Tourism competitiveness measurement. A perspective from Central America and Caribbean destinations

Víctor Ernesto Pérez León, Flor Mª Guerrero and Rafael Caballero

Abstract
Purpose – This study aims to present diverse proposals for the measurement of tourism destination competitiveness that serve as alternatives to the travel and tourism competitiveness index (TTCI).

Design/methodology/approach – The proposal includes principal component analysis, the DP2-distance method, goal programming, data envelopment analysis and the Borda count. The study evaluates 17 destinations from Central America and the Caribbean.

Findings – These include the feasibility that the methodologies provide reliable competitiveness rankings and the possibility of using less information due to the strength of the statistical methodologies. International tourist arrivals, income from international tourism and travel and tourism contribution to the gross domestic product could be used as approximations of tourism destination competitiveness.

Research limitations/implications – The main limitation is the absence of major destinations from the region that constitutes fierce competitors.

Practical implications – New aggregation methods can build composite indicators for competitiveness measurement and their presentation in a more comprehensible way.

Social implications – The results serve as an alternative for countries that have yet to be considered in international tourism competitiveness comparisons.

Originality/value – A better explanatory power of the proposed index is given, thanks to their decomposition capacity and the reduction of the limitations of the original TTCI. Moreover, the proposals facilitate the inclusion of external information or the execution of a completely objective methodology.

Keywords Competitiveness, Central America and the Caribbean, Composite indicators, Distance-based methods, Multicriteria, Data envelopment analysis

Paper type Research paper
Medición de la competitividad turística. Una perspectiva desde los destinos de centro América y El Caribe

Resumen

Propósito: El presente estudio busca presentar diversas metodologías para medir la competitividad de los destinos turísticos, de modo que sirvan como alternativa al Índice de Competitividad de Viajes y Turismo.

Diseño/metodología/enfoque: La propuesta incluye Análisis de Componentes Principales, el método de distancia DP2, Programación por Metas, Análisis Envolvente de Datos y el Recuento de Borda. Se analizan 17 destinos de Centro América y el Caribe.

Hallazgos: Estos incluyen la validez de las metodologías para obtener rankings de competitividad fiables y la posibilidad de emplear menor cantidad de información, dadas las fortalezas de los procedimientos estadísticos propuestos. Las Llegadas de Turistas Internacionales, los Ingresos por Turismo Internacional, y la Contribución del Turismo al PIB podrían ser buenas aproximaciones para medir competitividad turística.

Limitaciones/implicaciones: La principal limitación es la ausencia de destinos importantes de la región, que se consideran importantes competidores.

Implicaciones prácticas: Novedosos procedimientos de agregación para crear indicadores sintéticos para medir la competitividad turística y su presentación de un modo más comprensible.

Implicaciones sociales: Los resultados sirven como alternativa para otros destinos que aún no han sido considerados en comparaciones internacionales de competitividad turística.

Originalidad: Un mejor poder explicativo de los índices propuestos, gracias a su capacidad de descomposición, y de las limitaciones del índice del WEF. Además, las propuestas facilitan la inclusión de información externa o la ejecución de un método completamente objetivo.

Palabras clave: Competitividad, Centro americana y el caribe, Indicadores sintéticos Méritos basados en distancia, Multicriterio análisis envolvente de datos

Tipo de papel: Trabajo de investigación

1. Introduction

To assess destination competitiveness, researchers have diagnosed the competitive positions of a specific destination or groups of destinations using a wide range of approaches, tools and simple and specific indicators (Abreu-Novais et al., 2016). In addition, the literature reveals the existence of several studies dedicated to this end (Carayannis et al., 2018; Croes, 2011; Croes and Kubickova, 2013; Dwyer et al., 2000; Gómez-Vega and Picazo-Tadeo, 2019; Kayar and Kozak, 2010; Knežević Cvelbar et al., 2016; Kunst and Ivandić, 2021; Ritchie and Crouch, 2010; Rodríguez-Díaz and Pulido-Fernández, 2021; Uyar et al., 2022). Nevertheless, the progress presented to date reveals, amongst other factors, certain limitations regarding the selection of evaluation variables and the calculation of their respective weights (Carayannis et al., 2018), the methodology used to aggregate the information and the explanatory power of the results.

Amongst the diverse initiatives developed to measure destination competitiveness, there is the travel and tourism competitiveness index (TTCI) developed by the World Economic Forum (WEF) (WEF, 2015, 2017, 2019), which constitutes the most noteworthy contribution. This index has been launched biannually since 2007 and serves as a comprehensive strategic tool to measure the factors and policies that make the development of the tourism sector attractive in various countries, by enabling all stakeholders to work jointly to improve the competitiveness of the tourism industry in their national economies, thereby contributing towards growth and national prosperity (WEF, 2019).

The TTCI is composed of 14 “pillars” comprising a set of qualitative and quantitative variables. Each of the pillars is calculated as an unweighted average of the individual component variables. The sub-indices are then calculated as unweighted averages of the pillars included, and this process has remained invariable since its first publication (WEF, 2019).

This is one of the most commonly used and feasible indices, thanks to its credibility, data accuracy (Abreu-Novais et al., 2016) and the desirable combination of hard and soft data, which is narrowly limited to a small number of initiatives. The index is a valuable comparability tool for the demonstration of destination strengths (Pérez León, et al., 2021a).
and support of their visibility. Consequently, following the findings of Uyar et al. (2022),
diverse studies assess destination competitiveness using the TTCI in global analysis
(Rodríguez-Díaz and Pulido-Fernández, 2021; Salinas et al., 2022) and evaluate different
destinations according to their general behaviour (Salinas et al., 2020) or compare
regional destinations, including the Mediterranean (Kunst and Ivandić, 2021), Middle
Eastern destinations (Leung and Baloglu, 2013), European Union countries (Kayar and
Kozak, 2010) and Caribbean destinations (Pérez León et al., 2021a), among others.

This index is one of the most highly criticised initiatives in the measurement of destination
competitiveness, due to its intense use. The criticism involves methodological issues (Croes
and Kubickova, 2013), the arbitrary weighting of the variables (Pulido-Fernández and
Rodríguez-Díaz, 2016; Salinas et al., 2020), the number of indicators within each pillar
(Gómez-Vega and Picazo-Tadeo, 2019), the components of the index that most influence
destination competitiveness (Kubickova and Martin, 2020; Uyar et al., 2022), its viability as
a reliable measure of destination competitiveness (Kunst and Ivandić, 2021) and the
amount of information required for its creation (Mendola and Volo, 2017), among other
issues.

The latter consideration is the main reason why various countries have been omitted from
certain editions, as is the case with several destinations in the Caribbean region. While most
developed countries succeed in collecting reliable tourism data, less developed countries
struggle to provide accurate and timely statistics (Mendola and Volo, 2017). Alternatives are
therefore needed that allow tourism competitiveness to be measured with a smaller number
of indicators, whose degree of reliability and understanding is at least as high as that of the
TTCI.

Along these lines, this study aims to introduce various proposals for the measurement of
tourism destination competitiveness (TDC) that serves as an alternative to the TTCI, which
reduces negative aspects such as the amount of information needed for its creation,
includes the possibility of introducing external information and provides ease in interpreting
the results, thereby revealing the strengths and weaknesses of the destinations analysed,
and identifying the contribution of the subindices to the global competitiveness measure.
This research includes the achievement of a competitiveness ranking using different
methods, such as the $D_{2\angle}$-distance, principal component analysis, goal programming and
data envelopment analysis (DEA), and the study of their differences according to the
weights and aggregation processes. Additionally, a meta-index is obtained by means of the
Borda count method through allowing decision-makers to achieve a global ranking
representative of the overall degree of competitiveness for compared destinations, starting
from the results of different aggregation methods.

This is an innovative approach in the achievement of meta-indices as it enables the
strengths of the composite indicators to be taken into account while striving to reduce their
weaknesses. In contrast to other studies that use similar methods (Salinas et al., 2020,
2022), the $D_{2\angle}$-distance proposes the identification of those indicators that measure tourism
competitiveness without having to use all the information required in the TTCI and/or in the
distance-principal component (DPC) indicator. Moreover, in contrast to Gómez-Vega and
Picazo-Tadeo (2019), our proposal uses goal programming to create the dimensional
indicators with all the information available, together with the consideration of both internal
and external information. Furthermore, the use of DEA is proposed to obtain the global
competitiveness index so that it could be possible to identify the contribution of each
dimension to the global measure. Finally, the use of the Borda count method is proposed to
merge the rankings obtained and to solve the problem of their differences. Additionally, the
study includes the comparison of the rankings obtained with the rankings from the WEF,
both for each sub-index and globally to validate the feasibility of the proposed approaches.
Comparison to other indicators related to TDC is also made to evaluate their possibility of
being representative of a certain degree of competitiveness.
This research involves the measurement of destination competitiveness in various destinations from Central America and the Caribbean region, using the country level. Notwithstanding, this topic has been addressed at different levels: resorts (Claver-Cortés et al., 2007), tour operator and hotel companies (Assaf, 2012), cities (Enright and Newton, 2005), regions (Cracolici and Nijkamp, 2009) and countries (Salinas et al., 2020). The approaches presented in this study are useful for all destination sizes and depend on the scope of the indicators and the information used.

The paper is structured as follows. First, after the presentation of the research gap and of the objectives in the introduction, the proposals for the measurement of destination competitiveness are described in detail. The region case study and the data used in the verification of the suitability of the proposed methods are then presented. The results are given, both per dimension and globally, and include their relationship to other non-previously used indicators. Lastly, the conclusion section reveals the implications and proposes further research.

2. Methods

2.1 The DP$_2$-distance indicator

The first method, called the DP$_2$-distance indicator, was initially developed to measure the evolution of social welfare (Pena, 1978; Zarzosa and Somarriba, 2013). This method is objective and eliminates the problems related to duplicity of information. It has also been used as an alternative in the measurement of TDC by Salinas et al. (2020, 2022) to solve the problems arising from the aggregation of variables with different measurements and the assignation of arbitrary weights.

The DP$_2$-distance for a destination is defined as:

$$DP_2 = \sum_{i=1}^{n} \frac{d_i}{\sigma_i} \left( 1 - R_i^2_{j-i-1} \right) \text{with } R_i^2 = 0$$

For $i = 1, \ldots, n$, $d_i$ is the distance between the observed unit and the reference situation for the $i$th indicator, and $\sigma_i$ is the standard deviation of the $i$th indicator. The $d_i$ dividing the standard deviation of each indicator eliminates the problems associated with the units of measure. $R_i^2_{j-i-1}$ is the determination coefficient, and the term $1 - R_i^2_{j-i-1}$ is the correction factor that represents the variability percentage of the $i$th indicator that is not lineally explained for the previous $i - 1$ indicators. In this way, the problem of information duplicity is solved because this coefficient eliminates the information contained in the $i$th indicator contributed in the $i - 1$ previously added indicators.

This procedure contains certain advantages, such as its objectivity, its independence from normalisation processes and the fact that its weights are determined endogenously; therefore, any duplicity of information is eliminated.

2.2 Distance-principal component indicator (DPC)

This indicator combines principal component analysis with the concept of distance to a reference point based on multi-criteria decision-making philosophy and is defined as follows:

$$DPC_i = \sum_{j=1}^{q} \left[ VE_j \left( \sum_{k=1}^{p} |IN_k| \text{Corr}_{jk} \right) \right]$$

for $i = 1, 2, \ldots, n$, where $n$ is the number of observations, $p$ is the number of original indicators, $q$ is the number of components selected, $VE_j$ is the variance explained by the $j$th
component and $\text{Corr}_{jk}$ is the correlation between the $j$th component and the $k$th indicator. $\text{IN}_{ik}$ is the normalised value of the $i$th observation in the $k$th indicator, which is needed for the normalisation of the data such that the measuring units used for each indicator exert no effect on the final result. This procedure involves dividing the distance to the anti-ideal point by the difference between the maximum and the minimum values:

$$\text{IN}_{ik} = \frac{I_{ik} - \text{Min}}{\text{Max} - \text{Min}}$$

where $I_{ik}$ is the value of the $i$th observation in the $k$th indicator. The minimum value of each indicator is taken as the reference point while bearing in mind that higher values indicate that the destination is assumed to be more competitive. This approach enjoys certain advantages, such as the ease in interpreting the results, as the values of the initial indicators are defined according to their distance to a fixed reference value such that the synthetic indicator is a linear combination of these distances and not of the principal components. Moreover, weights are determined endogenously.

The DP$_2$ and the DPC are valid for those analyses in which the destinations have not gathered all the information requested by the WEF for the creation of the TTCI. In this way, the procedure may help to identify the indicators required to measure destination competitiveness. Hence, only the data concerning the indicators resulting from the initial selection process should be collected, i.e. those indicators that contribute with a higher level of information to the competitiveness measure (DP$_2$) or those obtained from the prior application of the principal component analysis (DPC). Furthermore, their use is proposed when there is no information regarding the level of importance of the indicators.

### 2.3 The goal programming synthetic index (GPSI)

The goal programming synthetic index (GPSI) is encouraged in the procedure of Blancas et al. (2010), whereby a set of $m$ initial indicators ($X_j$ with $j = 1, 2, \ldots, m$) is considered, for $n$ units ($U_i$ with $i = 1, 2, \ldots, n$), where $X_j$ represents the value of the $j$th unit valued in the $i$th indicator with $1 \leq i \leq n$ and $1 \leq j \leq m$. Firstly, it is necessary to differentiate between positive ($I_{ij}$) and negative ($I_{ik}$) indicators, depending on the direction of improvement: “more is better” or “less is better”, respectively. In this way, $X_{ij}$ represents the value for the $i$th unit in the $j$th positive indicator, with $j \in J$ ($J$, positive indicators) and $X_{ik}$ is the value of the $i$th unit in the $k$th negative indicator, with $k \in K$ ($K$, negative indicators). The achievement levels or the target for each indicator can therefore be determined: $u_{ij}^+$ for the positive and $u_{ik}^-$ for the negative. Subsequently, goals are created by introducing the deviation variables to measure the difference between the indicator value and the target:

For positive indicators: $I_{ij} + n_{ij}^+ - p_{ij}^- = u_{ij}^+$ with $n_{ij}^+ \geq 0$, $p_{ij}^- = 0$

For negative indicators: $I_{ik} + n_{ik}^- - p_{ik}^+ = u_{ik}^-$ with $n_{ik}^- \geq 0$, $p_{ik}^+ = 0$

where $n_{ij}^+$ is the undesirable variable for positive indicators, and $p_{ik}^+$ is the undesirable variable for the negative indicators. Values higher than these variables reveal an absence of competitiveness. This procedure enables several indices to be obtained and the net GPSI, $\text{GPSI}_{ik}$, is selected for its compensatory character between the strengths and weaknesses for each unit under evaluation. The $\text{GPSI}_{ik}$ for a unit is defined as:

$$\text{GPSI}_{ik}^N = \sum_{j \in J} w_j^+ \left( \frac{p_{ij}^+ - n_{ij}^+}{u_{ij}^+} \right) + \sum_{k \in K} w_k^- \left( \frac{n_{ik}^- - p_{ik}^+}{u_{ik}^-} \right), \forall i \in \{1, 2, \ldots, n\}$$

where $w_j^+$ and $w_k^-$ are the weights for positive and negative indicators, respectively. The first sum shows the difference between the strengths and weaknesses for positive indicators, and similarly, the second sum shows this difference for the negative indicators.
The contribution of this proposal in measuring TDC involves the possibility of establishing a lower bound for the indicators in such a way that a destination could be considered competitive with respect to this target value in comparison with its competitors. Moreover, there is the facility of interpreting the results through the identification of the strengths and weaknesses of the destinations under comparison in a more comprehensible way than when the TTCI is used.

This procedure can be used both for those destinations that hold all the information available and for those that lack some data. This enables the inclusion of weights obtained externally. Once the dimensional indicators are obtained through the proposed methods, the second stage then involves the use of DEA to generate a global index, as described below.

### 2.4 Data envelopment analysis (DEA)

DEA is a non-parametric technique used for the construction of composite indicators (Gómez-Vega and Picazo-Tadeo, 2019). DEA models possess the advantage of displaying unit invariance, which renders the normalisation stage redundant. For this stage, the initial information was previously obtained from the dimensional indicators for each destination. A single dummy input with value unity for each destination can be used. This model is formally equivalent to the original input-oriented, constant-returns-to-scale DEA model presented (Charnes et al., 1978). The global synthetic index for the \( i_0 \) observation is obtained by solving the following the linear programming problem:

\[
DEA_i = \max_{w} \sum_{j=1}^{d} w_j D_{ij}
\]

subject to:

\[
\sum_{j=1}^{d} w_j D_{ij} \leq 1 \quad \forall i = 1, \ldots, n \quad \text{(normalisation constraint)}
\]

\[
w_j D_{ij} \geq \omega \quad \forall i = 1, \ldots, n, \quad \forall j = 1, \ldots, d \quad \text{(virtual output constraint)}
\]

\[
w_j \geq 0 \quad \forall j = 1, \ldots, d \quad \text{(non-negativity constraint)}
\]

where \( w_j \) are the weights for the observation \( i_0 \), \( D_{ij} \) represents the \( j \)-th dimension indicator for the \( i \)-th observation, which would be the DPC if the global index refers to DEA after distance-principal component (DEAPC) or the GPSI is used if the global measurement represents DEA after goal programming (DEAGP); \( d \) is the number of dimensions considered (the sub-indices held in the TTCI) and \( \omega \) is a real number that represents the minimum value allowed for the \( j \)-th virtual output for the \( i \)-th observation. The virtual output constraint involves the implication of all the dimensions in the global composite index.

The objective function chooses the weights that maximise the value of the composite index for observation \( i_0 \). In the best situation, the index takes a value of 1, which implies that the destination has a performance equal to its reference unit. The 0 value represents the worst situation. The \([0,1]\) range is a characteristic of the input-oriented model, which numerically renders results more comprehensible and guarantees results with a higher explanatory power: this is a desirable characteristic of composite indicators.

The virtual output constraint has been introduced to guarantee the presence of all dimensions in the composite index with a minimum value of \( \omega \). Its use in the second phase of aggregation enables the identification of the contribution of each dimension towards the global index.
2.5 The Borda count method

The Borda count method uses mapping from a set of individual rankings to create a combined ranking that leads to the most relevant decision (Lumini and Nanni, 2006). In Borda count, a voter ranks all candidates in a strict order by assigning different points according to the ranking (Vainikainen et al., 2008). This method assigns zero points to a voter’s least preferred option, 1 point for the next option and \((n - 1)\) points for the most preferred (where \(n\) is the number of alternatives). However, this way of assigning zero points to the least preferred candidate is unfavourable for the implementation of the analytical calculation (Lawrence et al., 2012). The Borda ranking is therefore determined by placing the Borda scores in order. This approach is useful in those cases where the decision-makers have attained different rankings due to the use of diverse aggregation methods.

3. Geographical context and dataset

The study comprises 17 destinations from Central America and the Caribbean, which is the highest number of countries to have been included in an edition of the TTCI. These are underdeveloped countries in close geographical proximity, in the most tourism-dependent region worldwide, according to the World Travel & Tourism Council (WTTC) (2020, 2021). These destinations compete within the same tourist market, and they offer a similar tourist experience: predominantly sun-and-sand tourism, with emphasis on cruise tourism, which has become big business, with the Caribbean accounting for more than 35% of all such vacations globally (Caribbean Council, 2019). Moreover, while the number of countries included in the TTCI had been steadily rising, the number of Caribbean countries included has decreased in the latest editions, thereby passing from 17 to 13 destinations in the space of only four years. Their absence was caused due to difficulties in providing all the information required. Consequently, some of the proposed approaches serve as alternatives to these destinations, due to the possibility of using less information.

The data used correspond to the 2015 edition of the TTCI, which is the year that included the most destinations from the region. It comprises 90 indicators distributed into 14 pillars grouped into four sub-indices (WEF, 2015). Those indicators with more than three missing values are excluded. For those indicators with three or fewer missing values, their scores are substituted with the minimum. This substitution guarantees the presence of those indicators in the composite measure and, therefore, its representativeness. Moreover, the scores are not influenced, thanks to the proposed method. Consequently, the data set comprises 86 indicators: 40, 22, 14 and 10 for sub-indices A, B, C and D, respectively, of which 30 are subjective. In addition, all the pillars are presented in the study as follows: Pillar A.01 (12 indicators), A.02 (5), A.03 (6), A.04 (9), A.05 (8), B.06 (6), B.07 (3), B.08 (4), B.09 (10), C.10 (5), C.11 (4), C.12 (4), D.13 (5) and D.14 (5).

4. Results and discussion

The aggregation process is developed in the same way as that proposed by the WEF to create the TTCI (Figure 1). Firstly, the indicators are grouped into their pillars, and the pillars are then used to create the dimensional indicators. Lastly, a global index is built by grouping the sub-indices. The dimensional indicators are created through the DP2, the DPC and the GPSI approaches. The global competitiveness index is subsequently built using the DP2 and DEA methods. The latter is used for the two global indices proposed:

1. the DEAPC; and
2. the DEAGP methods.
As a result, three alternative methods are presented for the creation of the dimensional and global indicators.

Despite the unfeasibility of the DPC and DP2 indicators embracing more indicators than destinations, the proposed steps allow the inclusion of all the information. Moreover, to attain a process as close as possible to the WEF proposal, the aspiration level used for the GPSI is zero. In this regard, under this approach, all the destinations only evaluate their strengths. The denominators are omitted from the GPSI, and therefore, the weaknesses are not included.

The weights are achieved in a different way for each methodology. The DP2 and the DPC methods calculate their weights endogenously. On average, the DP2 assigns the highest weight to Sub-index B “T&T Policy and Enabling Conditions”, and the DPC gives more weight to Sub-index C “Natural and Cultural Resources”, while least importance is assigned to Sub-index A “Enabling Environment”. These assignations are consistent with the conditions of the region, comprised of underdeveloped countries with lower scores on safety, health, information and communication technology (ICT) readiness (WEF, 2015, 2017) and the demonstrated efforts made by the governments towards the development of the tourism sector in the region (Pérez León et al., 2021b), due to their dependence on this activity. For the GPSI, however, weights should be assigned. For the latter procedure (GPSI), the same importance is given to all the indicators contained in each pillar. For sub-dimensional indicators, the same importance is given to each pillar within the sub-indices. Lastly, all sub-indices receive the same importance in order to calculate the global indicator.

4.1 Dimensional results

The results for the pillars appear in Table A1, while the dimensional results are shown on Table 1. The dimensional results reveal great stability amongst the rankings, including the comparison with the results attained with those from the WEF. The five most and least competitive destinations coincide in all the rankings created. This is a great achievement because, despite the differences between the procedures, the results seem to present major similarity. The results from the GPSI approach are those more closely related to the other methods and, compared to those of the TTCI, the DP2 and the GPSI are those closest to the WEF outputs. This is a great advantage for the DP2 methodology because it reveals its capacity for englobing the relevant information under the statistical methods comprised in the procedure.

The similarities can be corroborated statistically. The Pearson correlation between scores demonstrates their similarity with all values higher than 0.871 and significant at the 0.01
<table>
<thead>
<tr>
<th>Destinations</th>
<th>TTCI_A</th>
<th>DP2_A</th>
<th>DPC_A</th>
<th>GPSI_A</th>
<th>TTCI_B</th>
<th>DP2_B</th>
<th>DPC_B</th>
<th>GPSI_B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barbados</td>
<td>5.25</td>
<td>1</td>
<td>10.25</td>
<td>1</td>
<td>3.365</td>
<td>1</td>
<td>5.246</td>
<td>1</td>
</tr>
<tr>
<td>Columbia</td>
<td>4.08</td>
<td>13</td>
<td>5.588</td>
<td>11</td>
<td>1.919</td>
<td>14</td>
<td>4.152</td>
<td>13</td>
</tr>
<tr>
<td>Costa Rica</td>
<td>4.84</td>
<td>2</td>
<td>9.197</td>
<td>2</td>
<td>3.272</td>
<td>2</td>
<td>4.921</td>
<td>2</td>
</tr>
<tr>
<td>Dominican Republic</td>
<td>4.21</td>
<td>9</td>
<td>5.514</td>
<td>12</td>
<td>2.221</td>
<td>10</td>
<td>4.264</td>
<td>9</td>
</tr>
<tr>
<td>El Salvador</td>
<td>4.13</td>
<td>11</td>
<td>5.672</td>
<td>10</td>
<td>1.999</td>
<td>13</td>
<td>4.174</td>
<td>12</td>
</tr>
<tr>
<td>Guatemala</td>
<td>4.14</td>
<td>10</td>
<td>5.966</td>
<td>8</td>
<td>2.085</td>
<td>12</td>
<td>4.209</td>
<td>11</td>
</tr>
<tr>
<td>Guyana</td>
<td>4.11</td>
<td>12</td>
<td>4.734</td>
<td>14</td>
<td>2.276</td>
<td>8</td>
<td>4.22</td>
<td>10</td>
</tr>
<tr>
<td>Haiti</td>
<td>3.42</td>
<td>17</td>
<td>1.319</td>
<td>17</td>
<td>1.569</td>
<td>16</td>
<td>3.42</td>
<td>17</td>
</tr>
<tr>
<td>Honduras</td>
<td>3.92</td>
<td>15</td>
<td>4.688</td>
<td>15</td>
<td>1.851</td>
<td>15</td>
<td>3.988</td>
<td>15</td>
</tr>
<tr>
<td>Jamaica</td>
<td>4.26</td>
<td>2</td>
<td>5.924</td>
<td>9</td>
<td>2.092</td>
<td>11</td>
<td>4.339</td>
<td>8</td>
</tr>
<tr>
<td>Mexico</td>
<td>4.34</td>
<td>7</td>
<td>6.117</td>
<td>7</td>
<td>2.249</td>
<td>9</td>
<td>4.392</td>
<td>7</td>
</tr>
<tr>
<td>Nicaragua</td>
<td>4.06</td>
<td>14</td>
<td>5.275</td>
<td>13</td>
<td>2.382</td>
<td>7</td>
<td>4.085</td>
<td>14</td>
</tr>
<tr>
<td>Panama</td>
<td>4.7</td>
<td>4</td>
<td>8.239</td>
<td>4</td>
<td>2.893</td>
<td>4</td>
<td>4.766</td>
<td>4</td>
</tr>
<tr>
<td>Puerto Rico</td>
<td>4.73</td>
<td>3</td>
<td>8.459</td>
<td>3</td>
<td>2.951</td>
<td>3</td>
<td>4.794</td>
<td>3</td>
</tr>
<tr>
<td>Suriname</td>
<td>4.42</td>
<td>6</td>
<td>6.356</td>
<td>6</td>
<td>2.577</td>
<td>5</td>
<td>4.411</td>
<td>6</td>
</tr>
<tr>
<td>Trinidad and Tobago</td>
<td>4.53</td>
<td>5</td>
<td>7.062</td>
<td>5</td>
<td>2.358</td>
<td>6</td>
<td>4.584</td>
<td>5</td>
</tr>
<tr>
<td>Venezuela</td>
<td>3.58</td>
<td>16</td>
<td>3.088</td>
<td>16</td>
<td>1.252</td>
<td>17</td>
<td>3.643</td>
<td>16</td>
</tr>
<tr>
<td>Destinations</td>
<td>TTCI_C</td>
<td>DP2_C</td>
<td>DPC_C</td>
<td>GPSI_C</td>
<td>TTCI_D</td>
<td>DP2_D</td>
<td>DPC_D</td>
<td>GPSI_D</td>
</tr>
<tr>
<td>Barbados</td>
<td>5.18</td>
<td>1</td>
<td>6.224</td>
<td>1</td>
<td>2.245</td>
<td>1</td>
<td>4.990</td>
<td>1</td>
</tr>
<tr>
<td>Colombia</td>
<td>2.92</td>
<td>13</td>
<td>2.25</td>
<td>11</td>
<td>1.017</td>
<td>10</td>
<td>3.121</td>
<td>10</td>
</tr>
<tr>
<td>Costa Rica</td>
<td>3.7</td>
<td>7</td>
<td>3.397</td>
<td>9</td>
<td>1.484</td>
<td>7</td>
<td>3.901</td>
<td>7</td>
</tr>
<tr>
<td>Dominican Republic</td>
<td>3.68</td>
<td>8</td>
<td>3.667</td>
<td>7</td>
<td>1.480</td>
<td>8</td>
<td>3.676</td>
<td>8</td>
</tr>
<tr>
<td>El Salvador</td>
<td>3.32</td>
<td>9</td>
<td>3.641</td>
<td>8</td>
<td>1.256</td>
<td>9</td>
<td>3.316</td>
<td>9</td>
</tr>
<tr>
<td>Guatemala</td>
<td>2.95</td>
<td>12</td>
<td>2.449</td>
<td>10</td>
<td>0.960</td>
<td>12</td>
<td>2.950</td>
<td>12</td>
</tr>
<tr>
<td>Guyana</td>
<td>2.84</td>
<td>14</td>
<td>1.974</td>
<td>14</td>
<td>0.897</td>
<td>13</td>
<td>2.840</td>
<td>13</td>
</tr>
<tr>
<td>Haiti</td>
<td>2.29</td>
<td>17</td>
<td>0.337</td>
<td>17</td>
<td>0.372</td>
<td>17</td>
<td>2.245</td>
<td>17</td>
</tr>
<tr>
<td>Honduras</td>
<td>3</td>
<td>11</td>
<td>2.22</td>
<td>12</td>
<td>0.965</td>
<td>11</td>
<td>2.998</td>
<td>11</td>
</tr>
<tr>
<td>Jamaica</td>
<td>3.93</td>
<td>5</td>
<td>4.051</td>
<td>6</td>
<td>1.530</td>
<td>6</td>
<td>3.927</td>
<td>6</td>
</tr>
<tr>
<td>Mexico</td>
<td>3.83</td>
<td>6</td>
<td>4.7</td>
<td>1.705</td>
<td>5</td>
<td>4.026</td>
<td>5</td>
<td>5.05</td>
</tr>
<tr>
<td>Nicaragua</td>
<td>2.8</td>
<td>15</td>
<td>1.904</td>
<td>15</td>
<td>0.779</td>
<td>15</td>
<td>2.741</td>
<td>15</td>
</tr>
<tr>
<td>Panama</td>
<td>4.72</td>
<td>2</td>
<td>5.43</td>
<td>3</td>
<td>2.229</td>
<td>2</td>
<td>4.742</td>
<td>2</td>
</tr>
<tr>
<td>Puerto Rico</td>
<td>4.64</td>
<td>3</td>
<td>5.882</td>
<td>2</td>
<td>2.051</td>
<td>3</td>
<td>4.645</td>
<td>3</td>
</tr>
<tr>
<td>Suriname</td>
<td>3.01</td>
<td>10</td>
<td>2.049</td>
<td>13</td>
<td>0.839</td>
<td>14</td>
<td>2.785</td>
<td>14</td>
</tr>
<tr>
<td>Trinidad and Tobago</td>
<td>4.57</td>
<td>6</td>
<td>4.682</td>
<td>5</td>
<td>1.942</td>
<td>4</td>
<td>4.566</td>
<td>4</td>
</tr>
<tr>
<td>Venezuela</td>
<td>2.43</td>
<td>16</td>
<td>0.727</td>
<td>16</td>
<td>0.5556</td>
<td>16</td>
<td>25.585</td>
<td>16</td>
</tr>
</tbody>
</table>
level in each comparison, as are Spearman’s rho correlation coefficients, all higher than
0.850 for all the procedures. In general, the high correlation between each pair of scores
and rankings in all the sub-indices demonstrates the feasibility of the proposals for reliable
competitiveness measurements. An analysis can be made within each dimension,
considering the sub-indices comprised, the indicators and their weights.

In the first sub-index, “Enabling Environment”, the five most competitive destinations (first
quartile) coincide for all the rankings: Barbados, Costa Rica, Panama, Puerto Rico and
Trinidad and Tobago. Only Trinidad and Tobago leaves this group in the DPC ranking,
where it worsens and occupies the sixth place, while Suriname shifts to the fifth position,
due to the weighting method. Barbados occupies the first position in all the rankings
attained. It presents the best scores in pillars A.02 “Safety and Security” and A.05 “ICT
Readiness” and remains within the most competitive destinations in the other pillars. Its
worst position is that of fifth in Pillar A.01 “Business Environment”.

4.2 Global results

The global index is generated starting from the dimensional indicators. The DP2 method is
applied to the previous indices created with the same methodology. To determine the
global DP2-distance indicator, the first step involves obtaining the dimensional indicators
and taking the maximum score for each indicator as the reference value. For the
construction of a global index, a representative group of initial indicators is selected for
each dimension. Initial indicators that show a correlation level greater than 0.5 with the
dimensional measures are selected. Weights are represented by the variability percentage
of the \( i \)th indicator, which is not lineally explained by the previous \( i-1 \) indicators. This
constitutes the amount of new information added for each indicator included in the process.

To create the global competitiveness index with the DPC and the GPSI approaches, DEA is
used to identify the contribution of each dimension to the global measure. As a result, the
DEAPC and the indices are proposed. In the DEAPC and DEAPG procedures, the minimum
admissible value for the virtual outputs that guarantees the feasibility of the linear problem is
0.015; therefore, this constitutes the lower bound established for this constraint
\( w_i^l D_{ij} \geq \omega; \ \omega \geq 0.015 \). The scores and rankings for all the global indices appear in Table 2.

The results enable a ranking for these methods to be established. By comparison with the
TTCI ranking, the DEAGP is found to be the most similar to the WEF, with an average
variation of 0.71 positions (less than one unit) and a variance of 0.471 in contrast to 0.809 for
the DP2 ranking and 4.375 for the DEAPC. A paired comparison of the rankings reveals that
the most similar are the DP2 and the DEAGP, and there is a minor average variation
between them of 0.824. Although the DEAPC and DEAGP indices are calculated with the
same method in the second stage, these are the indices that differ the most, and even
present the greatest contribution to the global index, largely in Sub-indices A and B. The
Pearson correlation and Spearman’s rho correlation coefficients support the proximity
between the rankings obtained. Both present values higher than 0.831 in all cases,
significant at the 0.01 level.

The use of different aggregation processes and weighting methods may cause diverse
rankings to be obtained. In the case that the decision-makers would like to use those
different procedures, it would not be possible to establish an overall competitiveness
ranking, despite the similarity of the indices. To this end, the Borda count approach is
applied to the results of the DP2, of the DEAPC and to those of the DEAGP. This is
considered a suitable approach because it involves all the sub-indices and the outputs of
the proposed methods. The final ranking is given in the “Borda Count” column of Table 2.
This method is presented as an alternative for the decision-makers because it enables the
results to be built as a single ranking. This is recommended when different aggregation
methods are used, and unification of the results is desired for greater understanding and
verification of their stability. However, it can be dispensed with in those cases where only one of the proposed methods is used.

4.3 Global programming synthetic index for global aggregation

The GPSI methodology is also used to calculate a global index. To determine the feasibility of the GPSI in replicating the WEF rank, a value of zero is conveniently assigned to all the aspiration levels, and the denominator is assigned a value of one to the GPSI function. This transformation is carried out due to the use of the normalised values provided by the WEF data set. The results are presented in the last column of Table 2.

The main advantage involves the possibility of observing the amount by which a destination surpasses the established goals and the representative quantity of the improvement necessity for each indicator, pillar and sub-index. Additionally, it is possible to increase goal requirements for a more rigorous comparison by means of changing the target values.

4.4 Link to other indicators

The correlation between the scores obtained with the proposed approaches, the TTCI scores and other additional indicators is analysed (international tourist arrivals, income from international tourism, international tourist expenditure and travel and tourism contribution to the gross domestic product (GDP)) (Table 3). Except for international tourism expenditure, the remaining three variables could be used as approximations of tourism destination competitiveness rankings, depending on their relationship with the scores obtained with the TTCI and the proposed methods.

5. Conclusions

This study contributes towards demonstrating the feasibility of various aggregation methods in building composite indicators for the measurement of TDC and the ability of such indicators to propose rankings. These methods are proposed through the combination of a variety of algorithms, each with its own advantages and disadvantages. The procedures explained present differences, such as the variability of the results due to the order of entry of the initial indicators in the measure, the possibility of introducing subjective judgements,

<table>
<thead>
<tr>
<th>Destinations</th>
<th>TTCI Score</th>
<th>Rank</th>
<th>DP2 Score</th>
<th>Rank</th>
<th>DEAPC Score</th>
<th>Rank</th>
<th>DEAGP Score</th>
<th>Rank</th>
<th>Borda count Score</th>
<th>Rank</th>
<th>GPSI Score</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barbados</td>
<td>4.08</td>
<td>4</td>
<td>6.96</td>
<td>4</td>
<td>0.75</td>
<td>4</td>
<td>0.89</td>
<td>4</td>
<td>3.96</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Colombia</td>
<td>3.73</td>
<td>6</td>
<td>6.60</td>
<td>6</td>
<td>0.74</td>
<td>6</td>
<td>0.85</td>
<td>7</td>
<td>3.80</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Costa Rica</td>
<td>4.10</td>
<td>3</td>
<td>8.63</td>
<td>2</td>
<td>0.93</td>
<td>2</td>
<td>0.93</td>
<td>3</td>
<td>4.17</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dominican Republic</td>
<td>3.50</td>
<td>10</td>
<td>4.76</td>
<td>13</td>
<td>0.67</td>
<td>12</td>
<td>0.82</td>
<td>12</td>
<td>3.52</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>El Salvador</td>
<td>3.41</td>
<td>12</td>
<td>5.20</td>
<td>11</td>
<td>0.70</td>
<td>10</td>
<td>0.82</td>
<td>11</td>
<td>3.42</td>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Guatemala</td>
<td>3.51</td>
<td>9</td>
<td>5.74</td>
<td>7</td>
<td>0.73</td>
<td>7</td>
<td>0.83</td>
<td>9</td>
<td>3.54</td>
<td>9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Guyana</td>
<td>3.26</td>
<td>15</td>
<td>3.82</td>
<td>14</td>
<td>0.59</td>
<td>14</td>
<td>0.76</td>
<td>14</td>
<td>3.20</td>
<td>15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Haiti</td>
<td>2.75</td>
<td>17</td>
<td>0.52</td>
<td>17</td>
<td>0.43</td>
<td>17</td>
<td>0.65</td>
<td>17</td>
<td>2.66</td>
<td>17</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Honduras</td>
<td>3.41</td>
<td>11</td>
<td>5.37</td>
<td>9</td>
<td>0.70</td>
<td>9</td>
<td>0.82</td>
<td>10</td>
<td>3.44</td>
<td>11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jamaica</td>
<td>3.59</td>
<td>8</td>
<td>5.36</td>
<td>10</td>
<td>0.66</td>
<td>13</td>
<td>0.84</td>
<td>8</td>
<td>3.61</td>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mexico</td>
<td>4.36</td>
<td>1</td>
<td>8.45</td>
<td>3</td>
<td>0.88</td>
<td>3</td>
<td>0.94</td>
<td>2</td>
<td>4.44</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nicaragua</td>
<td>3.37</td>
<td>13</td>
<td>5.07</td>
<td>12</td>
<td>0.74</td>
<td>5</td>
<td>0.81</td>
<td>13</td>
<td>3.39</td>
<td>13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Panama</td>
<td>4.28</td>
<td>2</td>
<td>8.75</td>
<td>1</td>
<td>0.93</td>
<td>1</td>
<td>0.97</td>
<td>1</td>
<td>4.30</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Puerto Rico</td>
<td>3.91</td>
<td>5</td>
<td>6.68</td>
<td>5</td>
<td>0.72</td>
<td>8</td>
<td>0.85</td>
<td>6</td>
<td>3.83</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Suriname</td>
<td>3.28</td>
<td>14</td>
<td>3.56</td>
<td>15</td>
<td>0.55</td>
<td>15</td>
<td>0.72</td>
<td>15</td>
<td>3.16</td>
<td>16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trinidad and Tobago</td>
<td>3.71</td>
<td>7</td>
<td>5.42</td>
<td>8</td>
<td>0.68</td>
<td>11</td>
<td>0.85</td>
<td>5</td>
<td>3.73</td>
<td>7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Venezuela</td>
<td>3.18</td>
<td>16</td>
<td>2.15</td>
<td>16</td>
<td>0.44</td>
<td>16</td>
<td>0.71</td>
<td>16</td>
<td>3.23</td>
<td>14</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
which enables not only the necessities of the stakeholders to be taken into consideration, but also the method used to calculate the weights. All these are practical implications that support the decision-making process.

The proposed methods complement each other and, together, contribute towards the decision-making process in measuring tourism competitiveness. They help reduce the weaknesses associated to the previous existent methods, mainly the TTCI, and therefore provide alternatives for the solution of key aspects, such as reducing the amount of information necessary, the weighting and the explanatory power of the results. The proposed methods can be applied separately, thereby taking advantage of each method to distribute information on the process of decision-making. Furthermore, they can be applied in a combined way, as explained in the study, thereby reaching the maximum of all of the positive aspects indicated.

The DP2-distance and DPC do not allow all the indicators to be used, although the information selection process does permit the inclusion of a greater amount of information in a smaller set of indicators. This is a great finding for other destinations because it allows their inclusion in a competitiveness ranking with less information.

The GPSI permits the inclusion of all the indicators in the composite measure. This is the most flexible approach because it facilitates the inclusion of external information through the goals and the weights. It has greater explanatory power than the previous indices due to the possibility of directly revealing the strengths and weaknesses of each destination involved by means of the deviation variables. This method also allows various results to be obtained, and therefore, their combination enriches the analysis of the outputs. Furthermore, this methodology contributes towards solving several problems, such as that of the equitable weight distribution across the pillars, the facility to analyse the results, the influence of the size of destinations and the selection of the target values.

The use of DEA in the second step brings flexibility to the procedure and enables the contribution of each dimension to the overall competitiveness value to be identified. The introduction of the virtual output constraint guarantees the inclusion of all the sub-indices in the global measure. Additionally, it is possible that this method identifies those dimensions that represent a strength or a weakness for each destination.

The meta-index created offers the possibility for decision-makers to seek alternatives to obtain diverse competitiveness rankings and merge them into a single ordered list. This aggregation is presented as an alternative to corroborate the stability of the results when different methods are used on the same data set. Moreover, the stability of the results demonstrates the suitability of the proposed methods. The comparative analysis is

<table>
<thead>
<tr>
<th></th>
<th>TTCI</th>
<th>DP2</th>
<th>DEAPC</th>
<th>DEAGP</th>
<th>GPSI</th>
<th>Borda count</th>
<th>Int. tour. arrivals</th>
<th>Income from int. tourism</th>
<th>Int. tour. exp.</th>
<th>TT&amp;GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>TTCI</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DP2</td>
<td>0.961**</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DEAPC</td>
<td>0.831**</td>
<td>0.904**</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DEAGP</td>
<td>0.980**</td>
<td>0.971**</td>
<td>0.831**</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GPSI</td>
<td>0.990**</td>
<td>0.956**</td>
<td>0.826**</td>
<td>0.975**</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Borda</td>
<td>0.951**</td>
<td>0.988**</td>
<td>0.931**</td>
<td>0.951**</td>
<td>0.946**</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Int. tour. arrivals</td>
<td>0.630**</td>
<td>0.544*</td>
<td>0.522*</td>
<td>0.517*</td>
<td>0.650**</td>
<td>0.549*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Income from int. tourism</td>
<td>0.725**</td>
<td>0.637**</td>
<td>0.566*</td>
<td>0.620**</td>
<td>0.740**</td>
<td>0.630**</td>
<td>0.934**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Int. tourism expenditure</td>
<td>0.363</td>
<td>0.35</td>
<td>0.306</td>
<td>0.289</td>
<td>0.422</td>
<td>0.353</td>
<td>0.706**</td>
<td>0.699**</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>TT&amp;GDP</td>
<td>0.522*</td>
<td>0.456</td>
<td>0.395</td>
<td>0.444</td>
<td>0.591*</td>
<td>0.458</td>
<td>0.826**</td>
<td>0.804**</td>
<td>0.897**</td>
<td>1</td>
</tr>
</tbody>
</table>

Notes: *Correlation is significant at the 0.05 level (two-tailed). **Correlation is significant at the 0.01 level (two-tailed).
supported, as it is possible to identify the dimensions, pillars and indicators that contributed the most regarding the competitiveness position of all the destinations analysed.

Furthermore, compared to the TTCI and to the results achieved, the correlation values indicate that the additional variables could be viewed as providing a good explanation of the rankings. Among these, the most representative is the income from international tourism, which is also significantly correlated to the meta-index results. Consequently, it is possible to affirm that these variables may be used to create indices with results almost identical to the outputs of the TTCI.

Future research should contemplate other possible analyses, such as the consideration of a common set of weights for DEA, the restrictive GPSI indicator and the use of participative methods to obtain the weights for the GPSI and/or DPC index. There is also the possibility of including a dynamic measure of the competitiveness with the consideration of information covering different time periods.

References


Further reading


Author affiliations

Víctor Ernesto Pérez León is based at the Departamento de Economía Aplicada II, Universidad de Sevilla Facultad de Ciencias Economicas y Empresariales, Sevilla, España.

Flor Mª Guerrero is based at the Department of Economics, Quantitative Methods and Economic History, Pablo de Olavide University, Sevilla, Spain.

Rafael Caballero is based at the Department of Applied Economics (Mathematics), Universidad de Málaga, Málaga, Spain.
## Table A1: Results for the pillars

<table>
<thead>
<tr>
<th>Destinations/pillars</th>
<th>A.01</th>
<th>A.02</th>
<th>A.03</th>
<th>A.04</th>
<th>A.05</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DP2</td>
<td>DPC</td>
<td>GPSI</td>
<td>DP2</td>
<td>DPC</td>
</tr>
<tr>
<td>Barbados</td>
<td>11.108</td>
<td>3.600</td>
<td>0.926</td>
<td>9.438</td>
<td>2.678</td>
</tr>
<tr>
<td>Colombia</td>
<td>7.639</td>
<td>2.644</td>
<td>0.845</td>
<td>2.418</td>
<td>0.708</td>
</tr>
<tr>
<td>Costa Rica</td>
<td>11.293</td>
<td>3.700</td>
<td>0.958</td>
<td>8.978</td>
<td>2.546</td>
</tr>
<tr>
<td>Dominican Republic</td>
<td>8.917</td>
<td>2.805</td>
<td>0.859</td>
<td>5.503</td>
<td>1.561</td>
</tr>
<tr>
<td>El Salvador</td>
<td>9.002</td>
<td>2.917</td>
<td>0.857</td>
<td>4.053</td>
<td>1.011</td>
</tr>
<tr>
<td>Guatemala</td>
<td>9.167</td>
<td>3.226</td>
<td>0.859</td>
<td>3.918</td>
<td>0.946</td>
</tr>
<tr>
<td>Guyana</td>
<td>10.364</td>
<td>3.398</td>
<td>0.914</td>
<td>6.145</td>
<td>1.784</td>
</tr>
<tr>
<td>Haiti</td>
<td>3.632</td>
<td>1.507</td>
<td>0.594</td>
<td>5.848</td>
<td>1.824</td>
</tr>
<tr>
<td>Honduras</td>
<td>7.728</td>
<td>2.586</td>
<td>0.834</td>
<td>4.186</td>
<td>1.014</td>
</tr>
<tr>
<td>Jamaica</td>
<td>9.919</td>
<td>3.168</td>
<td>0.92</td>
<td>4.78</td>
<td>1.146</td>
</tr>
<tr>
<td>Mexico</td>
<td>7.794</td>
<td>2.742</td>
<td>0.843</td>
<td>4.612</td>
<td>1.373</td>
</tr>
<tr>
<td>Nicaragua</td>
<td>7.195</td>
<td>2.211</td>
<td>0.797</td>
<td>9.266</td>
<td>2.770</td>
</tr>
<tr>
<td>Panama</td>
<td>12.221</td>
<td>4.107</td>
<td>1.016</td>
<td>7.674</td>
<td>2.138</td>
</tr>
<tr>
<td>Puerto Rico</td>
<td>12.23</td>
<td>3.853</td>
<td>0.971</td>
<td>7.51</td>
<td>1.952</td>
</tr>
<tr>
<td>Suriname</td>
<td>8.289</td>
<td>2.374</td>
<td>0.718</td>
<td>9.067</td>
<td>2.594</td>
</tr>
<tr>
<td>Trinidad and Tobago</td>
<td>11.365</td>
<td>3.788</td>
<td>0.937</td>
<td>4.853</td>
<td>1.325</td>
</tr>
<tr>
<td>Venezuela</td>
<td>2.932</td>
<td>0.715</td>
<td>0.502</td>
<td>3.238</td>
<td>0.774</td>
</tr>
</tbody>
</table>

---

## Appendix
About the authors
Victor Ernesto Pérez León is a Lecturer in Statistics at the Department of Applied Economics II, University of Seville. PhD in Economic Sciences (University of Pinar del Río) and PhD in Business Administration (Pablo de Olavide University). Experience in Operations Research acting on composite indicators applied to tourism sustainability and competitiveness. Contribution to the article: data collection, data analysis and interpretation, drafting the article. Victor Ernesto Pérez León is the corresponding author and can be contacted at: vpleon@us.es

Flor Mª Guerrero Casas is a Professor of Mathematics Methods for Economy and Business at Pablo de Olavide University. Her research activity focuses on mathematical applications in Business Administration. In particular, sustainable development, tourist activity, social welfare, through simple and synthetic indicators, multidimensional indicators and multi-objective optimisation. Contribution to the article: conception or design of the work, critical revision of the article, final approval of the version to be published.

Rafael Caballero is a Professor at Department of Applied Economics (Mathematics), University of Málaga, Spain. He is interested in the field of multiple objective programming. Presently, his research is in metaheuristics methods and application to problems in economy and business and forestry sciences. Contribution to the article: conception or design of the work, critical revision of the article.

For instructions on how to order reprints of this article, please visit our website: www.emeraldgrouppublishing.com/licensing/reprints.htm
Or contact us for further details: permissions@emeraldinsight.com