considering emergency situations. Another notable development is the alignment of both the GSTC and DTI systems with the United Nations' Sustainable Development Goals (SDGs), providing a global framework for sustainability.

Despite these advances, significant challenges remain in the application of indicator systems, as highlighted in recent literature. A gap still exists between the definition of STIs and their practical application. More importantly, extracting actionable managerial guidance for destination stakeholders remains a critical issue. This study has aimed to shed light on the complexities of tourism sustainability and the strategies needed to achieve it, contributing to the ongoing reflection on this subject and encouraging improvements. The complexity of the topic has been evident, underscoring its relevance for the future of the tourism sector.

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Notes

1 Global Sustainable Tourism Council [41].
2 European Tourism Indicators System for sustainable destination management (ETIS) [12,13].
3 Tourism and Environment Reporting Mechanism (TOUERM).
4 Network of European Regions for Sustainable and Competitive Tourism (NECSTour).
5 International Network of Sustainable Tourism Observatories (INSTO-UNWTO) [42].
6 International Sustainability and Environmental Accreditation and Labeling Alliance (ISEAL) [43].
7 The first version was launched in 2008 and the second in 2012.
8 The review of destination criteria is carried out periodically, at intervals of no less than five years. The first version was launched in 2013, the second in 2019, and a third is planned for 2024.
9 See UNWTO [44].
10 See UNWTO [42].

[11] Although the proposal is primarily national, it is also being used in six associated South American destinations.
[12] Agency of the Ministry of Industry, Commerce and Tourism [45].
[13] https://www.destinosinteligentes.es/
[14] https://www.destinosinteligentes.es/metodologia-dti/

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