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Evaluating destinations' efforts to improve sustainability in tourism using the inter-temporal decomposition of a composite indicator

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A B S T R A C T

Sustainable tourism indicators are instruments for measuring tourism sustainability, widely used in the planning and decision-making processes. For this measurement, in recent decades composite indicators have been proposed that provide dynamic evaluations to assess the progress that each destination registers towards more sustainable situations. However, the measures proposed so far do not allow the evaluation of each destination's own effort or the effectiveness of the measures put in place, because the evaluation they provide depends on the decisions made when adding information (weighting, reference situations…). In this study, a dynamic measure of sustainable tourism is proposed, which, through the intertemporal decomposition of a global indicator with multiplicative aggregation, assesses the effort that each destination makes to improve its sustainability situation. The aggregation procedure is carried out in two stages. In the first one, a compensatory synthetic indicator is obtained for each aspect using a weighting scheme determined from information and dispersion criteria. In a second phase, the global composite indicator is obtained with a multiplicative aggregation, setting unique and common weights for all destinations through DEA models and using different benchmarks for each type of destination, in order to take into account their different starting situations.

1. Introduction

The main goal of public policy analysis is to help managers make the right decisions. To do so, they must start from the systematic collection of information that allows them to assess the actions put in place. Likewise, managers must establish clearly defined, realistic, quantifiable objectives, specifying the results that are expected and the date on which they are anticipated to be achieved.

In this context, it is necessary for there to be some measurement mechanism that allows checking if the proposed objectives have been attained, based on an exhaustive diagnosis of the initial situation. And it can be affirmed that in the area of the evaluation of public policies, indicator systems and composite indicators play a fundamental role. These allow finding out the degree of fulfillment of the objectives set by the managers. Having these tools makes it possible to perceive both the starting situations and the evolution, in the form of progress or regression, after the application of a measure. That is why they will be essential in decision-making processes.

In the field of tourism, this is the approach of the United Nations World Tourism Organization (UNWTO). Proof of this is not only the different studies that have been carried out on the matter in recent decades (UNWTO (United Nations World Tourism Organization), 1996, UNWTO, 2004, 2016, 2018), but also, for example, the new UNWTO Tourism Recovery Tracker (UNWTO, 2022), a free tool, the result of a partnership between international organisations and the private sector, which quantifies key performance indicators for tourism. The collection of relevant data by months, regions and sub-regions in one place allows public managers and private companies to track the recovery of tourism at the global and regional levels.

In this line of work, in the literature there are works that use analytical measurement instruments to measure the degree of tourism sustainability taking into account the social, economic and environmental aspects that determine it (Mitchell, 1996; Lu and Nepal, 2009; Penny and Li, 2013; Blancas et al., 2015, 2016; Pérez et al., 2013, 2017; Lozano et al., 2019a, 2019b).

Following this line, in this paper a study of the sustainability of tourist destinations is carried out, starting from the quantification of a system of indicators, grouped into three dimensions (social, economic and environmental), each of these dimensions including a series of aspects of sustainability quantified by different sustainable tourism

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indicators (UNWTO (United Nations World Tourism Organization), 1996). In order to facilitate the use of the information provided by this system, our proposal is to define a composite indicator.

A composite indicator (CI) is a mathematical aggregation of individual indicators to measure a multidimensional concept using a global unique valor. These CIs have been increasingly incorporated as a useful tool in a wide variety of contexts in economics, environmental sciences, and social sciences. The main reason for this extensive use of CIs in multiple fields is based on their straightforward interpretation and the possibility of an easier evaluation of complex phenomena, faciliting its synthesis and analysis. Other advantages that support the use of these tools are: the assessment of the progress over time, the inclusion of new information without size limits, placing the evaluated issues at the center of the policy debate, facilitating communication and understanding of the general public and, finally, enabling the comparison of complex dimensions by users.

A review of the literature on this subject reveals that although these analytical tools have been used to measure tourism sustainability for several decades, there is still no consensus on the aspects to be included in the indicator systems, nor on the methodology for calculating the composite indicators (Pulido and Sánchez, 2009; Kristjánsdóttir et al., 2018; Punzo et al., 2022).

Regarding the issues to consider when defining indicator systems, this work is based on the systems proposed by different international organisations (United Nations Commission on Sustainable Development, 2001; OECD (Organisation for Economic Co-operation and Development), 2005, OECD, 2008; UNEP (United Nations Environment Programme), 2007; UNWTO, 2004; European Commission, 2016), as well as the analysis of works that have been developed at the regional and local level (Blancas et al., 2010a,b, Blancas and Lozano-Oyola, 2022; Tanguay et al., 2010, 2013; Rajaonson and Tanguay, 2012, 2019; Lozano-Oyola et al., 2012).

Regarding the construction of the synthetic indicator, there is no consensus as to how it is calculated. Depending on whether or not the inclusion of compensation among the system's indicators is taken into account, the different methodologies fall into two large groups: compensatory and non-compensatory composite indicators. The main difference between them is in the way of interpreting the weights assigned to the starting indicators and the degree of compensation allowed between them.

The compensatory additive indicators allow the marginal contribution of each variable to be assessed separately, assuming that there is no synergy or conflict between the aspects quantified in the system. In this case, the weights show the exchange ratios between the initial indicators, without representing their relative importance (Munda and Nardo, 2009; Decancq and Lugo, 2013). Likewise, the values of the synthetic indicator show the net result obtained by admitting the complete and constant compensability between the indicators of the system (the strengths of some indicators can compensate for the weaknesses of others).

On the contrary, non-compensatory type methodologies assume the absence of compensation between indicators, assigning values to the weights that represent coefficients of importance (Paruolo et al., 2013). These noncompensatory aggregation techniques are defined using a discrete noncompensatory multicriteria approach (OECD, 2008), assuming the absence of preferential independence (Munda, 1995; Roy, 1996; Vincke, 1992).

Another distinction in the way of calculating the synthetic indicators refers to whether they allow tourism sustainability to be studied from a static or a dynamic point of view.

In this context, the static measures of sustainability that offer a description of the situation of a destination at a specific moment in time, do not seem to permit by themselves the evaluation of the process that leads to the objective of sustainable tourism (Dahl, 2012). For this reason, the trend in recent years is to move towards the definition of dynamic-type measures, focused on the evaluation of the progress registered in terms of sustainability (Ko, 2001, 2005; Mahdavi et al., 2013). Responding to this need, recent proposals can be found in the literature where vector-type indicators are defined from initial indicators that enable grading movements towards sustainable positions, instead of only evaluating the absence of sustainability (Blancas et al., 2016). Specifically, the components of the vectorial indicator grade the progress or regress of the destination with respect to the sustainability of its performance at a global level, considering the differences that exist between the contexts of each destination, being able to incorporate differentiated reference values for each type of destination (Blancas et al., 2018).

However, these proposals have an important limitation in the sustainable tourism area: the registered evolution may be influenced by the evolution of the reference values set in each period for each type of destination. This is due to the lack of targets set at the international level by international organisations for the indicators of sustainable tourism considered in the systems proposed for its evaluation. The existence of consensus on this matter allows dynamic measures to be obtained in other areas that overcome this limitation, although it is still an issue in development (Carrillo, 2022; Landaluce-Calvo and Gonzalo-Delgado, 2021). Thus, it is not possible to analyse the effort of each destination to improve its sustainability situation in the tourism sector and evaluate the policies developed in the territory.

To overcome this limitation, this paper proposes a dynamic indicator of sustainability that allows an isolated analysis of the effort that each destination makes in the evaluation period, admitting different degrees of compensation in the information of the initial system.

To do this, for each period, a synthetic measure of sustainability is constructed that uses a method of aggregation by phases, which admits total compensation between the indicators that are part of the same concept. And it uses a multiplicative aggregation to reach a global indicator of sustainability, admitting a lower compensation between the aspects of sustainability considered and using a different reference situation for each type of destination, depending on its characteristics. Thus, a measure is sought whose information can be used effectively within the planning processes, facilitating the identification of aspects that require greater attention by tourism managers, given the easy determination of the weaknesses of each area.

Using the decomposition of the indicators, a dynamic composite indicator is defined that makes it possible to distinguish what part of the improvement in the sustainability situation of each destination is due to the efforts made by the destination, eliminating the influence of the fixed registered evolution by the benchmarks set in each case (Fuchs and Weiermair, 2004; Kozak, 2004, 2014; Luštický and Kincl, 2012; Zlatković, 2016; Vinyals-Mirabent, 2019).

As a result, this paper offers an easy-to-use and interpret tool that enables policy-makers to analyse the tourism sustainability of destinations.

To show the applicability of the proposed methodology, a practical case is shown in this paper. To this end, the destinations with the greatest tourist demand in the region of Andalusia, located in the south of Spain, have been chosen. Being aware of the important repercussions that the COVID 19 pandemic has had at a global economic level, and especially with regard to tourism, in order to avoid distortions that the effects of the pandemic may have on the study, the proposed study was carried out in 2014 and 2019.

The rest of the paper is structured as follows. Section 2 presents the methodology proposed for the definition of a composite indicator that allows measuring sustainability from a dynamic point of view. In Section 3 an empirical application of the proposed methodology is carried out, analysing the tourism sustainability of the municipalities with the highest tourism demand in Andalusia (Spain). The work's main conclusions are presented in Section 4.

2. Sustainability dynamic evaluation methodology: a composite indicator's intertemporal decomposition

This section presents the methodology used to define a composite indicator that provides a dynamic evaluation in terms of sustainability in a set of tourist destinations. This methodology is summarised in Fig. 1 and has been defined following international guidelines (UNWTO, 2004; OECD, 2008; Munda and Nardo, 2005).

To do so, firstly, the theoretical framework is established to assess the degree of tourism sustainability of a destination and the indicators that make up the starting system are presented. Subsequently, the first phase of the aggregation process is introduced based on the implementation of a compensatory method to obtain composite indicators for each evaluated aspect. Using the information from the compensating indicators of the aspects, a second phase of geometric aggregation is implemented that uses a set of common weights, determined by models based on the Benefit of the Doubt approach, to obtain global synthetic indicators. Finally, a dynamic evaluation composite indicator is obtained from the global synthetic indicators, whose inter-temporal decomposition allows quantifying the efforts made by each destination to improve its sustainability situation.

2.1. Theoretical framework: Initial sustainable tourism indicators system

The theoretical framework of a composite indicator requires a clear operational conception of the phenomenon being evaluated: sustainable tourism. International practice in this field seeks the operability of concepts by dividing them into dimensions and providing them with a detailed content, setting the aspects that need to be evaluated in each case.

This disaggregation is largely determined by the practical usefulness of the proposed measure with which the synthetic indicator is constructed (Blancas and Lozano-Oyola, 2022). This study defines a sustainability indicator that permits analysing the evolution registered by the destinations, taking into account the starting situation of each one, its different characteristics and the evolution that the point of reference (or benchmark) that has been taken as reference experience in the evaluation period. In this way, an indicator with a differentiated evaluation is sought that enables isolating each territory's own effort.

To this end, this study operationalises the concept of sustainable tourism by breaking it down into three basic dimensions: social, economic and environmental. Within each dimension, the aspects of sustainability that need to be assessed from an institutional perspective are identified (UNWTO (United Nations World Tourism Organization), 1996; UNWTO, 2004). This perspective has strong international support and guarantees the full integration of the proposed measure into the planning processes of the sector (Padin, 2012).

Likewise, other aspects of sustainability are incorporated that complete the previous ones, taking as a reference empirical studies that evaluate tourism sustainability at different territorial levels (Tanguay et al., 2013; Eckert and Hartmann, 2020; Alfaro et al., 2020; Rasoolimanesh et al., 2020; Ivars-Baidal et al., 2021; Font et al., 2021). In any case, the selection of aspects focuses on the identification of the key issues that must be managed in any type of tourist destination.

The quantification of each aspect of sustainability is carried out using the most appropriate indicators in each case, taking into account their applicability and the official statistical information available for disaggregated territorial levels. The selection of these indicators is performed employing the following protocol.

1) A list of potential indicators for each aspect of sustainability is drawn up based on a review of the literature (Blancas et al., 2011; Lozano-Oyola et al., 2012; Tanguay et al., 2013; Poudel et al., 2014; Schernewski et al., 2014; Wang et al., 2016; Law et al., 2017; Karnauskaite et al., 2019; Lee et al., 2021; Blancas and Lozano-Oyola, 2022). 2) the selection criteria that allow identifying the most suitable indicators for each aspect (information usability, frequency of use, relevance, conceptual contribution, representative character, the possibility of quantification and replication over time) are established. 3)

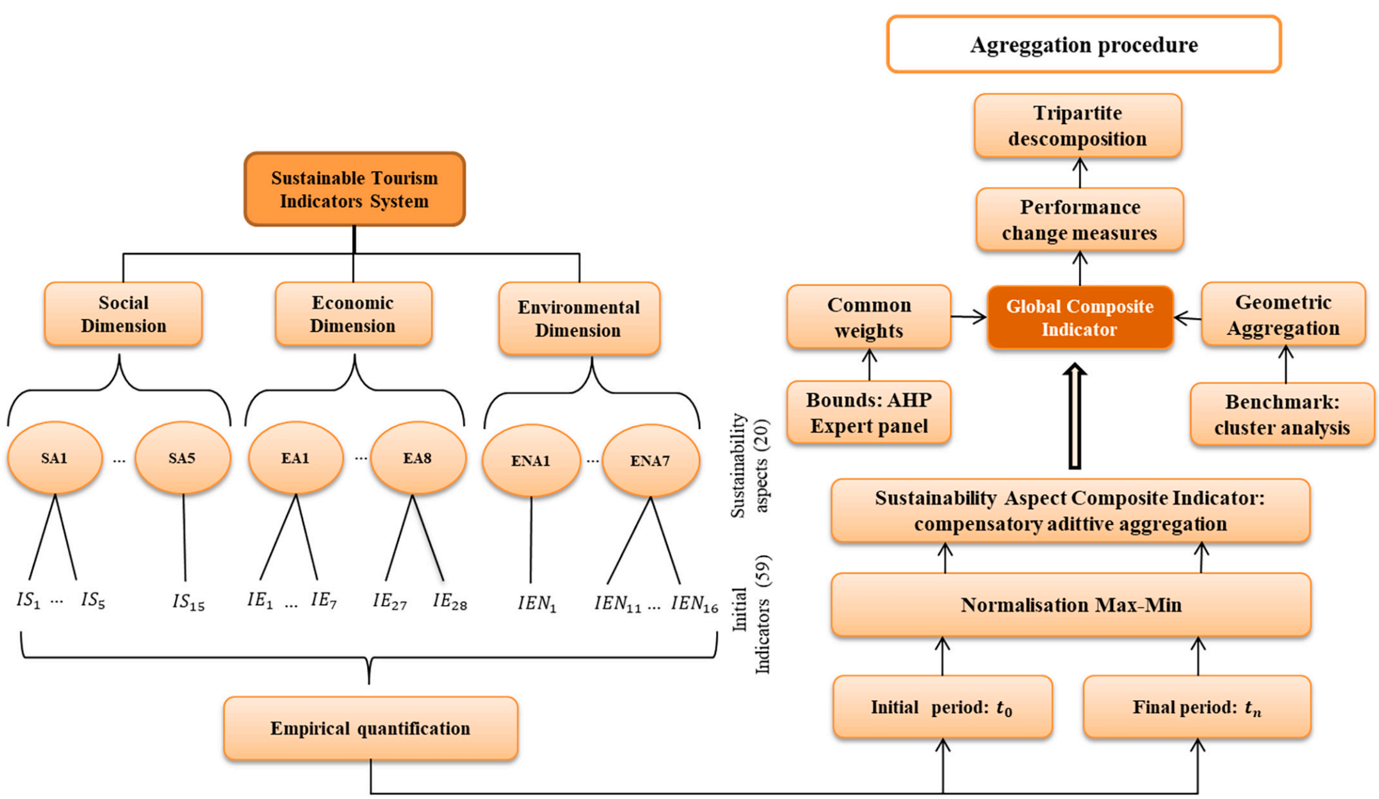


Fig. 1. Aggregation methodology proposed: graphical abstract.

Selection criteria assess the suitability of each potential indicator. Those which achieve more of them are selected.

Finally, following the guidelines established by international organisations (European Commission, 2016; UNWTO, 2004), how each indicator represents its aspect of sustainability and its relevance is analysed. This information is included in an interpretation guide associated with each system indicator (which is not included in this study due to its length).

The indicator system finally chosen is made up of 20 sustainability aspects and 59 indicators (Tables 1-3).

For each indicator, its direction of variability is set according to its relationship with the aspect of sustainability evaluated. The indicator is positive when the increase in value improves the sustainability situation, and it is negative otherwise.

From a social point of view, the positive indicators focus on those aspects that either produce an improvement in the socio-cultural effects of tourism on the host community or the local public safety, or they contribute to the conservation of cultural heritage and the maintenance of population levels. The indicators destined to measure the pressure of tourism on the sites and systems that support the tourist activity of the territory, are considered negative, aiming to control and minimize the potential and suffered damage. As far as the economic dimension is concerned, the negative indicators are limited to the control of unemployment levels and the dimension of the non-regulated accommodation offer. Finally, from an environmental point of view, the direction of negative variability is set for the indicators that quantify the pressure of tourism activity on natural resources, as well as the control of waste generation at source and the consumption of energy resources.

The sustainability evaluation methodology proposed in this work is based on the measurement of the evolution registered in the municipality between two moments of time that are denoted by t_0 and t_n (with $t_n > t_0$). Thus, it is a dynamic evaluation that permits the progress or regression of the destination to be graded in terms of sustainability for a period that adjusts to the duration of the tourism plans implemented in the destination. To do this, a first step consists of quantifying the indicators of the system for the two periods considered.

Taking the quantification of the system for the periods t_0 and t_n as a

Table 1
Social sustainability dimension.

Sustainability aspects	Indicators	Notation	Sign
SA1: Socio-cultural effects of tourism on host community	Health care equipment	I_{S1}	Positive
	Number of pharmacies per habitant	I_{S2}	Positive
	Number of passenger transport vehicles per habitant	I_{S3}	Positive
	Number of financial establishments per habitant	I_{S4}	Positive
	Number of services sector establishments per habitant	I_{S5}	Positive
SA2: Local public safety	Evaluation of destination safety by tourists	I_{S6}	Positive
SA3: Conservation of cultural heritage	Number of cultural assets	I_{S7}	Positive
	Pressure on cultural heritage	I_{S8}	Negative
SA4: Effects on national population structure	Variation of population level	I_{S9}	Negative
	Percentage of young population	I_{S10}	Positive
	Percentage of non-active older population	I_{S11}	Negative
	Population density	I_{S12}	Negative
	Vegetative growth	I_{S13}	Negative
	Net migration rate	I_{S14}	Negative
SA5: Social carrying capacity of the destination	Ratio of tourists to locals	I_{S15}	Negative

Source: Own elaboration.

Table 2
Economic sustainability dimension.

Sustainability aspects	Indicators	Notation	Sign
EA1: Economic benefits of tourism for the host community and destination	Total number of tourist arrivals	I_{E1}	Positive
	Average length of stay	I_{E2}	Positive
	Tourism revenues	I_{E3}	Positive
	Percentage of employees in the services sector with respect to total employment	I_{E4}	Positive
	Unemployment rate	I_{E5}	Negative
	Net national available income per inhabitant	I_{E6}	Positive
	Income from access/use of community tourist attractions	I_{E7}	Positive
EA2: Sustaining tourist satisfaction	Global satisfaction level of tourists	I_{E8}	Positive
	Evaluation of the price–quality relationship by tourists	I_{E9}	Positive
EA3: Development control	Existence of land use planning. Including tourism	I_{E10}	Positive
	Income from fines for urban planning infractions	I_{E11}	Positive
EA4: Tourist offers - providing visitors with a variety of experiences	Vacancies in official tourism accommodation establishments	I_{E12}	Positive
	High quality vacancies of official tourism accommodation establishments	I_{E13}	Positive
	Number of non-official tourism accommodation establishments	I_{E14}	Negative
	Tourist catering and restaurant service establishments	I_{E15}	Positive
	Number of tourist information offices per tourist	I_{E16}	Positive
	Existence of a website that provides information about the destination	I_{E17}	Positive
EA5: Seasonality of tourism activity	Percentage of official tourism accommodation establishments that are open all year	I_{E18}	Positive
	Ratio of low-season tourists to peak-season tourists	I_{E19}	Positive
EA6: Tourism employment	Percentage of permanent jobs in the tourism sector	I_{E20}	Positive
	Total number employed in the tourism sector	I_{E21}	Positive
	Percentage of employees in the tourism sector with respect to the total volume of employment	I_{E22}	Positive
	Percentage of permanent contracts registered with respect to the total contracts	I_{E23}	Positive
	Percentage of registered contracts for highly trained employees	I_{E24}	Positive
EA7: Tourism-related transport	Number of passenger transport vehicles	I_{E25}	Positive
	Density of roads	I_{E26}	Positive
EA8: Destination competitiveness	Average occupancy rate for official tourism accommodation establishments	I_{E27}	Positive
	Number of entities certified with a Q for tourism quality	I_{E28}	Positive

Source: Own elaboration.

Table 3
Environmental sustainability dimension.

Sustainability aspects	Indicators	Notation	Sign
ENA1: Protection of the natural ecosystems	Percentage of the destination's surface considered to be a protected natural area	I_{EN1}	Positive
ENA2: Energy management	Energy consumption per person and day	I_{EN2}	Negative
	Energy consumption of renewable resources per person and day	I_{EN3}	Positive
ENA3: Management of solid urban waste	Volume of waste collected	I_{EN4}	Positive
	Volume of waste generated at destination per person per day	I_{EN5}	Negative
	Tourist's perception of destination cleanliness	I_{EN6}	Positive
ENA4: Atmospheric pollution	Air pollutant emissions	I_{EN7}	Negative
ENA5: Management of the visual impact of facilities and infrastructure	Construction density per unit area	I_{EN8}	Negative
	Total surface with erosion problems	I_{EN9}	Negative
ENA6: Intensity of tourist use	Total tourists per unit area	I_{EN10}	Negative
ENA7: Municipal environmental budget	Budget allocated to the General Administration of the Environment	I_{EN11}	Positive
	Budget allocated to parks and gardens	I_{EN12}	Positive
	Budget allocated to the protection and improvement of the environment	I_{EN13}	Positive
	Budget for home supply of drinking water	I_{EN14}	Positive
	Budget allocated to the collection, management and treatment of waste	I_{EN15}	Positive
	Budget allocated to street cleaning	I_{EN16}	Positive

Source: Own elaboration.

starting point, the information aggregation process begins to obtain a composite indicator of global sustainability in several phases, which is described below.

Consider a system composed of m quantified indicators for a total of n destinations. The value that each indicator j in each of the periods considered for each destination i is given by: $I_{ij}^{t_0}$ and $I_{ij}^{t_n}$ (with $j = 1, \ldots, m$ and $i = 1, \ldots, n$). The value of the indicator is the result of the formula that defines each of the elements of the system and that is determined with the variables obtained from the appropriate statistical sources (for more information see Blancas et al., 2011).

The number of indicators included in each dimension is given by Ds (with s = 1, 2 and 3) so that $m = D_1 + D_2 + D_3$. Within each dimension, the indicators considered evaluate a set of sustainability aspects, where n_s is the number of aspects of dimension s.

2.2. First aggregation phase: compensatory aspects composite indicators

In a first step, a compensatory composite indicator is computed for each of the aspects considered within each dimension. Compensation between the indicators is allowed because each initial indicator included in the same aspect evaluates related issues but from a different and complementary perspective.

Given the different direction of variability between the starting indicators and the differences in terms of measurement units used, their values are normalised to a common 1–10 scale, unifying their direction of variability in a positive direction (the closer to one the normalised value, the best sustainability situation they represent) (Actis di Pasquale and Balsa, 2017).

The normalised values in the case of positive rate indicators for a period t are given by:

$$IN_{ij}^{t} = 1 + \frac{\left(I_{ij}^{t} - I_{minj}^{t}\right) \bullet (10-1)}{I_{maxj}^{t} - I_{minj}^{t}} \tag{1}$$

If the initial direction of variation is negative, its normalised value in the positive direction is obtained as follows:

$$IN_{ij}^{t} = 10 - \frac{\left(I_{maxj}^{t} - I_{ij}^{t}\right) \bullet (10-1)}{I_{maxj}^{t} - I_{minj}^{t}} \tag{2}$$

being I_{maxj}^{t} and y I_{minj}^{t} the maximum and minimum values of indicator j in period t.

Using the Normalized values of each indicator, a compensatory composite indicator is obtained for each aspect of sustainability. Thus, a Sustainability Aspect Composite Indicator (SACI) is defined for each aspect h that belongs to dimension s for each period t. The value of this indicator for destination I is given by:

$$SACI_{shi}^{t} = \sum_{j \in H \subset D_s} w_j^t \bullet IN_{ij}^{t} \forall i \in \{1, 2, \ldots, n\} \tag{3}$$

To determine the numerical values for the substitution rates between the indicators in each evaluation period, a weighting procedure is used that combines variability criteria and the amount of new information obtained by each indicator within its aspect (Diakoulaki et al., 1995). According to this procedure, the weighting value for an indicator j that belongs to aspect h of dimension s would be given by:

$$w_j^t = \frac{C_j^t}{\sum_{k \in H \subset D_s} C_k^t} \tag{4}$$

being

$$C_j^t = \sigma_j \bullet \sum_{j \neq p \subset H \in D_s} \left(1 - |r_{jp}|\right) \tag{5}$$

The weight is determined based on the amount of contribution that the indicator provides to evaluate the aspect considered. This quantity depends on the intrinsic sensitivity of the indicator (measured through its dispersion) and on the associations that exist between the indicators of the aspect (quantified through linear correlation coefficients). Thus, the weight of the indicator will be higher as its values are more dispersed around its average value, since it will enable better discrimination between the analysed destinations. Likewise, the indicators that will receive a greater weight will be those that show a linear dependence with the rest to a lesser extent, since they will provide a greater amount of information not contained in other indicators.

2.3. Second aggregation phase: a geometric global composite indicator

In the second phase, the values of compensatory synthetic indicators of each sustainability aspect ($SACI_{shi}^{t}$) are aggregated for each of the periods analysed. The goal is to determine a global sustainability measure (GCI) for each period that provides an overall view of the situation of the destination.

In order for the proposed measure to be useful for decision-making in destination planning and management processes, it has been decided to use a geometric aggregation, admitting a different degree of compensation between the indicators of each aspect. Thus, the lower degree of compensation associated with the weaknesses of each destination defines a global indicator that favours areas that show a balanced situation in all aspects and penalises destinations with marked weaknesses. This provides relevant information for the rapid identification of those aspects in which action is most urgently needed to improve the sustainability situation of the destination and achieve a better position compared to competitors.

The advantages of geometric aggregation have been studied by various researchers. One can see in Ebert and Welsch (2004), Zhou et al. (2006) and Zhou et al. (2010), among others, a number of the positive aspects of the considered scheme compared to the alternatives.

For the definition of the global indicator, it is necessary to select the weighting profile. This study considers a weight assignation scheme inspired by the Benefit of the Doubt (BoD) principle, this being based on DEA methodology. This scheme's most positive element is the weighting values being endogenously ascertained. In other words, the weighting vector is not established by analysts' subjective decisions; rather they are computed from the observed values of the composite indicators' aspects. Both multiplicative aggregation and BoD weighting are combined in various recent procedures (Giambona and Vassallo, 2014; Van Puyenbroeck and Rogge, 2017; Verbunt and Rogge, 2018; Dominguez-Gil et al., 2021).

In this paper, the procedure proposed implies the inclusion of a common set of weights for all destinations derived from a DEA-inspired model. Specifically, to ascertain the weighting vector, this study advances the computing of a revisited BoD model that appeared in Contreras and Hinojosa (2019). Here the classical normalisation condition of DEA-models is replaced by the requirement that the addition of the aggregated values across the set of units equals the unity. The principal positive aspect which comes from this model is to assure, unlike common DEA-based models, the singularity of the optimal vector of weights (this is explained in detail in Khodabakhshi and Aryavash (2012)).

This proposal considers a common set of weights to construct the GCI. With a view to doing so, a computation criterion to ascertain the optimal set of weights must be included. In this proposal, the minimisation of the differences from the optimal individual values across the n entities is carried out. It is of interest to remark that, with this criterion, the worst valued alternative is given the chance to establish the common set of weights for the assessment of the complete set of destinations.

First, the vector $\theta^{max} = (\theta_1^{max}, \dots, \theta_n^{max})$ that includes the optimal values for each destination is calculated. Values θ_o^{max} designate the maximum individual value for destination o (with $o = 1, \dots, n$), and they are computed as the solution of model (6).

$$\begin{aligned}
\theta_0^{max(t)} = \quad & Max \sum_{s=1}^{3}\sum_{h=1}^{n_s} w_{sh}^t \bullet SACI_{sh0}^t \\
s.t. \quad & \sum_{i=1}^{n}\sum_{s=1}^{3}\sum_{h=1}^{n_s} w_{sh}^t \bullet SACI_{shi}^t = 1 \\
& L_{sh} \le \frac{w_{sh}^t \bullet SACI_{sh0}^t}{\sum_{i=1}^{3}\sum_{h=1}^{n_s} w_{sh}^t \bullet SACI_{sh0}^t} \le U_{sh} \quad \forall s = \{1,2,3\} \forall h = \{1,2,\dots,n_s\} \\
& w_{sh}^t \ge 0 \quad \forall s = \{1,2,3\} \forall h = \{1,2,\dots,n_s\}
\end{aligned} \tag{6}$$

where L_{sh} and U_{sh} are, respectively, the lower and upper limits, set in terms of the relative significance for virtual outputs, enforced to determine the optimal weights. It is not difficult to see that $L_{sh}, U_{sh} \in [0,1]$.

To determine the range of values that limit the relative weight of each sustainability aspect, it is proposed to use the Analytical Hierarchy Process (AHP) multi-criteria method (Saaty, 1980). To do this, a panel of 32 experts in sustainable tourism is selected, from which sets of weights are determined which set the relative importance that each aspect of sustainability should have within the synthetic indicator for each expert considered.

To obtain these individual weightings, each expert is asked to make binary comparisons between the sustainability aspects based on their relative importance using the scale proposed by Saaty and shown in Table 4.

The result of the comparisons made by each expert e_x with $x = \{1, 2, \dots, 32\}$ are presented in a matrix A^{e_x} called square binary comparison matrix of order equal to the number of sustainability aspects contemplated in the system. The set of weights which represents the relative importance that each expert gives to the associated sustainability aspects is given by the dominant eigenvector of the matrix A^{e_x}. It is thus fulfilled that:

Table 4
Fundamental Scale to binary comparison of sustainability aspects.

Intensity of importance	Definition	Explanation
1	Equal importance	Two aspects contribute equally to the sustainability objective
3	Moderate importance of one over another	Experience and judgment strongly favour one aspect over another
5	Essential or strong importance	Experience and judgment strongly favour one aspect over another
7	Very strong importance	An aspect is strongly favoured and its dominance demonstrated in Practice
9	Extreme importance	The evidence favouring one aspect over another is of the highest possible order of affirmation
2, 4, 6 y 8	Intermediate values between the two adjacent judgments	When compromise is needed
Reciprocals	If aspect h has one of the above numbers assigned to it when compared with aspect p, then p has the reciprocal value when compared with h	

Source: Own elaboration from Saaty (1990).

$$A^{e_x} \bullet v^{e_x} = \lambda_{max}^{e_x} \bullet v^{e_x} \forall x \in \{1, 2, \dots, 32\} \tag{7}$$

being v^{e_x} the dominant eigenvector associated with the dominant eigenvalue $\lambda_{max}^{e_x}$ of the matrix of binary comparisons. The components of the eigenvector, which it denotes by

$$v^{ex} = \left(v_{sh}^{ex}\right) \forall x \in \{1, 2, \dots, 32\} \forall s \in \{1, 2, 3\} \forall h \in \{1, 2, \dots, n_s\} \tag{8}$$

represent the relative importance given by each expert e_x to each of the sustainability aspects considered. All the experts show highly consistent answers in their assessments, showing an average consistency ratio (Saaty, 1990) of 1.04%, with all the values obtained in each case within the interval [0.27%, 2.099%], these values being clearly below the 10% threshold.

Starting from the eigenvectors determined for all the experts, the lower and upper bounds for the relative importance for virtual outputs are determined using a consensus measure among the panel of experts.

The lower bounds are calculated by taking the average value of the components of the eigenvector corresponding to each aspect using the valuations of the 16 experts who give it the least importance (which is denoted as the MIN group):

$$L_{sh} = \frac{\sum_{x \in MIN} v_{sh}^{e_x}}{16}$$

In the same way, the upper bounds are calculated by taking the average of the components of the eigenvector that correspond to each aspect using the values that correlate to the 16 experts that give it the greatest relative importance (which is denoted as the MAX group):

$$U_{sh} = \frac{\sum_{x \in MAX} v_{sh}^{e_x}}{16}$$

The common set of weights is ascertained by computing model (9), which minimises the maximum differences with $\theta_i^{max\ (t)}$ across the n destinations:

$$
\begin{aligned}
&Min \quad D \\
&s.t. \quad \sum_{i=1}^{n}\sum_{s=1}^{3}\sum_{h=1}^{n_s} w_{sh}^{*t} \bullet SACI_{shi}^{t} = 1 \\
&D \geq \theta_i^{max(t)} - \sum_{s=1}^{3}\sum_{h=1}^{n_s} w_{sh}^{*t} \bullet SACI_{shi}^{t} \qquad \forall i = \{1,2,\dots,n\} \\
&L_{sh} \leq \frac{w_{sh}^{*t} \bullet SACI_{shi}^{t}}{\sum_{i=1}^{3}\sum_{h=1}^{n_s} w_{sh}^{*t} \bullet SACI_{shi}^{t}} \leq U_{sh} \qquad \forall i = \{1,2,\dots,n\}, \forall s = \{1,2,3\}, \\
&\qquad \forall h = \{1,2,\dots,n_s\} \\
&w_{sh}^{*t} \geq 0 \qquad \forall s = \{1,2,3\} \forall h = \{1,2,\dots,n_s\}
\end{aligned} \tag{9}
$$

The result from the model (9) is a singular vector of weights for each period t $w^{*t} = (w_{sh}{}^{*t})$ which minimises the maximum differences from the values $\theta_i^{max(t)}$. The optimal vector achieved for period t from model (9) is normalised in such a way that:

$$
w_{sh}^{(t)} = \frac{w_{sh}^{*t} \bullet SACI_{shk}^{t}}{\sum_{i=1}^{3}\sum_{h=1}^{n_s} w_{sh}^{*t} \bullet SACI_{shk}^{t}}; \tag{10}
$$

where k shows the destination which set the minimum aggregated value in model (9); that is, using the case of the destination that minimises the maximum difference.

Finally, before proceeding to obtain the global composite indicator, a baseline value or benchmark for each sustainability aspect composite indicator is established. This benchmark will be common for all destinations that have similar characteristics and a similar volume of tourist activity. Thus, the global composite indicator can assess sustainability in each destination, taking into account its own characteristics and the different starting situation of each of them. Sustainability is thus evaluated using multiple benchmarks so that more effective and achievable destination benchmarking practices can be designed (Blancas et al., 2018).

Benchmarks are identified using cluster analysis, with a view to determining groups of tourist destinations with different characteristics, resources and levels of tourist intensity. In order to obtain this classification, it is necessary to previously establish the variables that allow discriminating between destinations and adequately reflect their different conditions to improve their sustainability. From our point of view, previous clusters must be defined using information related to tourist sector's dimension (such as the tourist demand volume or the capacity of the official accommodation offer), the resources available in the destination (for example, the beach area or the cultural heritage), and other physical and social characteristics of the destination (such as its surface area or its population level).

The specific choice of variables will depend on the characteristics of the destinations analysed in each empirical study.

From the information of the classifying variables, the destination clusters are identified by applying the hierarchical Ward method. This method is one of the most used since it provides more efficient results. Its optimum classification provides clusters with a similar and homogeneous dimension and small sizes (Kuiper and Fisher, 1975).

At the analyst's discretion, this classification can be complemented or validated using administrative criteria or through knowledge provided by experts who are familiar with the characteristics of the areas analysed.

Classifying the individuals into groups, a reference or benchmark value is set for each aspect of sustainability in each period t, which is given by the mean value of the SACI for the destinations classified in the same group. The defined reference value is denoted by I_{shg}^{Bt}. Considering these values, the Global Composite Indicator for aspect h of dimension s for a destination i included in group g in period t, (denoted as GCI_{ig}^{t}), is given by:

$$
GCI_{ig}^{t} = \prod_{s=1}^{3}\prod_{h=1}^{n_s}\left(\frac{SACI_{shig}^{t}}{I_{shg}^{Bt}}\right)^{w_{sh}^{(t)}} \tag{11}
$$

2.4. Final phase: inter-temporal decomposition of the global composite indicator

The geometric composite indicator which has been proposed above enables including a dynamic analysis (see Verbunt and Rogge (2018) for a detailed analysis of the dynamic analysis of the geometric indicator).

The objective is to use the temporary decomposition of the global composite indicator to propose a dynamic evaluation that allows identifying the effort of each destination to improve its degree of tourism sustainability.

To do this, the starting point is the value of the global composite indicator obtained for the valuation periods considered: t_0 and t_n (with $t_n > t_0$), which are given by:

$$
GCI_{ig}^{t_0} = \prod_{s=1}^{3}\prod_{h=1}^{n_s}\left(\frac{SACI_{shig}^{t_0}}{I_{Sh_g}^{Bt_o}}\right)^{w_{sh}^{(t0)}} \quad GCI_{ig}^{t_n} = \prod_{s=1}^{3}\prod_{h=1}^{n_s}\left(\frac{SACI_{shig}^{t_0}}{I_{Sh_g}^{Bt_o}}\right)^{w_{sh}^{(tn)}} \tag{12}
$$

A measure of the variation in performance for destination i from t_0 to t_n (denoted by PC_{ig}) which belongs to group g, can be designated as:

$$
PC_i = \frac{GCI_{ig}^{t_n}}{GCI_{ig}^{t_0}} = \frac{\prod_{s=1}^{3}\prod_{h=1}^{n_s}\left(\frac{SACI_{shig}^{t_n}}{I_{shg}^{Bt_n}}\right)^{w_{sh}^{(t_n)}}}{\prod_{s=1}^{3}\prod_{h=1}^{n_s}\left(\frac{SACI_{shig}^{t_0}}{I_{shg}^{Bt_0}}\right)^{w_{sh}^{(t_0)}}} \tag{13}
$$

It is simple to interpret PC_{ig} . A value of PC_{ig} greater (lower) than one signifies that unit i has made better (worsened) its performance from t_0 to t_n. Observe that this comparison is affected by three different distinct factors: the incidence of the individual aspects indicators for destination i, the incidence of the benchmark values and the weighting scheme finally considered.

Next, a tripartite decomposition of PC_{ig} can be achieved,

$$
PC_{ig} = \Delta OWN_{ig} \times \Delta BP_{ig} \times \Delta W_{ig} \tag{14}
$$

The component ΔOWN_{ig} measures the changes stemming from the variations in the aspects composite indicators seen for destination i in the two periods. A value greater (less) than the unity indicates an improve (deterioration) in the sustainable tourism indicators in period t_n compared to period of reference t_0.

$$
\Delta OWN_{ig} = \prod_{s=1}^{3}\prod_{h=1}^{n_s}\left(\frac{SACI_{shig}^{t_n}}{SACI_{shig}^{t_0}}\right)^{\frac{w_{sh}^{(t_n)}+w_{sh}^{(t_0)}}{2}} \tag{15}
$$

ΔBP_{ig} measures the changes stemming from the variation of the benchmark of t_0 over t_n. In this case, a value higher than the unity signifies that the composite value of the benchmark increases during the time period between t_0 and t_n. Observe that, since the aspect indicators are included in relative terms regarding the baseline, a lower value of the benchmark value means an indirect enhancement of the assessment for this individual indicator. Combining the first component (ΔOWN_i) and the second component together measures the progress or regress of the set of aspect indicators of destination i regarding the development of the benchmark's indicators.

$$
\Delta BP_{ig} = \prod_{s=1}^{3}\prod_{h=1}^{n_s}\left(\frac{I_{shg}^{Bt_0}}{I_{sh}^{Bt_n}}\right)^{\frac{w_{sh}^{(t_n)}+w_{sh}^{(t_0)}}{2}} \tag{16}
$$

Lastly, a value ΔW_{ig} higher (lower) than the unity shows a weighting scheme change that provides an advantage (disadvantage) for the assessment of destination i. That is, a value higher (lower) than the unity, means a positive (negative) effect stemming from the optimal weights in period t_n compared to period t_0.

$$\Delta W_{i^g} = \frac{\prod_{s=1}^{3}\prod_{h=1}^{n_s}\left(\frac{SACI_{shi^g}^{t_0}}{I_{shg}^{Bt_0}} \times \frac{SACI_{shi^g}^{t_n}}{I_{shg}^{Bt_n}}\right)^{w_{sh}^{(t_n)}}}{\prod_{s=1}^{3}\prod_{h=1}^{n_s}\left(\frac{SACI_{shi^g}^{t_0}}{I_{shg}^{Bt_0}} \times \frac{SACI_{shi^g}^{t_n}}{I_{shg}^{Bt_n}}\right)^{w_{sh}^{(t_0)}}} \tag{17}$$

With these tools, a dynamic evaluation of sustainability is achieved that allows quantifying the effort of each unit, eliminating the influence of changes in the situation taken as a reference (or fixed benchmark) as well as the weighting system.

3. Empirical application: a dynamic sustainability analysis in Andalusia (Spain)

In this section, an empirical application is presented to illustrate the potential of the proposed methodology when making dynamic evaluations of sustainable tourism and quantifying the effort made by each destination to achieve a better situation. Specifically, the region of Andalusia (located in the south of Spain) is analysed, given its tourist relevance and the management carried out in its destinations since the mid-1990s for the configuration of more diverse, sustainable tourism models based on service quality. As a tourist destination, Andalusia plays an important role at the national level. Proof of this is that at the end of 2021, Andalusia was the first tourist destination in Spain, surpassing the rest of the communities, including Catalonia, the Canary Islands and the Balearic Islands, which traditionally amounted to more hotel stays. Andalusia received nearly 20 million tourists in 2021, which represents a growth of 48.4% compared to the previous year, although the figures prior to the pandemic have not yet been reached. In addition, to this it is the destination that contributes the most to the increase in jobs in the Spanish hospitality industry with 45,900 of the 183,000 new jobs and that in 2021 it ranked fifth in the ranking of passenger arrivals in Spain with a share of 11.3%. Thus, Andalusia has recovered more than a third of the tourism lost during the pandemic and it is expected that in 2023 the data will equal those achieved in 2019, through a diversified, safe, inclusive, sustainable and intelligent offer (Junta, 2022). All of this as is a result of the actions developed in the sector within the General Plans for Sustainable Tourism that the region has been implementing since 2007.

Within this region, the empirical study focuses on the 56 so-called *Tourist Sites* (Instituto Nacional de Estadística (INE), 2022), which are municipalities with the most significant tourism demand and concentration of tourism supply.

For this set of destinations, the evolution recorded in terms of sustainability between 2014 and 2019 is analysed. An evaluation period is thus set that allows the effort made to improve the sustainability of tourism activity in each territory to be graded, within the framework of the General Plan for Sustainable Tourism Horizon 2020 launched by the Regional Government. Thus, the last year of planning affected by the COVID-19 pandemic, which has had such serious consequences for the tourist activity of that period, is ruled out.

For each evaluation period, a database is created, based on the compilation of official statistical information, to quantify the proposed indicators system (Tables 1-3). Specifically, we have started from official statistical information provided by the Andalusian Statistical Institute (Multiterritorial Information System of Andalusia). However, the information available in this source is not complete. This is why, other statistical sources at the national (Ministry of Finance and Public Function and the Institute for Spanish Tourism Quality (ICTE)) and regional level (Ministry of Environment and Ministry of Tourism, Culture and Sport of Andalusia) were used. The possibility of its complete quantification through these official statistics shows that the proposed evaluation tool is highly operational and applicable in other tourist destinations, making the most of the information available in the regional statistical institutes.

Once the information provided by the indicator system is available, the first phase of compensatory aggregation by sustainability aspects is carried out in each period to obtain the Sustainability Aspect Composite Indicators. To do this, it is previously normalised on a 1–10 scale, unifying the direction of variability of the initial indicators in a positive direction. Likewise, the weights that show the exchange rates between the indicators included within each aspect are determined, combining variability criteria and the amount of new information provided by each indicator within the aspect in which it is included.

Through a weighted sum of the normalised values, the 20 compensatory synthetic indicators of each sustainability aspect ($SACI_{shi}^{t}$) included in the system for the periods considered (2014 and 2019) are obtained.

Next, the global composite indicator is attained in each period, synthesising the information of the 20 compensatory indicators derived for each aspect of the system. To do so, the weights of each sustainability aspect (common for all destinations in each period) and the reference values or benchmarks are previously obtained.

As discussed in the previous section, a procedure inspired by the Benefit of the Doubt (BoD) principle, which is based on the DEA methodology, is used to assign weights. Using model (6) the maximum individual values for each destination (θ_0^{max}) is determined. To do this, the lower and upper bounds L_{sh} and U_{sh} to the relative importance for virtual outputs is calculated, using the eigenvectors v^{ex} associated with the A^{e_x} matrices generated by each of the 32 experts in sustainable tourism that make up the panel employed in this study.

The assessments provided by the experts for each aspect of sustainability and the consensus limits reached are shown in Graph 1. The upper consensus limit U_{sh} is given by the average value of the 16 best assessments of the experts who give it the greatest importance, the lower limit of consensus being L_{sh}, the average of the 16 worst valuations.

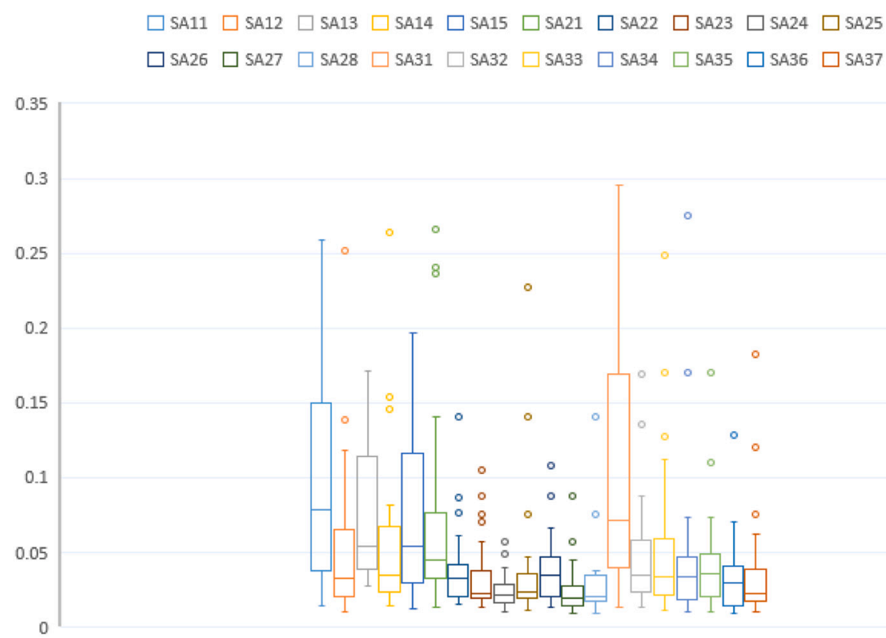
As can be seen in the graph above, there is a greater consensus among experts regarding the relative importance of economic issues, setting a lower weight for them with lower thresholds, and with an average amplitude of 3.38%. On the contrary, on social issues there is a greater disparity in the opinions of the experts consulted, which translates into relatively higher thresholds, with an average amplitude of 7.84%. Regarding environmental issues, these present weights halfway between the two previous dimensions, with thresholds that show an average amplitude of 5.52%.

Subsequently, using model (9), the common weights are determined for each aspect and period, to which the information of the compensatory indicators will be added. These common weights are shown in Graph 1.

Regarding the reference values, a different benchmark is set for each type of destination, taking into account its characteristics and its different starting situation. The identification of each type of destination is carried out in this empirical study combining administrative criteria and multivariate analysis techniques.

The tourism planning framework in Andalusia considers that the region's tourism space is divided into three large areas: coastline (and its area of influence), inland urban (formed by non-coastal urban areas with >20,000 inhabitants) and inland rural (inland destinations with a population of <20,000 inhabitants) (Junta de Andalucía, 2016). With these criteria, the considered destinations were classified into two groups: a first group with 38 coastal destinations and a second group made up of 17 fundamentally urban destinations and some large rural ones with a high tourist activity.

Given the large size of each administrative group, a hierarchical cluster analysis was applied to each of them using Ward's method (Ward, 1963) as a grouping criterion. The variables used to carry out this multivariate classification were made taking into account the characteristics of the destinations and their discriminant power. The variables considered were: population, total number of tourists, average length of stay, supply of regulated and non-regulated accommodation, and



	L_{sh}	U_{sh}	$w^{*(2014)}$	$w^{*(2019)}$
SA_{11}	4.35%	15.76%	8.51%	13.67%
SA_{12}	2.05%	8.00%	7.67%	6.64%
SA_{13}	3.83%	10.78%	10.78%	7.04%
SA_{14}	2.33%	8.46%	5.57%	5.02%
SA_{15}	3.17%	11.91%	6.74%	5.53%
SA_{21}	3.09%	11.10%	7.44%	5.26%
SA_{22}	2.16%	5.29%	2.69%	2.16%
SA_{23}	1.78%	4.97%	3.62%	2.77%
SA_{24}	1.62%	3.18%	2.13%	2.92%
SA_{25}	1.79%	5.46%	4.74%	5.11%
SA_{26}	2.24%	5.36%	2.24%	3.84%
SA_{27}	1.49%	3.31%	2.13%	1.81%
SA_{28}	1.65%	4.20%	1.66%	1.65%
SA_{31}	4.12%	16.68%	10.84%	8.51%
SA_{32}	2.46%	7.18%	7.18%	3.41%
SA_{33}	2.18%	7.83%	7.83%	7.70%
SA_{34}	1.95%	6.97%	1.95%	5.85%
SA_{35}	2.17%	6.07%	2.85%	4.04%
SA_{36}	1.71%	4.86%	1.71%	1.71%
SA_{37}	1.72%	5.34%	1.72%	5.34%

Graph 1. Expert valuations, Lower and Upper bounds and common weights for sustainability aspects.

whether or not it is the capital of the province. In the case of coastal destinations, the area of beaches is also included, with the provision of protected cultural heritage being the specific variable for urban and rural destinations.

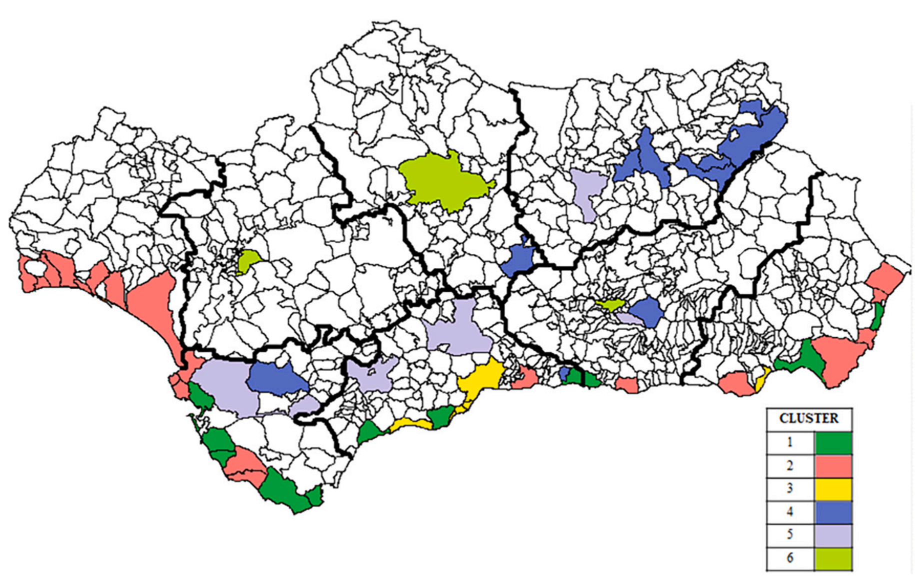
As a result of this multivariate classification, the destinations are grouped into six clusters that are shown in Map 1.

The destinations classified in each group have the following characteristics:

- Group 1: Coastal destinations that have long stretches of beaches, where the tourist activity reaches intermediate values, with low average stays.
- Group 2: Sparsely populated coastal destinations with a low tourist intensity, which attract a demand with a high average stay.
- Group 3: Coastal destinations with a greater tourist intensity, a high population and a high concentration of demand in reduced beach spaces.
- Group 4: Inland urban and rural destinations with a low tourism intensity and little protected heritage, where the demand received registers a high average stay.
- Group 5: Inland urban destinations with a medium-intensity tourist activity.
- Group 6: Main provincial capitals with a high population, an extensive cultural heritage and a very intensive tourist activity and a low average stay.

For each group, the average value of each compensatory indicator within each group in each period considered is set as a reference. This is denoted by I^{Bt}_{shg}.

Finally, the global composite indicator is obtained for each period by



Map 1. Andalusian Tourist Sites: hierarchical cluster analysis results.

means of a geometric aggregation, so that the evolution registered by each destination measured by means of the PC_{ig} quotient is shown in Graph 2.

The destinations that achieve a performance change measure greater than one show an improvement in their level of global sustainability in the period analysed. 67.85% of the tourist points improve their position, with the destinations with the least tourist intensity (groups 1, 2 and 4) registering the highest levels of improvement. The advances in destinations with a better starting situation are less pronounced. However, the evaluation offered by this dynamic indicator is influenced by issues such as the benchmark values and the weighting scheme finally considered.

In order to be able to evaluate each destination manager's own efforts within the framework of regional planning, the value of the performance change measure is broken down, focusing on the ΔOWN_{ig} component that measures the changes derived from the variations in the aspects composite indicators observed for destination i in both periods.

The value of this component and its breakdown by dimensions are shown in Graphs 3 and 4.

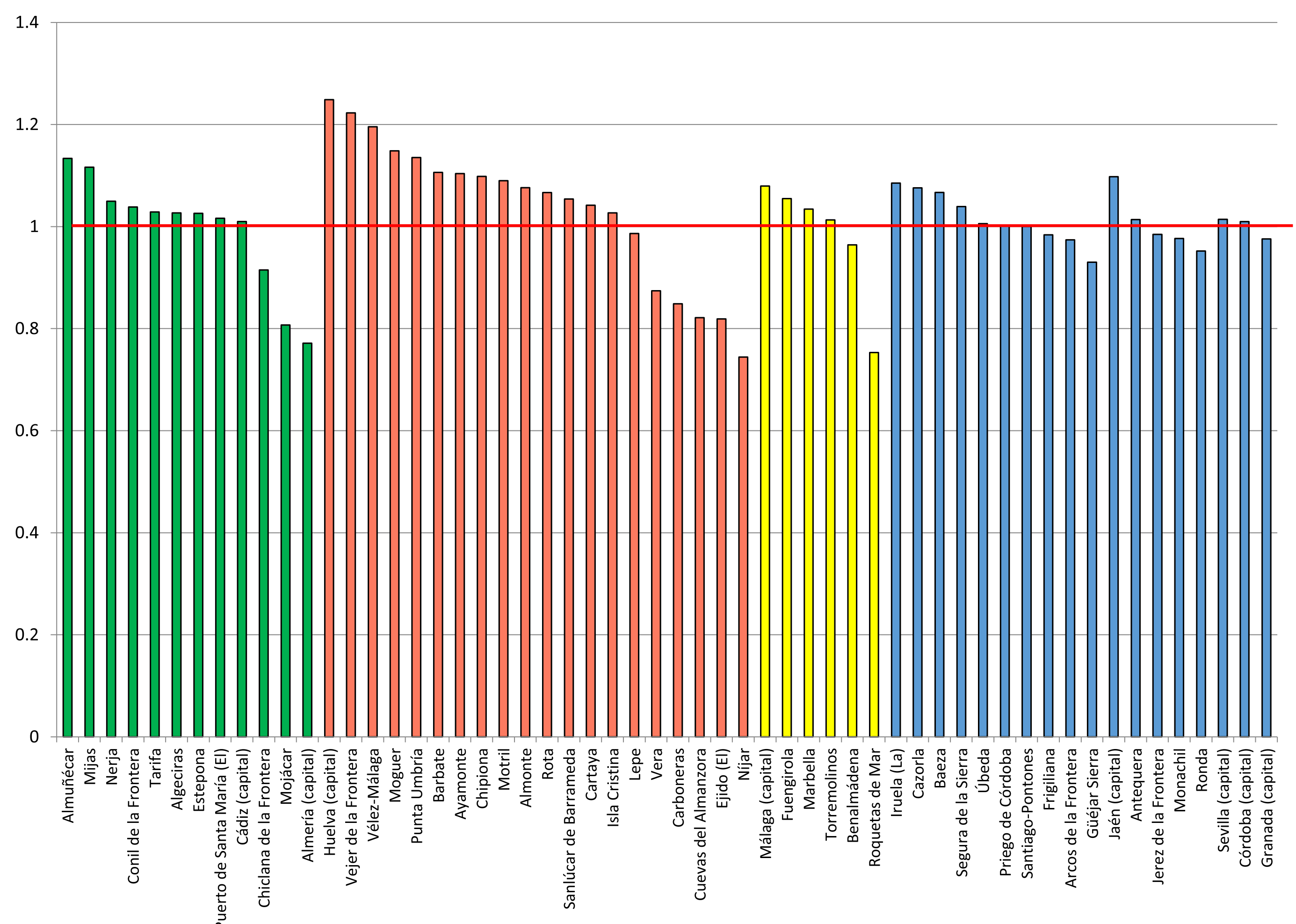
When the efforts of each area are analysed, it can be seen that the destinations that register a setback in some dimension (with aggregate values <1) see how global evolution is penalised due to the multiplicative aggregation which defines synthetic measures. Thus, only the destinations that achieve significant progress in some dimension or a balanced progress in all dimensions reach a positive global measure, due to the lower degree of compensation allowed between the weaknesses (or setbacks) of each area.

When analysing the general evolution of the destinations considered, it is observed that the greatest improvement efforts are made by the destinations in groups 4 and 5, where all their components reach a positive global evolution. Thus, improvements in sustainability have occurred in inland and rural areas, with a medium and low intensity tourist activity, guaranteeing its activity in the medium and long term. Likewise, the large urban destinations that form group 6 make a balanced effort in all dimensions, highlighting the improvements in economic terms.

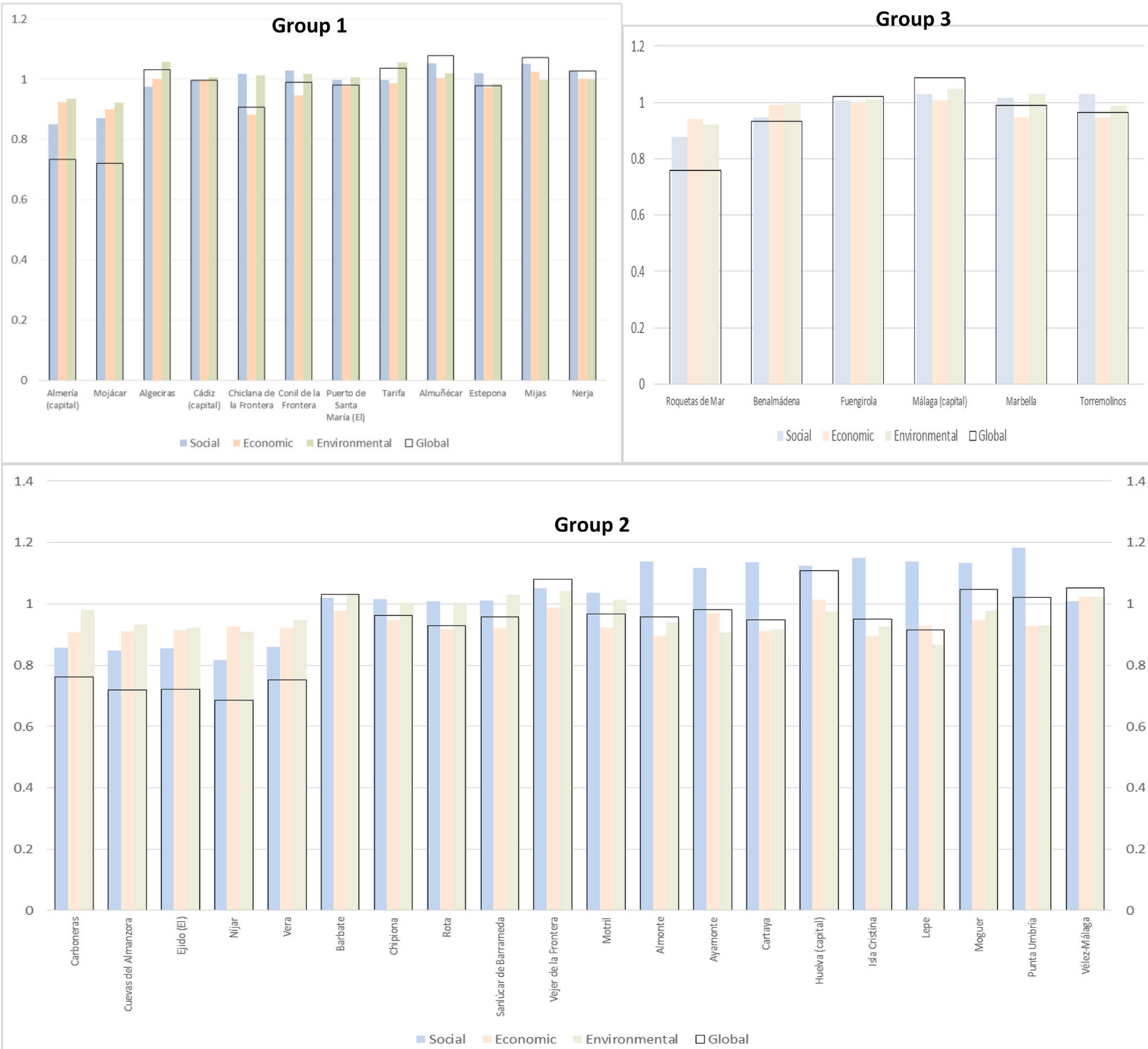
On the contrary, the coastal destinations (especially in groups 1 and 2) are the ones that register the greatest setbacks in terms of sustainability. Specifically, the coastal areas of the province of Almería are those that show a setback in all dimensions. A large part of the destinations in the coastal areas of the provinces of Huelva, Cádiz, Granada and Málaga, despite making progress in some dimensions, do not make it possible to compensate for the setback registered in the rest. However, exceptions are found, such as the provincial capitals (Huelva and Málaga), Almuñécar, Vélez-Málaga and Fuengirola, destinations in which balanced improvements are achieved in all dimensions.

A greater disaggregation of the dynamic composite indicators that measure the effort of each region allows identifying the issues where there have been more setbacks and that will require a greater effort in future planning. Moreover, this analysis highlights the aspects in which the current planning within the General Plan for Sustainable Tourism Horizon 2020 has not been satisfactory, requiring a modification of the action lines at the regional level.

In order to do this, the value of the ΔOWN_{ig} indicator is broken down,



Graph 2. Performance change measures: results for groups of destinations.



Graph 3. Own component: dimensional disaggregation. Results for coastal destinations groups.

determining the progress or setback that is recorded in each aspect of sustainability evaluated. Once this is done, the number of destinations that register setbacks in each aspect is determined, performing this calculation by groups of destinations. This number is relativised by determining the percentage of destinations that show setbacks (over the total of each group and the global total of destinations considered). The result of this disaggregation is shown in Table 5.

As the previous table shows, the main deficiencies in the social dimension have been registered in the socio-cultural effects of tourism for the local community, requiring action lines to improve the provision of services for residents. Likewise, it is necessary to better manage the effects of tourist activity on the structure of the local population through specific action lines and control in this area.

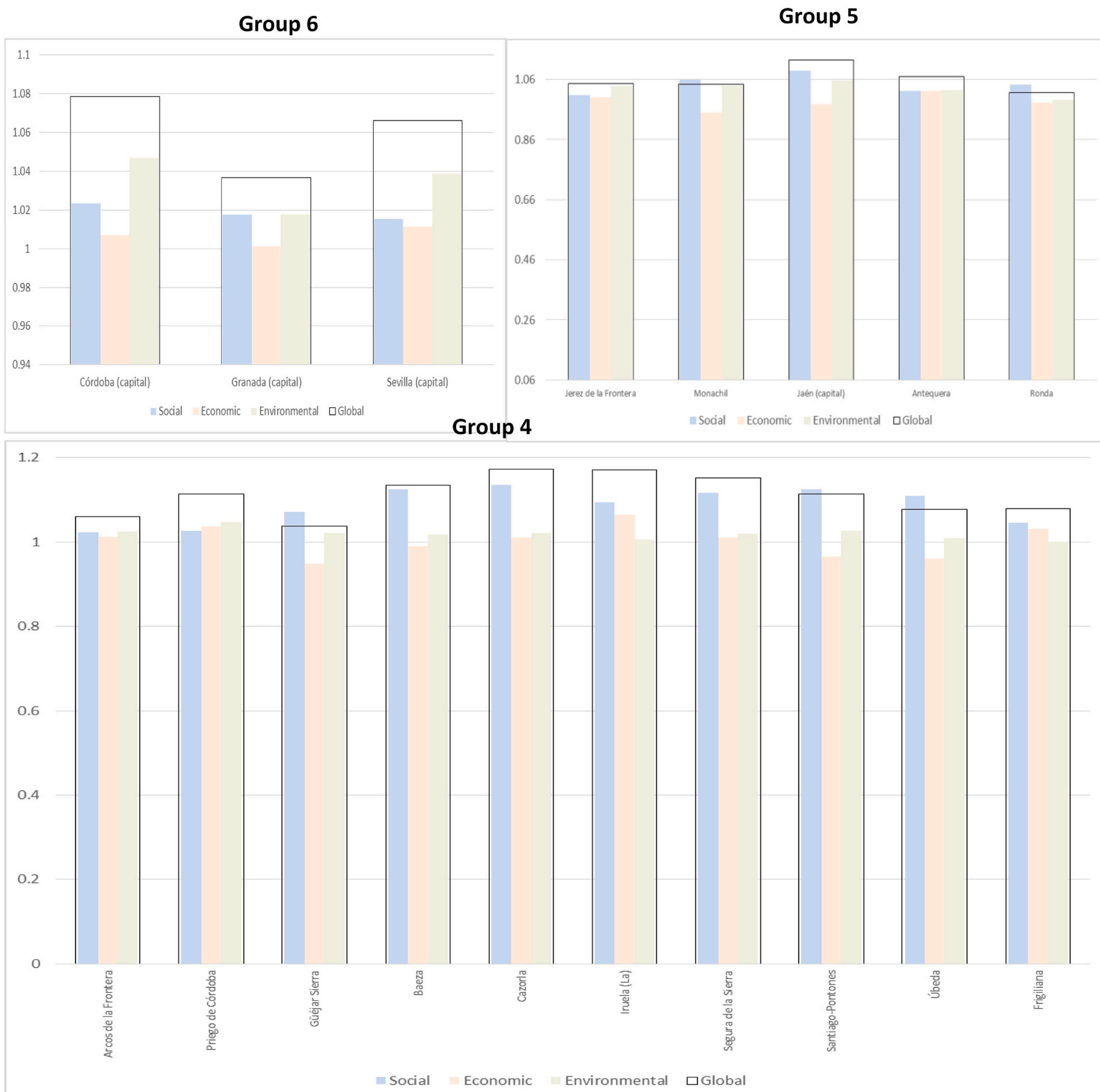
From an economic point of view, lines are required that allow improving the economic benefits of the tourist activity, promoting a less seasonal activity, which allows improving the levels of competitiveness of each destination and transport infrastructures that guarantee a better mobility of demand.

From an environmental point of view, new lines of action are necessary to provide greater budgetary support in environmental matters to local managers and reduce atmospheric pollution levels.

4. Conclusions

This paper proposes the use of indicator systems and composite indicators as tools that allow deepening the knowledge of the sustainability of tourist destinations and contribute to adequate decision-making by political managers. These tools are considered to allow the evaluation of the impact of public policies using the evidence provided by the data. In this work, tourism sustainability is analysed through the study of a series of indicators, grouped by baseline aspects, within three dimensions: social, economic and environmental.

In particular, a system of tourism sustainability indicators has been designed and quantified that includes baseline aspects of the three basic



Graph 4. Own component: dimensional disaggregation. Results for urban destinations groups.

dimensions, based on official statistical information. Making the most of this official information, composite indicators have been obtained that allow a dynamic and global evaluation of sustainability, applying a new methodology that has several advantages over others used to carry out a study of sustainability in the field of tourism.

Firstly, the formulated methodology allows evaluating tourism sustainability from a dynamic point of view, in a differentiated way. Given that the destinations under study have very different characteristics, they are classified by combining administrative and statistical criteria through a hierarchical cluster analysis based on their tourism activity, their resources and their position within the region's tourism space. This classification enables different reference values to be set for each type of destination, so that the evaluation provided by the composite indicators permits the design of more efficient benchmarking practices between destinations.

Likewise, the proposed aggregation methodology can be used to carry out both static and dynamic evaluations of sustainability, in several phases.

The first phase is committed to carrying out a fully compensatory aggregation, approximating the exchange rates through weights that take into account dispersion criteria and information specific to each indicator. Next, in a second phase the information is added geometrically, defining the weightings through DEA-based models that provide unique weightings, where the relative weight of each sustainability aspect is limited by means of the information provided by a panel of experts, using the AHP method.

By using a geometric aggregation, the global indicator proposed in this paper favours areas with a balanced situation in all aspects and penalises destinations with significant weaknesses. This allows managers to find out the aspects on which it is necessary to act in the short term at the local level and redefine action strategies at the regional level.

Through the intertemporal decomposition of indicators with geometric aggregation, a sustainable dynamic composite indicator is defined that allows quantifying the effort made by each destination to improve its tourism sustainability, regardless of the influence of the changes suffered in the destination set as a benchmark, and the

Table 5
ΔOWN_{ig} disaggregation: number of destinations with regresses. Percentage distribution.

	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Total
$SACI_{11}$	5	12	5	2	4	3	41,67%	60,00%	83,33%	20,00%	80,00%	100,00%	**55,36%**
$SACI_{12}$	2	5	1	0	0	0	16,67%	25,00%	16,67%	0,00%	0,00%	0,00%	**14,29%**
$SACI_{13}$	3	2	4	1	1	2	25,00%	10,00%	66,67%	10,00%	20,00%	66,67%	**23,21%**
$SACI_{14}$	4	16	1	9	3	3	33,33%	80,00%	16,67%	90,00%	60,00%	100,00%	**64,29%**
$SACI_{15}$	0	2	1	2	0	1	0,00%	10,00%	16,67%	20,00%	0,00%	33,33%	**10,71%**
$SACI_{21}$	7	16	5	6	0	0	58,33%	80,00%	83,33%	60,00%	0,00%	0,00%	**60,71%**
$SACI_{22}$	2	5	1	0	0	0	16,67%	25,00%	16,67%	0,00%	0,00%	0,00%	**14,29%**
$SACI_{23}$	4	4	2	1	2	0	33,33%	20,00%	33,33%	10,00%	40,00%	0,00%	**23,21%**
$SACI_{24}$	8	9	4	5	0	0	66,67%	45,00%	66,67%	50,00%	0,00%	0,00%	**46,43%**
$SACI_{25}$	7	19	2	7	4	1	58,33%	95,00%	33,33%	70,00%	80,00%	33,33%	**71,43%**
$SACI_{26}$	6	10	2	3	0	0	50,00%	50,00%	33,33%	30,00%	0,00%	0,00%	**37,50%**
$SACI_{27}$	9	15	6	9	3	2	75,00%	75,00%	100,00%	90,00%	60,00%	66,67%	**78,57%**
$SACI_{28}$	12	16	5	8	5	3	100,00%	80,00%	83,33%	80,00%	100,00%	100,00%	**87,50%**
$SACI_{31}$	5	8	1	2	0	0	41,67%	40,00%	16,67%	20,00%	0,00%	0,00%	**28,57%**
$SACI_{32}$	0	0	0	1	0	0	0,00%	0,00%	0,00%	10,00%	0,00%	0,00%	**1,79%**
$SACI_{33}$	2	13	2	0	0	0	16,67%	65,00%	33,33%	0,00%	0,00%	0,00%	**30,36%**
$SACI_{34}$	7	16	5	8	2	0	58,33%	80,00%	83,33%	80,00%	40,00%	0,00%	**67,86%**
$SACI_{35}$	4	8	0	3	2	3	33,33%	40,00%	0,00%	30,00%	40,00%	100,00%	**35,71%**
$SACI_{36}$	8	9	5	4	1	2	66,67%	45,00%	83,33%	40,00%	20,00%	66,67%	**51,79%**
$SACI_{37}$	11	20	4	10	4	2	91,67%	100,00%	66,67%	100,00%	80,00%	66,67%	**91,07%**

weighting system used.

The empirical analysis carried out for the case of the most important tourist sites in the region of Andalusia (Spain) shows the potential of both the system of indicators and the global synthetic indicator to carry out a study of tourism sustainability, providing practical tools for the sustainable planning of the tourism sector. The information provided by both the proposed composite indicator and the results obtained by dimensions, let public managers know in depth the current sustainability situation, as well as the evolution in the evaluation period set. This will enable them to make decisions better based on reality, which will facilitate the achievement of improvements in tourism sustainability in the short, medium and long term.

It should be noted that the methodology used in this study allows for the analysis of the most sustainable tourism practices, not only at a local level, but also at a regional and global level, which confirms the potential of the tools presented. However, to perform this analysis on a higher scale, the different national and supranational organisations should make an effort to quantify a greater number of indicators that allow tourism sustainability to be analysed taking into account the real situation in a greater number of aspects. For example, in the study carried out it was not possible to have municipal data that would allow quantifying aspects such as the assessment of tourism by the local population or the noise pollution of each destination, which would enrich the analysis. That is why it is considered that it is necessary to reach a greater consensus on the indicators that enable evaluating the degree of tourism sustainability at a global level among experts in the field.

Finally, the incorporation of non-compensatory type evaluations among the aspects or dimensions assessed in the proposed system is an issue that must continue to be worked on, so that the least possible loss of information is produced by supporting the evaluation in the induced rankings by the indicators whose information is synthesised.

Author statement

Francisco J. Blancas, Ignacio Contreras and Macarena Lozano-Oyola contributed to the design and implementation of the research, to the analysis of the results and to the writing of the manuscript.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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References

Actis di Pasquale, E., Balsa, J., 2017. Interval linear scaling technique: proposal for standardization applied to the measurement of social well-being levels. Revista de Métodos Cuantitativos para la Economía y la Empresa 23, 164–193.

Alfaro, J.L., Andrés, M.E., Mondéjar, J.A., 2020. An approach to measuring sustainable tourism at the local level in Europe. Curr. Issue Tour. 23 (4), 423–437. https://doi.org/10.1080/13683500.2019.1579174.

Blancas, F.J., Lozano-Oyola, M., 2022. Sustainable tourism evaluation using a composite indicator with different compensatory levels. Environ. Impact Assess. Rev. 93, 106733 https://doi.org/10.1016/j.eiar.2021.106733.

Blancas, F.J., Caballero, R., González, M., Lozano, M., Pérez, F., 2010a. Goal programming synthetic indicators: an application for sustainable tourism in Andalusian coastal counties. Ecol. Econ. 69, 2158–2172. https://doi.org/10.1016/j.ecolecon.2010.06.016.

Blancas, F.J., González, M., Lozano, M., Pérez, F., 2010b. The assessment of sustainable tourism: application to Spanish coastal destinations. Ecol. Indic. 10, 484–492. https://doi.org/10.1016/j.ecolind.2009.08.001.

Blancas, F.J., Lozano, M., González, M., Guerrero, F.Ma., Caballero, R., 2011. How to use sustainability indicators for tourism planning: the case of rural tourism in Andalusia (Spain). Sci. Total Environ. 412-413, 28–45. https://doi.org/10.1016/j.scitotenv.2011.09.066.

Blancas, F.J., Lozano, M., González, M., 2015. A European sustainable tourism labels proposal using a composite indicator. Environ. Impact Assess. Rev. 54, 39–54. https://doi.org/10.1016/j.eiar.2015.05.001.

Blancas, F.J., Lozano, M., González, M., Caballero, R., 2016. Sustainable tourism composite indicators: a dynamic evaluation to manage changes in sustainability. J. Sustain. Tour. 24, 1403–1424. https://doi.org/10.1080/09669582.2015.1122014.

Blancas, F.J., Lozano, M., González, M., Caballero, R., 2018. A dynamic sustainable tourism evaluation using multiple benchmarks. J. Clean. Prod. 174, 1190–1203. https://doi.org/10.1016/j.jclepro.2017.10.295.

Carrillo, M., 2022. Measuring Progress towards sustainability in the European Union within the 2030 agenda framework. Mathematics 10 (12), 2095. https://doi.org/10.3390/math10122095.

Contreras, I., Hinojosa, M.A., 2019. A note on "The cross-efficiency in the optimistic–pessimistic framework". Operat. Res. Int. J. 21, 1393–1401. https://doi.org/10.1007/s12351-019-00484-2.

Dahl, A.L., 2012. Achievements and gaps in indicators for sustainability. Ecol. Indic. 17, 14–19. https://doi.org/10.1016/j.ecolind.2011.04.032.

de Andalucía, Junta, 2016. Plan General de Turismo Sostenible. Horizonte 2020. https://www.juntadeandalucia.es/organismos/transparencia/planificacion-evaluacion-estadistica/planes/detalle/11734.html.

Decancq, K., Lugo, M.A., 2013. Weights in multidimensional indices of wellbeing: an overview. Econ. Rev. 32 (1), 7–34. https://doi.org/10.1080/07474938.2012.690641.

Diakoulaki, D., Mavrotas, G., Papayannakis, L., 1995. Determining objective weights in multiple criteria problems: the critic method. Comput. Oper. Res. 22 (7), 763–770. https://doi.org/10.1016/0305-0548(94)00059-H.

Dominguez-Gil, C., Segovia-Gonzalez, M.M., Contreras, I., 2021. A multiplicative composite indicator to evaluate educational systems in OECD countries. J. Compar. Int. Educ. https://doi.org/10.1080/03057925.2020.1865791.

Ebert, U., Welsch, H., 2004. Meaningful environmental indices: a social choice approach. J. Environ. Econ. Manag. 47 (2), 270–283.

Eckert, E., Hartmann, R., 2020. Measuring sustainability in tourism destinations: adaptation of indicator sets to local conditions illustrated by the example of Windhoek, Namibia. Zeitschrift für Tourismuswissenschaft 12 (3), 370–390. https://doi.org/10.1515/tw-2020-0019.

European Commission, 2016. The European Tourism Indicator System. ETIS Toolkit for Sustainable Destination Management. Publications Office of the European Union, Luxembourg. https://ec.europa.eu/docsroom/documents/21749.

Font, X., Torres-Delgado, A., Crabolu, G., Palomo, J., Kantenbacher, J., Miller, G., 2021. The impact of sustainable tourism indicators on destination competitiveness: the European tourism Indicator system. J. Sustain. Tour. 1-23 https://doi.org/10.1080/09669582.2021.1910281.

Fuchs, M., Weiermair, K., 2004. Destination benchmarking: an indicator-system's potential for exploring guest satisfaction. J. Travel Res. 42, 212–225. https://doi.org/10.1177/0047287503258827.

Giambona, F., Vassallo, E., 2014. Composite indicator of social inclusion for European countries. Soc. Indic. Res. 116 (1), 269–293. https://doi.org/10.1007/s11205-013-0274-2.

Instituto Nacional de Estadística (INE), 2022. DEFine: an application for looking up the main concepts in use at the INE. https://www.ine.es/DEFIne/index.htm?L=1.

Ivars-Baidal, J.A., Vera-Rebollo, J.F., Perles-Ribes, J., Femenia-Serra, F., Celdrán-Bernabeu, M.A., 2021. Sustainable tourism indicators: what's new within the smart city/destination approach? J. Sustain. Tour. https://doi.org/10.1080/09669582.2021.1876075.

Junta, de Andalucía, 2022. Andalucía consigue un hito histórico al posicionarse como primer destino turístico de España y aspira a alcanzar los 26 millones de visitantes en 2022. Gobierno al día. https://www.juntadeandalucia.es/presidencia/portavoz/gobiernoaldia/168313/Andalucia/JuanmaMoreno/JuanMarin/Gobiernoandaluz/Fitur/turismo/pandemia/visitantes/hito/fondoseuropeos/economia/empleo/progreso/bienestar/gestion/empresariosyprofesionales. (Accessed 19 January 2022).

Karnauskaite, D., Schernewski, G., Støttrup, J.G., Kataržyte, M., 2019. Indicator-based sustainability assessment tool to support coastal and marine management. Sustainability 11, 3175. https://doi.org/10.3390/su11113175.

Khodabakhshi, M., Aryavash, K., 2012. Ranking all units in data envelopment analysis. Appl. Math. Lett. 25 (12), 2066–2070. https://doi.org/10.1016/j.aml.2012.04.019.

Ko, J.T.G., 2001. Assessing progress of tourism sustainability. Ann. Tour. Res. 28 (3), 817–820. https://doi.org/10.1016/s0160-7383(00)00070-0.

Ko, J.T.G., 2005. Development of a tourism sustainability assessment procedure: a conceptual approach. Tour. Manag. 26, 431–445. https://doi.org/10.1016/j.tourman.2003.12.003.

Kozak, M., 2004. Introducing destination benchmarking: a conceptual approach. J. Hosp. Tour. Res. 28 (3), 281–297. https://doi.org/10.1177/1096348003256603.

Kozak, M., 2014. Destination benchmarking. In: Jafari, J., Xiao, H. (Eds.), Encyclopedia of Tourism. Springer, Cham. https://doi.org/10.1007/978-3-319-01669-6_52-1.

Kristjánsdóttir, K.R., Ólafsdóttir, R., Ragnarsdóttir, K.V., 2018. Reviewing integrated sustainability indicators for tourism. J. Sustain. Tour. 26 (4), 583–599. https://doi.org/10.1080/09669582.2017.1364741.

Kuiper, F.K., Fisher, L., 1975. A Monte Carlo comparison of six clustering procedures. Biometrics 31, 777e783. https://doi.org/10.2307/2529565.

Landaluce-Calvo, M.I., Gonzalo-Delgado, M., 2021. Proposal for a dynamic composite indicator: application in a comparative analysis of trends in the EU member states towards the Europe 2020 strategy. Soc. Indic. Res. 154, 1031–1053. https://doi.org/10.1007/s11205-020-02547-w.

Law, A., DeLacy, T., McGrath, G.M., 2017. A green economy indicator framework for tourism destinations. J. Sustain. Tour. 25 (10), 1434–1455. https://doi.org/10.1080/09669582.2017.1284857.

Lee, T.H., Jan, F.H., Liu, J.T., 2021. Developing an indicator framework for assessing sustainable tourism: evidence from a Taiwan ecological resort. Ecol. Indic. 125, 107596 https://doi.org/10.1016/j.ecolind.2021.107596.

Lozano, M., Blancas, F.J., González, M., Caballero, R., 2019a. Sustainable tourism tags to reward destination management. J. Environ. Manag. 250 (109458), 1–11. https://doi.org/10.1016/j.jenvman.2019.109458.

Lozano, M., Contreras, I., Blancas, F.J., 2019b. An operational non-compensatory composite indicator: measuring sustainable tourism in Andalusian urban destinations. Ecol. Econ. 159, 1–10. https://doi.org/10.1016/j.ecolecon.2019.01.008.

Lozano-Oyola, M., Blancas, F.J., González, M., Caballero, R., 2012. Sustainable tourism indicators as planning tools in cultural destinations. Ecol. Indic. 18, 659–675. https://doi.org/10.1016/j.ecolind.2012.01.014.

Lu, J., Nepal, S.K., 2009. Sustainable tourism research: an analysis of papers published in the journal of sustainable tourism. J. Sustain. Tour. 17 (1), 5–16. https://doi.org/10.1080/09669580802582480.

Luštický, M., Kincl, T., 2012. Tourism destination benchmarking: evaluation and selection of the benchmarking partners. J. Competitiv. 4 (1), 99–116. https://doi.org/10.7441/joc.2012.01.08.

Mahdavi, D., Parishan, M., Hasar, A.Y., 2013. Practical model for measuring progress towards sustainable rural tourism development (SRTD) in rural area of Iran. Int. Res. J. Appl. Basic Sci. 5 (8), 1073–1082.

Mitchell, G., 1996. Problems and fundamentals of sustainable development indicators. Sustain. Dev. 4, 1–11. https://doi.org/10.1002/(SICI)1099-1719(199603).

Munda, G., 1995. Multicriteria evaluation in a Fuzzy Environment, Physica-Verlag. Contributions to Economics Series, Heidelberg.

Munda, G., Nardo, M., 2005. Constructing Consistent Composite Indicators: The Issue of Weights. Institute for the Protection and Security of the Citizen. Office for Official Publications of the European Communities, European Commission, Luxembourg. https://core.ac.uk/download/pdf/38619689.pdf.

Munda, G., Nardo, M., 2009. Noncompensatory/nonlinear composite indicators for ranking countries: a defensible setting. Appl. Econ. 41, 1513–1523. https://doi.org/10.1080/00036840601019364.

OECD, 2008. Handbook on Constructing Composite Indicators. Methodology and User Guide. Organization for Economic Cooperation and Development, Paris.

OECD (Organisation for Economic Co-operation and Development), 2005. Environmental Performance Reviews. Organization for Economic Cooperation and Development, Paris.

Padin, C., 2012. A sustainable tourism planning model: components and relationships. Eur. Bus. Rev. 24 (6), 510–518. https://doi.org/10.1108/09555341211270528.

Paruolo, P., Saisana, M., Saltelli, A., 2013. Ratings and rankings: voodoo or science? J. Roy. Stat. Soc. Ser. A (Stat. Soc.) 176 (3), 609–634. https://doi.org/10.1111/j.1467-985X.2012.01059.x.

Penny, Y., Li, X., 2013. Sustainability of tourism development in Macao, China. Int. J. Tour. Res. 15 (1), 52–65. https://doi.org/10.1002/jtr.873.

Pérez, V., Guerrero, F.M., González, M., Pérez, F., Caballero, R., 2013. Composite indicator for the assessment of sustainability: the case of Cuban nature-based tourism destinations. Ecol. Indic. 29, 316–324. https://doi.org/10.1016/j.ecolind.2012.12.027.

Pérez, V.E., Santoyo, A.H., Guerrero, F., León, M.A., da Silva, C.L., Caballero, R., 2017. Measuring the sustainability of Cuban tourism destinations considering stakeholders' perceptions. Int. J. Tour. Res. 19 (3), 318–328. https://doi.org/10.1002/jtr.2114.

Poudel, S., Nyaupane, G.P., Budruk, M., 2014. Stakeholders' perspectives of sustainable tourism development: a new approach to measuring outcomes. J. Travel Res. 55 (4), 465–480. https://doi.org/10.1177/0047287514563166.

Pulido, J., Sánchez, M., 2009. Measuring tourism sustainability: proposal for a composite index. Tour. Econ. 15, 277–296. https://doi.org/10.5367/000000009788254377.

Punzo, G., Trunfio, M., Castellano, R., Buonocore, M., 2022. A multi-modelling approach for assessing sustainable tourism. Soc. Indic. Res. https://doi.org/10.1007/s11205-022-02943-4.

Rajaonson, J., Tanguay, G.A., 2012. Strategy for selecting sustainable tourism indicators for the Gaspésie and Îles de la Madeleine regions. Les innovations en tourisme durable 31 (3), 77–84. https://doi.org/10.7202/1036567ar.

Rajaonson, J., Tanguay, G.A., 2019. Urban sustainability indicators from a regional perspective: lessons from the Montreal metropolitan area. Social Indicat. Res. Int. Interdisc. J. Quality-of-Life Measur. 141 (3), 985–1005. https://doi.org/10.1007/s11205-017-1823-x.

Rasoolimanesh, S.M., Ramakrishna, S., Hall, C.M., Esfandiar, K., Seyfi, S., 2020. A systematic scoping review of sustainable tourism indicators in relation to the sustainable development goals. J. Sustain. Tour. 1-21 https://doi.org/10.1080/09669582.2020.1775621.

Roy, B., 1996. Multicriteria Methodology for Decision Analysis. Kluwer, Dordrecht.

Saaty, T.L., 1980. The Analytic Hierarchy Process: Planning, Priority Setting, Resource Allocation. McGraw-Hill, New York.

Saaty, T.L., 1990. How to make a decision: the analytic hierarchy process. Eur. J. Oper. Res. 24 (2), 9–16.

Schernewski, G., Schönwald, S., Katar, M., 2014. Application and evaluation of an indicator set to measure and promote sustainable development in coastal areas. Ocean Coast. Manag. 101, 2–13. https://doi.org/10.1016/j.ocecoaman.2014.03.028.

Tanguay, G.A., Rajaonson, J., Lefebvre, J.F., Lanoie, P., 2010. Measuring the sustainability of cities: an analysis of the use of local indicators. Ecol. Indic. 10 (2), 407–418. https://doi.org/10.1016/j.ecolind.2009.07.013.

Tanguay, G.A., Rajaonson, J., Therrien, M.-C., 2013. Sustainable tourism indicators: selection criteria for policy implementation and scientific recognition. J. Sustain. Tour. 21 (6), 862–879. https://doi.org/10.1080/09669582.2012.742531.

UNEP (United Nations Environment Programme), 2007. Global Environmental Outlook. UNEP, Geneva.

United Nations Commission on Sustainable Development, 2001. Indicators of Sustainable Development: Guidelines and Methodologies. UNCSD, New York.

UNWTO, 2004. Indicators of Sustainable Development for Tourism Destinations. A Guidebook. Ed. World Tourism Organization, Madrid.

UNWTO, 2016. Measuring the Sustainability of Tourism: Developing a Statistical Framework for Sustainable Tourism. World Tourism Organization.

UNWTO, 2018. Medición creíble del turismo sostenible para mejorar la toma de decisiones. Retrieved from: https://www.unwto.org/es/press-release/2018-03-02/medicion-creible-del-turismo-sostenible-para-mejorar-la-toma-de-decisiones.

UNWTO, 2022. UNWTO Tourism Recovery Tracker. Retrieved from: https://www.unwto.org/unwto-tourism-recovery-tracker.

UNWTO (United Nations World Tourism Organization), 1996. What Tourism Managers Need to Know: A Practical Guide to the Development and Use of Indicators of Sustainable Tourism. World Tourism Organization, Madrid.

Van Puyenbroeck, T., Rogge, N., 2017. Geometric mean quantity index numbers with benefit-of-the doubt weights. Eur. J. Operat. Res. 256 (3), 1004–1014. https://doi.org/10.1016/j.ejor.2016.07.038.

Verbunt, P., Rogge, N., 2018. Geometric composite indicators with compromise benefit-of-the doubt weights. Eur. J. Operat. Res. 264 (1), 388–401. https://doi.org/10.1016/j.ejor.2017.06.061.

Vincke, P., 1992. Multicriteria decision aid. Wiley, New York.

Vinyals-Mirabent, S., 2019. European urban destinations' attractors at the frontier between competitiveness and a unique destination image. A benchmark study of communication practices. J. Destin. Mark. Manag. 12, 37–45. https://doi.org/10.1016/j.jdmm.2019.02.006.

Wang, S.H., Lee, M.T., Château, P.A., Chang, Y.C., 2016. Performance Indicator framework for evaluation of sustainable tourism in the Taiwan coastal zone. Sustainability 8, 652. https://doi.org/10.3390/su8070652.

Ward, J.H., 1963. Hierarchical grouping to optimize an objective function. J. Am. Stat. Assoc. 58, 236–244. https://doi.org/10.1080/01621459.1963.10500845.

Zhou, P., Ang, B.W., Poh, K.L., 2006. Comparing aggregation methods for constructing the composite environmental index: an objective measure. Ecol. Econ. 59 (3), 305–311. https://doi.org/10.1016/j.ecolecon.2005.10.018.

Zhou, P., Ang, B.W., Zhou, D.Q., 2010. Weighting and aggregation in composite indicator construction: a multiplicative optimization approach. Soc. Indic. Res. 96 (1), 169–181. https://doi.org/10.1007/s11205-009-9472-3.

Zlatković, M., 2016. Tourism destination benchmarking analysis. Eur. J. Multidisc. Stud. 1 (1), 283–293. https://doi.org/10.26417/ejms.v1i1.p283-293.

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