

This is the peer reviewed version of the following article: ‘Analysis of the Worth of the Weights in a new Travel and Tourism Competitiveness Index’, which has been published in final form at: <https://doi.org/10.1177/0047287519899982>.

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Analysis of the Worth of the Weights in a new Travel and Tourism Competitiveness Index

Abstract

The aim of this article is to analyze the influence of the weights when building a tourism competitiveness (TC) synthetic indicator. The most frequently used index is the Travel and Tourism Competitiveness Index (TTCI), which is composed of 14 pillars organized into four subindexes. However, this index has been criticized especially regarding the weights. This study measures the weights using statistical methods and analyzes if they affect countries according to their stage of development. Subsequently, we applied these weights to the TTCI and to four TC synthetic indexes calculated by applying multicriteria techniques and we obtained different scenarios. These synthetic indexes enable a more realistic measurement of TC, so we analyze whether the ranking differences caused by variations in the pillar's weights were equally relevant in the TTCI as in the different indexes proposed. We demonstrate how the choice of these weights benefits some countries while harming others.

Keywords

Travel and Tourism Competitiveness Index, weights, World Economic Forum, multicriteria

Introduction

Tourism is currently one of the fastest growing economic activities in the world and has become as important in some countries as other sectors that have traditionally been critical for economic progress. This boom has converged with the growing diversification of tourism, as seen in the emergence of new destinations that compete with traditional ones.

Therefore, there is a need to better understand the competitive capabilities of a destination and the strengths and weaknesses of its competitors. The most distinguished contribution in this area is the Travel and Tourism Competitiveness Index (TTCI), an index of the competitiveness of the world's main tourist destinations that has been published regularly since 2007 by the World Economic Forum (WEF) in its Travel and Tourism Competitiveness Report (TTCR). The objective of this index is to evaluate the factors and policies that make a destination attractive to international tourism. To that end, the Travel and Tourism Competitiveness Report 2017 (World Economic Forum 2017) includes 136 tourist destinations and 90 indicators that measure different dimensions of competitiveness, including political, socioeconomic, structural, environmental, and cultural. These indicators are grouped into 14 pillars categorized under four subindexes: enabling environment; travel and tourism policy and enabling conditions; infrastructure; and natural and cultural resources. Lastly, these subindexes are aggregated in the TTCI. From a methodological perspective, the WEF builds the corresponding

composite indicator at each level of aggregation as an unweighted average of the indicators, pillars, or subindexes included in the immediately preceding level. More details can be found in the World Economic Forum (2017). The four subindexes are not weighted, but the pillars are implicitly weighted because the subindexes have different numbers of pillars. The subindexes with fewer pillars are therefore more significant in the calculation of the overall index.

The TTCI has been the target of significant criticism, especially regarding methodological issues (Crouch 2007; Croes and Kubickova 2013; Leung and Baloglu 2013; Mazanec and Ring 2011). Mazanec and Ring (2011, 729) offer different methodological alternatives to convert the TTCI into a true predictor of a tourist destination's ability to compete. These authors summarize the critiques as follows:

(1) the index's composition, especially the combination of statistical data with survey information; (2) the use of variables with weak theoretical justification; (3) the comparability of countries in different stages of development; (4) the arbitrary weighting of the variables; and (5) the reliability and validity of the index, and the statistical methods used to demonstrate its usefulness.

Our task in this study is to address one of the main criticisms of this interesting tool—the arbitrary weighting of the variables that compose each pillar. These variables are not weighted when calculating the subindexes, nor when calculating the overall index.

We propose a more consistent synthetic indicators, which avoid the substitutability among pillars, which is also a disadvantage of the WEF methodology (Pulido-Fernández and Rodríguez-Díaz 2016) and we check the effect of weights on this methodology. We will also analyze whether it is necessary to use different weights according to their stage of development.

In this study, weights will be estimated exogenously using two different methodologies to then compare the results—the DP₂ distance method and factor analysis. In addition, analyses presented in studies such as that by Gómez-Vega and Picazo-Tadeo (2019) will be examined.

The variation in country rankings is studied for each scenario of proposed weights; the final indicator is calculated using the WEF methodology and the double reference point method proposed by Pulido-Fernández and Rodríguez-Díaz (2016). This method allows the values for each country to be normalized through two reference values (aspiration level—the desired level for a pillar; and reserve value—the minimum acceptable value). The aggregation of normalized values results in a weak index that measures aggregate tourism competitiveness, a strong index that measures the status of the worst pillar, and a series of mixed indexes that measure different degrees of tourism competitiveness (a mixed index is a linear combination of the first two). These indexes identify the pillar in which each country is failing, which will enable managers and politicians to take the most appropriate actions to overcome these deficiencies.

The aspiration and reserve levels are key to interpreting and analyzing the results. These can be determined statistically or with opinions from a panel of experts. The use of the reference levels provided by experts could produce an absolute measure of the tourism competitiveness of each region that can identify the competitive and uncompetitive destinations, as opposed to a simple ranking.

However, given the difficulty of establishing a consensus on the objective reference values for all of the countries, relative statistical reference values for each pillar are used while taking into account the current circumstances of the countries. These statistical criteria enable measuring the relative tourism competitiveness of certain regions compared with others.

The information provided in the latest WEF report is used, and different weight scenarios are applied. The results

produce different country rankings that can be compared to the WEF rankings, thereby eliciting a series of conclusions.

The results obtained may be of interest since they can help determine the strengths and weaknesses of tourist destinations by identifying the factors that constrain their competitiveness the most, as well as the pillars and subindexes that contribute the most. This information could be relevant to policymakers and destination managers and help them prioritize reforms for their tourism industries.

Literature Review

The scientific literature on the competitiveness of tourist destinations is abundant; most studies indicate that it is a complex and highly multidimensional concept (Crouch 2007; De la Peña et al. 2019; Dwyer et al. 2014; Gomezelj and Mihalič 2008; Gooroochurn and Sugiyarto 2005; Hong 2009; Mazanec, Wöber, and Zins 2007; Ritchie and Crouch 2003). These studies have also resulted in numerous definitions and analysis models. Dwyer and Kim (2003) define the competitiveness of a tourist destination as the relative capability of a destination to meet the needs of visitors in various aspects of the tourism experience or to provide better products and services than other destinations in those aspects of the tourism experience considered important by tourists.

Many studies in this field have tried to measure the competitiveness of international tourist destinations using data obtained from official statistics (Gómez-Vega and Picazo-Tadeo 2019; Martín, Mendoza, and Román 2017; Pulido-Fernández and Rodríguez-Díaz 2016); from information sources that pertain to specific destinations (Gu et al. 2019; Lopes, Muñoz, and Alarcón-Urbistondo 2018; Zhang et al. 2011); or from their own surveys of tourists (Bahar and Kozak 2007; Cracolici and Nijkamp 2009) and other stakeholders (Bornhorst, Ritchie, and Sheehan 2010; Chens, Sok, and Sok 2008).

Gooroochurn and Sugiyarto (2005) used data from the competitiveness monitor scale proposed by the World Travel and Tourism Council, which measures TDC through the development of eight key indicators, using confirmatory factor analysis, in order to calculate an aggregate index; Croes (2011) proposed a more accurate TDC index, using the most important factors affecting the competitiveness of island destinations; Croes and Kubickova (2013) proposed an alternative TCI, which they apply to the Central American region; Leung and Baloglu (2013) compared the competitiveness levels of 16 Asia Pacific destinations using cluster analysis and multidimensional scaling.

Most of the studies derive composite indicators of competitiveness using a variety of mathematical and statistical techniques with multiple variables that represent the various dimensions of the competitiveness concept (Mendola and Volo 2017; Sainaghi, Phillips, and Zavarrone 2017).

The information provided in the TTCI allows understanding the competitive advantages and disadvantages of a country

as a tourist destination and for creating public policies and private sector activities that promote tourism. Therefore, the index must be calculated in a way that reflects reality to the greatest extent possible. In fact, it is increasingly used by researchers as a source for their studies on tourism competitiveness (e.g., Dwyer et al. 2014; Ivanov and Webster 2013; Kayar and Kozak 2010; Kendall and Gursoy 2007; Gursoy, Baloglu, and Chi 2009; Leung and Baloglu 2013; Webster and Ivanov 2014).

Various studies have been conducted that analyze the factors that determine tourism competitiveness (Michael, Reisinger, and Hayes 2019; Montero-Muradas, and Oreja-Rodríguez 2017; Nazmfar et al. 2019) or that analyze the specific effect of a factor, such as sustainability (Cucculelli and Goffi 2016; Goffi, Cucculelli, and Masiero 2019; Dias 2017; Mendieta-Peñalver et al. 2018; Khan et al. 2017; Romão and Nijkamp 2019).

Methodology

The calculation of synthetic indicators involves the following steps or phases: normalization, determination of a weight for each partial indicator, and aggregation of the partial indicators. Determining the weights is one of the main challenges in building a synthetic indicator. All of the dimensions studied must be examined to determine if they are of equal priority or if different weights should be allocated to each partial indicator, thus producing a synthetic indicator with values that are closer to reality.

Synthetic Index

The tourism competitiveness of a country is determined by multiple factors. The multicriteria decision-making methodology allows various alternatives to be simultaneously evaluated. The methodology we propose for calculating the synthetic index for tourism competitiveness enables a new normalization and aggregation of the indicators. To evaluate the tourism competitiveness of a country, we will apply an achievement function proposed by Wierzbicki, Makowski, and Wesse (2000) that is based on the double reference point method. This function normalizes the objective functions (pillars) by considering two reference levels for each pillar: an aspiration value (desired value) and a reserve value (the minimum acceptable value) (Luque et al. 2009).

This type of achievement function allows all objective functions (pillars) to be normalized within the range $[-1, 2]$. The piecewise linearity of the achievement function allows for extracting information that cannot be extracted through a classical normalization (range between the maximum and minimum). Given country i and pillar j , if s_{ij} is -1 , then this is the minimum value of the pillar for that indicator; if it is 0 , then this is the reserve level; if it is 1 , then this is the aspiration level; and if it is 2 , then this is the maximum value. Thus, when it is between -1 and 0 , the pillar value for this

country is below the reserve value; between 0 and 1 , the pillar value is between the reserve and aspiration values; and between 1 and 2 , the pillar value is above the aspiration value.

For each country i , a weak index (I_i^d), a strong index (I_i^f), and a mixed index (I_i^m) is defined:

$$I_i^d = \frac{1}{M} \sum_{j=1}^M s_{ij} \quad (1)$$

$$I_i^f = \min_{j=1, \dots, M} s_{ij} \quad (2)$$

$$I_i^m = \alpha I_i^d + (1 - \alpha) I_i^f, \quad 0 < \alpha < 1 \quad (3)$$

where the weak index is the arithmetic mean of the values of the M pillars; the strong index is the minimum of the pillar values; and the mixed index is the linear combination of the weak and strong indexes (Pulido-Fernández and Rodríguez-Díaz 2016).

The weak indicator measures aggregate competitiveness and allows for some compensation between the different pillars. The strong indicator measures the status of the worst pillar; that is, it does not allow any compensation. Mixed indicators can also be developed for different permissible aggregation levels.

To compare results, in addition to the proposed index, we will also calculate the index for each scenario corresponding to the weights obtained using the WEF methodology.

Weighting Analysis

There is no generally accepted methodology for calculating weights in the literature, so many traditional authors have tended to assign the same weight to each partial indicator. However, some studies rely on the subjective opinions of experts, while others choose to use statistical methods.

Regarding the available statistical methods, two methodologies are proposed in this study to objectively identify the variables that most objectively contribute to tourism competitiveness and for comparing the results. These two methodologies are the DP_2 distance method and factor analysis.

The ultimate objective is the development of a synthetic index that ranks countries according to their tourist competitiveness based on the information provided by the initial variables.

The iterations applied with the DP_2 distance technique produce a synthetic indicator that gathers together a set of mathematical properties: existence and determination, monotony, uniqueness, homogeneity, transitivity, completeness, additivity, and invariance. They all work together to

solve the problem of aggregating variables with different units of measure or of duplicate information (Zarzosa and Somarriba 2013). The DP_2 method originated with the quality of life analysis of Pena (1977), which built upon the Ivanovic distance method.

Unlike DP_2 , other methods lack some of the mathematical properties indicated above. For example, principal components analysis (PCA) does not offer a dynamic analysis of the circumstances of a country or group of countries, nor does it fulfill some of the abovementioned mathematical properties, such as monotony and uniqueness (Zarzosa and Somarriba 2013). To overcome the limitations of this approach, some authors have proposed combining it with DP_2 , which would require applying the distance–principal components technique.

Exploratory factor analysis (EFA) is a statistical technique that enables a more precise exploration of the underlying dimensions, constructs, or latent variables of the observed variables (those observed and measured by the researcher). Although PCA and EFA have several similarities and the terms have even been used interchangeably, the underlying mathematical models and conceptual assumptions for their applications are different (Rietveld and van Hout 1993; DeCoster 1998; Fabrigar et al. 1999; Conway and Huffcutt 2003; Costello and Osborne 2005; Hair et al. 2010).

The adaptive critic designs (ACD)-fuzzy set theory also offers key tools for the development of a synthetic indicator that reveals multidimensional information about a country. In recent years, several authors have applied techniques such as data envelope analysis (DEA) to design a synthetic indicator. Gómez-Vega and Picazo-Tadeo (2019) propose a combination of DEA and multiple criteria decision making (MCDM) to calculate a synthetic indicator of tourism competitiveness.

In some cases, these methodologies, such as the DP_2 , have been used to first calculate weights and then perform a linear combination, despite limitations such as compensation between components. We take a further step and propose a richer, more multidimensional approach (multicriteria of the problem). We apply these weights in the previously proposed methodology.

DP_2 . This method produces a synthetic indicator that measures distances and/or disparities between different geographical areas or countries and includes information from a set of indicators. The synthetic indicator for a country or group of countries is calculated using the following mathematical expression (Pena 1977).

We consider N_i the number of indicators, N_c the number of alternatives or countries, and y_{ij} ($i = 1, \dots, N_c$ and $j = 1, \dots, N_i$) the value of country i and indicator j :

$$DP_{2i} = \sum_{j=1}^{N_i} \frac{d_{ij}}{\sigma_i} \quad (1 - R_{j,j-1,j-2,\dots,1}^2) \text{ with } R=0 \quad (4)$$

where

- d_{ij} is the difference between the value of country i and indicator j , and the minimum of the variable in the least desirable situation or the theoretical region with the worst values for the variables studied ($d_{ij} = y_{ij} - y_j^{\min}$). Note that N_i is the number of indicators (14), and we are analyzing 136 countries (N_c).
- σ_i is the standard deviation of indicator i .
- $\frac{\sigma_i}{d_{ij}}$ is the Frechet indicator of variable i . It measures the distance between the i th variable in a country and a fictitious country (the least desirable situation) in normalized terms.
- $(1 - R_{j,j-1,j-2,\dots,1}^2)$ is the correction factor, that is, the weight associated with indicator i . By incorporating it into the mathematical expression, it retains the new information received from each indicator, taking advantage of useful information and eliminating duplicate information (Somarriba and Pena 2008).
- $R_{j,j-1,j-2,\dots,1}^2$ is the coefficient of determination, which measures the part of the variance in each variable explained by the linear regression, estimated using the preceding variables.

Thus, we have a linear aggregation that uses $(1 - R_{j,j-1,j-2,\dots,1}^2)$ as weights. Since $R_{j,j-1,j-2,\dots,1}^2$ depends on the order of the variable, this order must be determined. The most logical sorting criterion is the amount of information that each component contributes to the synthetic indicator. The component with the most information about the objective to be measured would be first, and so on. As Pena (1977) states, the importance of each component is measured by the degree of dependence between it and the objective to be measured. Therefore, the components would be ranked by arranging them from highest to lowest based on the absolute value of the simple correlation coefficient between the values of the indicators and the synthetic indicator.

It is initially impossible to determine the correlations between the DP_2 and the synthetic indicators, since the ranking process must first be conducted to calculate the DP_2 ; therefore, one must begin with an initial solution. The initial solution proposed by Pena (1977) for the ranking process is the Frechet distance, which is calculated as the weighted sum of the normalized indicators with equal weights ($\frac{d_i}{\sigma_i}$), a division of the distance with regard to the object studied between each country and a fictitious base that reflects the worst possible scenario, and a standard deviation.

The partial indicators are arranged in descending order, according to the absolute values of the correlation coefficients with this indicator, such that once the DP_2 is calculated, the indicators are recalculated and rearranged in the new order.

Next is the calculation of the correlation coefficient between the indicator with the highest correlation coefficient and the one that follows in order. The same calculation is

then made for the third indicator and the two previous indicators, and so on until we finally determine the correlation coefficient between the indicator with the lowest coefficient and all the preceding indicators in order ($R_{j,j-1,j-2,\dots,1}^2$).

Thus, the partial indicator with the highest Frechet correlation coefficient will have an R^2 equal to zero so that its correction factor will be equal to one. The weights associated with each of the partial indicators will correspond to $1 - R^2$, with R^2 being the coefficient that measures the correlation between a partial indicator and its preceding indicators in the established order.

These weights are applied to the normalized indicators to finally produce an indicator for each country (DP_21).

We then perform the previously mentioned calculations with this indicator. If the value of the new synthetic indicator (DP_22) is the same as the previous value, the process ends. Otherwise, the same procedure indicated above must be repeated until finding an iteration in which the new indicator value is approximately equal to the previous one. The process continues iteratively until the difference between two contiguous DP_2 values is null.

In short, the resulting index is given by a linear combination formed by aggregating the distances of each country or region relative to a baseline that represents the least desirable situation. Each distance is divided by its respective standard deviation and then weighted by a correction instrument to resolve problems such as the aggregation of indicators expressed in different units of measure or duplicate information.

This method offers other properties, notably, existence and determination (the index assumes a certain value for any country), monotony, uniqueness (the final index has a unique value for a country), invariance (regarding changes in origin and/or scale), first-order homogeneity, transitivity, and exhaustiveness (fully utilizes the indicator information and avoids possible duplicates). All these properties help solve the problem of aggregating variables expressed in different units of measure or the duplicity of information (Zarzosa and Somarriba 2013).

The index value for each country is interpreted as follows: a higher value signifies a higher degree of tourism competitiveness (in this case), since there is more distance from the least desirable situation. A country with a lower index value is less competitive in tourism, since there is less distance from the least desirable situation.

DP_2 is only used here to determine weights, not to produce the synthetic indicator. Some authors apply this method to design a linear combination that produces a final synthetic index for each country, but this is not the case here.

Exploratory factor analysis. EFA is a statistical technique that enables a more precise exploration of the underlying dimensions, constructs, or latent variables of the observed variables (those observed and measured by a researcher). It is valuable for examining the extent to which certain quantitative indicators adequately represent different constructs or components.

The purpose of the analysis is to identify the number and composition of the common factors (latent variables) needed to explain the common variance in the set of items analyzed. The algebraic representation of the model for $m < p$ common factors is the following equation:

$$\begin{aligned} X_1 &= v_{1(1)}F_{(1)} + v_{1(2)}F_{(2)} + \dots + v_{1(m)}F_{(m)} + e_1 \\ X_2 &= v_{2(1)}F_{(1)} + v_{2(2)}F_{(2)} + \dots + v_{2(m)}F_{(m)} + e_2 \\ X_p &= v_{p(1)}F_{(1)} + v_{p(2)}F_{(2)} + \dots + v_{p(m)}F_{(m)} + e_p \end{aligned} \quad (5)$$

where X_j , F_p , and e_i contain a country's scores for item X_j , the common factor F_p , and the specific factor e_i ; m is the number of common factors; p is the number of items; F is the common factor; $v_{j(i)}$ is the weight of the i th common factor associated with the j th observed variable or item; $i = 1, 2, \dots, p$; e_i is the unique factor; and $j = 1, 2, \dots, p$. The TTCI aggregate tourist competitiveness index is considered a latent variable, and the different pillars are observed as variables. The weighting coefficients are given by the correlation between each normalized partial indicator and the latent dimension that explains the highest possible percentage of variance between these indicators. This weighting system ensures that the indicators most correlated with a dimension have greater weight when calculating the corresponding aggregate index. If the first factor only explains a small percentage of the indicator variances that compose the aggregate index, then additional factors must be considered. In most cases, consideration of more than one factor requires a factorial rotation that guarantees that each indicator will be highly correlated with only one of them.

Data

The tourism competitiveness of 136 countries will be evaluated based on data published in the TTCR 2017, using the methodology presented above. The criteria applied are the 14 WEF pillars that group the 90 indicators used. The data used for each pillar will already be normalized on a scale of 1–7, where 1 represents the worst situation and 7 the best; therefore, all pillars are considered for maximization.

We analyzed these pillars for the 136 countries and obtained the descriptive statistics presented in Table 1.

These pillars are aggregated into four dimensions, as shown in Figure 1. It appears as if the aggregation is performed without any weighting, but there is an implicit weighting since each dimension has a different number of pillars. Thus, a country with a high value for subindex 4 (natural and cultural resources), which only has two pillars, unlike other subindexes with three, four, or five pillars, will be better ranked with the subindex grouping than if the 14 pillars were aggregated individually. Table 2 presents the weights used by the WEF and the implicit weights given to each pillar.

Table 1. Descriptive Statistics for the TTCl Pillars.

Pillars	Mean	Deviation
Business environment	4.529	0.678
Safety and security	5.209	0.937
Health and hygiene	5.125	1.228
Human resources and labor market	4.562	0.626
ICT readiness	4.408	1.220
Prioritization of T&T	4.487	0.829
International Openness	3.206	0.916
Price competitiveness	4.856	0.693
Environmental sustainability	4.181	0.563
Air transport infrastructure	3.000	1.193
Ground and port infrastructure	3.469	1.125
Tourist service infrastructure	4.059	1.281
Natural resources	3.257	0.997
Cultural resources and business travel	2.323	1.414

Note: TTCl = Travel and Tourism Competitiveness Index; ICT = information and communication technology; T&T = travel and tourism.
Source: Own elaboration.

Results

Weightings

The correction factors and weights for each indicator that were obtained using the DP₂ methodology are presented here in Table 3. The ICT readiness has a weight of 20.81% (the indicator that exerts greater influence in determining the final index). It is followed by the prioritization of travel and tourism (8.86%) and ground and port infrastructure (8.74%).

In contrast, natural resources indicator presents a very low weight (0.87%).

Furthermore, per our confirmatory analysis, the WEF's current grouping of pillars into four dimensions does not seem to be the most appropriate. When analyzing the data, three dimensions tend to emerge, along the lines of the 2013 WEF groupings. However, the current assumption of four dimensions was used in this study to facilitate comparisons. Our analysis followed this four-dimensional structure and calculated the implicit weights of the pillars (see Table 4), as illustrated in Figure 2.

The analyses showed that regions had different characteristics, which could lead to different weights, as performed using the Global Competitiveness Index (GCI) by WEF, which distributed weights according to the stage of development of each country based on the gross domestic product (GDP) per capita. Although all the pillars of tourism competitiveness are critical for the economies of these countries, some pillars are more relevant than others, according to their stage of development of each country and affect countries in different ways. This approach ensures that higher weights are attributed to regions with higher potential for competitiveness and penalizes countries with less economic development.

Nevertheless, all competitiveness factors will have a similar impact on the competitiveness of countries, regardless of their income levels. Information and communication technologies are reducing information barriers and allowing the rapid transfer of concepts, technologies, and products worldwide, opening new opportunities for developing economies. So, we consider it necessary to reward

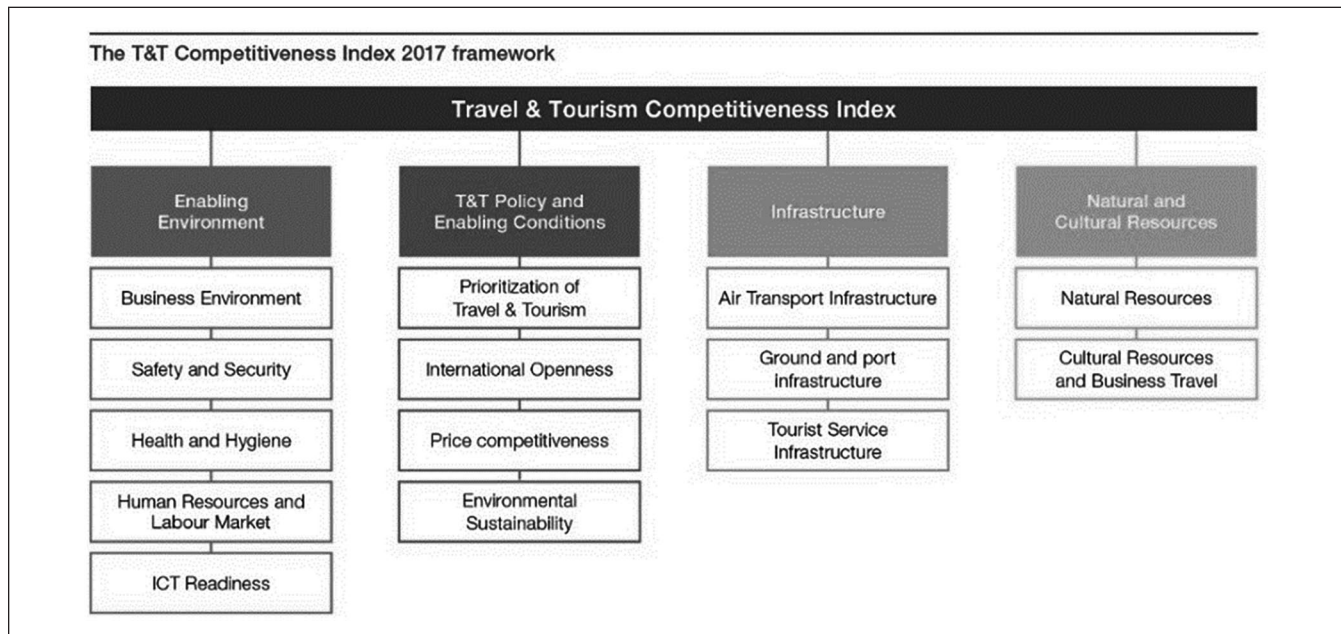
**Figure 1.** TTCl structure.

Table 2. Weights Used by the World Economic Forum.

Pillars	Dimension Weight, %	Weight of Pillar within a Dimension, %	Implicit Weight of Pillar, %
Dimension 1: Enabling Environment	25		
Business environment		20	5.00
Safety and security		20	5.00
Health and hygiene		20	5.00
Human resources and labor market		20	5.00
ICT readiness		20	5.00
Dimension 2: T&T Policy and Enabling Conditions	25		
Prioritization of T&T		25	6.25
International Openness		25	6.25
Price competitiveness		25	6.25
Environmental sustainability		25	6.25
Dimension 3: Infrastructure	25		
Air transport infrastructure		33.33	8.33
Ground and port infrastructure		33.33	8.33
Tourist service infrastructure		33.33	8.33
Dimension 4: Natural and Cultural Resources	25		
Natural resources		50	12.50
Cultural resources and business travel		50	12.50

Note: T&T = travel and tourism.

Source: Own elaboration.

Table 3. Correction Factors and Weights for Indicators per DP₂.

Pillars	Correction Factors	Weights, %
Business environment	0.370277	7.71
Safety and security	0.239393	4.98
Health and hygiene	0.328525	6.84
Human resources and labor market	0.416384	8.67
ICT readiness	1	20.81
Prioritization of T&T	0.425466	8.86
International openness	0.336977	7.01
Price competitiveness	0.154742	3.22
Environmental sustainability	0.374955	7.80
Air transport infrastructure	0.359564	7.48
Ground and port infrastructure	0.420122	8.74
Tourist service infrastructure	0.210085	4.37
Natural resources	0.041689	0.87
Cultural resources and business travel	0.126584	2.63

Note: ICT = information and communication technology; T&T = travel and tourism.

Source: Own elaboration.

countries that advance and to penalize those that neglect any aspect of competitiveness, regardless of their stage of development. In this sense, we used similar weights for countries at different stages of development; and we consider the use of the strong index of great relevance, because it penalizes countries that do not achieve reservation values in important pillars, so countries with low scores in

Table 4. Implicit Weights in the Factor Analysis.

Pillars	Weights, %
Business environment	9.05
Safety and security	7.28
Health and hygiene	8.00
Human resources and labor market	6.67
ICT readiness	6.94
Prioritization of T&T	8.10
International openness	4.68
Price competitiveness	9.03
Environmental sustainability	8.16
Air transport infrastructure	5.44
Ground and port infrastructure	5.89
Tourist service infrastructure	5.66
Natural resources	8.64
Cultural resources and business travel	6.46

Note: ICT = information and communication technology; T&T = travel and tourism.

Source: Own elaboration.

essential pillars, which required the most urgent solutions, can be identified. The proposed methodology exposes the countries that offset low scores with high scores on other pillars.

Synthetic Index

The synthetic indexes with different weighting scenarios were then developed, as shown in Table 5:

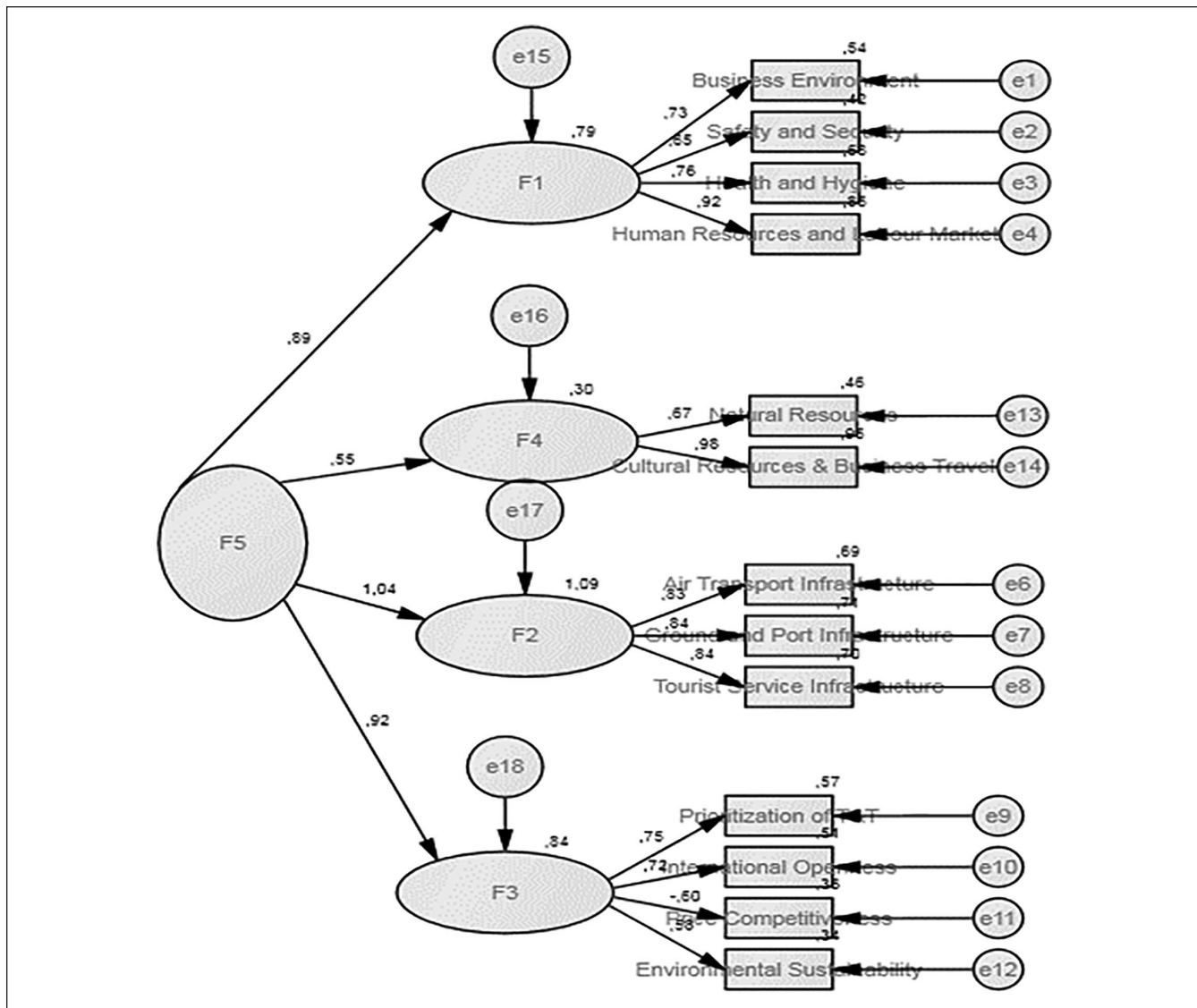


Figure 2. Factor analysis.

Table 5. Different Weighting Scenarios.

Pillars	Scenario 1, %	Scenario 2, %	Scenario 3, %	Scenario 4, %	Scenario 5, %
Business environment	7.14	7.71	5.00	9.05	3.23
Safety and security	7.14	4.98	5.00	7.28	2.15
Health and hygiene	7.14	6.84	5.00	8.00	3.41
Human resources and labor market	7.14	8.67	5.00	6.67	0.75
ICT readiness	7.14	20.81	5.00	6.94	5.76
Prioritization of T&T	7.14	8.86	6.25	8.10	10.66
International openness	7.14	7.01	6.25	4.68	8.69
Price competitiveness	7.14	3.22	6.25	9.03	6.90
Environmental sustainability	7.14	7.80	6.25	8.16	3.94
Air transport infrastructure	7.14	7.48	8.33	5.44	20.41
Ground and port infrastructure	7.14	8.74	8.33	5.89	8.21
Tourist service infrastructure	7.14	4.37	8.33	5.66	10.66
Natural resources	7.14	0.87	12.50	8.64	14.68
Cultural resources and business travel	7.14	2.63	12.50	6.46	27.32

Note: ICT = information and communication technology; T&T = travel and tourism.

Source: Own elaboration.

Table 6. Top 21 Rankings Using the Official Methodology and Scenario 1.

Economy	GDP Tourism	Region	General GDP per Capita	TTCI, 1–7 (best)	Ranking WEF	I_i^d	I_i^f	I_i^m 50	I_i^m 90	Official
Spain	High income	Europe	High income	5.42641261	1	6	10	4	6	1
Germany	High income	Europe	High income	5.28369874	3	2	34	8	24	2
Japan	High income	Asia-Pacific	High income	5.2636705	4	3	5	2	4	3
France	High income	Europe	High income	5.32258391	2	8	38	14	29	4
Switzerland	Medium-high income	Europe	High income	4.94267671	10	1	104	37	89	5
United Kingdom	High income	Europe	High income	5.20257539	5	9	102	41	90	6
Singapore	Medium-high income	Asia-Pacific	High income	4.85458271	13	7	19	7	15	7
Hong Kong SAR	High income	Asia-Pacific	High income	4.86421336	11	5	31	9	21	8
United States	High income	Americas	High income	5.1218458	6	14	30	16	22	9
Australia	High income	Asia-Pacific	High income	5.10114478	7	10	55	21	45	10
Austria	High income	Europe	High income	4.85739137	12	4	51	15	44	11
Canada	High income	Americas	High income	4.97082863	9	12	9	5	8	12
New Zealand	Medium-low income	Asia-Pacific	High income	4.68096368	16	13	21	13	18	13
Netherlands	Medium-high income	Europe	High income	4.64210562	17	18	43	24	41	14
Norway	Medium-high income	Europe	High income	4.63831931	18	11	70	28	53	15
Portugal	Medium-high income	Europe	High income	4.74173633	14	15	1	1	1	16
Italy	High income	Europe	High income	4.99277768	8	30	50	38	46	17
Luxembourg	Low income	Europe	High income	4.49299132	28	17	8	6	9	18
Iceland	Low income	Europe	High income	4.49804172	25	16	73	34	62	19
Sweden	Medium-high income	Europe	High income	4.55394765	20	19	41	22	34	20
United Arab Emirates	Medium-high income	Middle East	High income	4.49181108	29	21	11	11	11	21

Note: TTCI = Travel and Tourism Competitiveness Index; WEF = World Economic Forum.
Source: Own elaboration.

- Equal weights for all indicators (scenario 1).
- Weights calculated using DP_2 (scenario 2).
- Implicit WEF weights (scenario 3).
- Weights calculated using EFA (scenario 4).
- Weights obtained from the literature review (Gómez-Vega and Picazo-Tadeo 2019) (scenario 5).

We calculated the synthetic indexes using the methodology presented in this study and using the WEF methodology to provide a more exhaustive comparative analysis. Tables 6–10 present the rankings per the WEF methodology, our methodology, and with different compensatory measures.

As shown in Table 6, when equal weights (scenario 1) are used instead of the WEF weights (scenario 3), three countries (Luxembourg, Iceland, and the United Arab Emirates) move into the top 21, displacing China, Korea, and Belgium, which were ranked 15th, 19th, and 21st, respectively.

Table 7 shows that in scenario 2, five countries (Luxembourg, Iceland, Denmark, the United Arab Emirates,

and Finland) move into the top 21—the same three countries as in scenario 2, plus Denmark and Finland. The displaced countries again include China, Korea, and Belgium, plus Italy and Portugal.

Scenario 3 represents the official WEF rankings that are the point of comparison in this study. Scenario 4 (Table 8) is similar to previous scenarios in that Luxembourg, Iceland, and the United Arab Emirates move into the top 21, displacing China, Korea, and Belgium. Lastly, in scenario 5 (Table 9), Mexico and Brazil move into the top 21, displacing Sweden and Belgium. Therefore, we can observe that the competitiveness of a country can be influenced by the weights that politicians and managers decide to use (Table 10).

Figure 3 illustrates our analysis of the difference between “equal weights” (scenario 1) and the WEF’s “implicit weights” (scenario 3) using the official methodology to see if it benefits certain countries. The x-axis indicates tourist arrivals. A high GDP is indicated in dark gray, medium-high GDP in medium-dark gray, medium-low GDP in medium-light gray, and a low GDP in light gray. A negative value for

Table 7. Top 21 Rankings Using the Official Methodology and Scenario 2.

Economy	TTCI	I_i^d	I_i^f	I_i^{m50}	I_i^{m90}	Official
Switzerland	10	1	78	17	38	1
Hong Kong SAR	11	2	31	16	19	2
Singapore	13	3	19	19	18	3
Germany	3	4	33	20	20	4
Japan	4	6	1	1	1	5
United Kingdom	5	7	77	29	49	6
Netherlands	17	10	35	22	23	7
France	2	13	37	27	24	8
Austria	12	5	46	21	27	9
Luxembourg	28	9	2	2	2	10
Norway	18	8	55	23	31	11
Spain	1	19	9	6	9	12
Iceland	25	11	57	24	35	13
United States	6	22	40	34	30	14
Sweden	20	12	39	25	25	15
Australia	7	18	48	31	32	16
Denmark	31	16	50	30	33	17
United Arab Emirates	29	17	8	5	6	18
Finland	33	14	29	26	22	19
New Zealand	16	15	20	28	21	20
Canada	9	24	4	4	4	21

Note: TTCI = Travel and Tourism Competitiveness Index.
Source: Own elaboration.

Table 8. Top 21 Rankings Using the Official Methodology and Scenario 4.

Economy	TTCI	I_i^d	I_i^f	I_i^{m50}	I_i^{m90}	Official
Spain	1	6	12	5	11	1
Germany	3	2	35	12	26	2
Japan	4	3	9	3	6	3
France	2	7	40	17	30	4
Switzerland	10	1	122	38	101	5
Hong Kong SAR	11	5	33	11	22	6
United Kingdom	5	9	121	44	105	7
Singapore	13	8	19	13	19	8
Australia	7	10	63	22	50	9
United States	6	17	30	20	23	10
Austria	12	4	59	19	46	11
Canada	9	13	11	7	12	12
New Zealand	16	12	21	14	20	13
Norway	18	11	74	27	59	14
Portugal	14	14	4	1	2	15
Netherlands	17	20	47	28	43	16
Luxembourg	28	16	10	8	10	17
Iceland	25	15	83	33	70	18
Italy	8	30	57	41	53	19
Sweden	20	19	43	24	35	20
United Arab Emirates	29	18	13	10	13	21

Note: TTCI = Travel and Tourism Competitiveness Index.
Source: Own elaboration.

Table 9. Top 21 Rankings Using the Official Methodology and Scenario 5.

Economy	TTCI	I_i^d	I_i^f	I_i^{m50}	I_i^{m90}	Official
Spain	1	1	5	1	3	1
France	2	2	40	6	18	2
Japan	4	3	3	2	2	3
Germany	3	4	38	8	19	4
United Kingdom	5	5	87	11	49	5
United States	6	6	27	9	17	6
Australia	7	7	61	10	25	7
Italy	8	9	57	12	28	8
Canada	9	8	4	3	4	9
China	15	15	49	22	30	10
Singapore	13	13	20	15	20	11
Hong Kong SAR	11	12	33	14	22	12
Switzerland	10	10	88	20	58	13
Mexico	22	20	31	28	27	14
Brazil	27	29	56	35	39	15
Portugal	14	14	1	4	1	16
Korea, Rep.	19	24	67	33	41	17
Austria	12	11	58	16	31	18
Netherlands	17	23	73	34	47	19
New Zealand	16	16	21	23	24	20
Norway	18	19	68	31	40	21

Note: TTCI = Travel and Tourism Competitiveness Index.
Source: Own elaboration.

a country means that using the WEF's implicit weights (scenario 3) instead of equal weights (scenario 1) negatively affects its ranking. Figure 4 also illustrates these ranking differences but arranged in WEF rank order instead of by number of tourist arrivals.

Looking at countries indicated in dark gray (high GDP), in addition to having high rankings, they almost always increase in rank when using the WEF weights. The countries indicated in light gray (low GDP) decrease in rank with the WEF weights. The medium-dark gray countries (medium-high GDP) also almost always improve with the WEF weights. In conclusion, the low and medium-low income countries lose out with the WEF weights. The countries that increase in rank the most are usually those with the highest tourist incomes, although it is somewhat better distributed. However, quite the opposite results are obtained when performing this same analysis using per capita GDP.

Since the choice of weights is very subjective (even if statistical techniques are used), and since each technique yields different weights, it would be better to incorporate the participation of experts. These experts would be influenced not by the status of the pillars in different countries but by what is considered a country that is competitive in tourism. A global rather than a relative measure is thus yielded.

Table 10. Top 21 WEF Rankings and Rankings with Different Weightings.

Economy	Ranking WEF	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	GDP Tourism	Region	GDP General
Spain	1	1	12	1	1	1	High income	Europe	High income
France	2	4	8	2	4	2	High income	Europe	High income
Germany	3	2	4	3	2	4	High income	Europe	High income
Japan	4	3	5	4	3	3	High income	Asia-Pacific	High income
United Kingdom	5	6	6	5	7	5	High income	Europe	High income
United States	6	9	14	6	10	6	High income	Americas	High income
Australia	7	10	16	7	9	7	High income	Asia-Pacific	High income
Italy	8	17	30	8	19	8	High income	Europe	High income
Canada	9	12	21	9	12	9	High income	Americas	High income
Switzerland	10	5	1	10	5	13	Medium-high income	Europe	High income
Hong Kong SAR	11	8	2	11	6	12	High income	Asia-Pacific	High income
Austria	12	11	9	12	11	18	High income	Europe	High income
Singapore	13	7	3	13	8	11	Medium-high income	Asia-Pacific	High income
Portugal	14	16	26	14	15	16	Medium-high income	Europe	High income
China	15	31	51	15	31	10	High income	Asia-Pacific	Medium-low income
New Zealand	16	13	20	16	13	20	Medium-low income	Asia-Pacific	High income
Netherlands	17	14	7	17	16	19	Medium-high income	Europe	High income
Norway	18	15	11	18	14	21	Medium-high income	Europe	High income
Korea, Rep.	19	25	24	19	27	17	High income	Asia-Pacific	High income
Sweden	20	20	15	20	20	27	Medium-high income	Europe	High income
Belgium	21	23	23	21	24	23	Medium-high income	Europe	High income

Note: WEF = World Economic Forum; GDP = gross domestic product.
Source: Own elaboration.

Conclusions

Given the importance of tourism and the complexity of using a single measure to evaluate the competitiveness of an area, this study can provide a valuable contribution. The methodology applied in this field to analyze the competitiveness of different regions is of utmost importance. The innovative aspects of our study enable us to conclude that, on the one hand, competitiveness can be analyzed in a weak and strong manner (allowing full compensation or none). On the other hand, reference values determined by experts can be used, which enables measuring competitiveness in absolute terms. In addition, weights were obtained for the different pillars using various exogenous methods, and the resulting differences in rankings were analyzed.

The methodology used in this study to calculate the synthetic tourism competitiveness indicator has been previously used to

calculate other indicators, such as the Human Development Index (Luque, Pérez-Moreno, and Rodríguez 2016), the Global Competitiveness Index (Pérez-Moreno, Rodríguez, and Luque 2016), maternal and child health indicators (Luque et al. 2017), which are evidence of the methodology's viability.

The current WEF methodology results in a final TTCI for each country that can lead to erroneous conclusions. This situation arises because there may be countries with excellent results in some pillars that, with the weighting implicit in the TTCI calculation, end up compensating for poor results in other pillars. Our proposed methodology corrects this flaw.

In addition, these weights may vary due to country-specific characteristics (as in the Global Competitiveness Index), such as their development level, continent, or tourism development itself. However, there are no significant differences that prompt us to consider different weights.

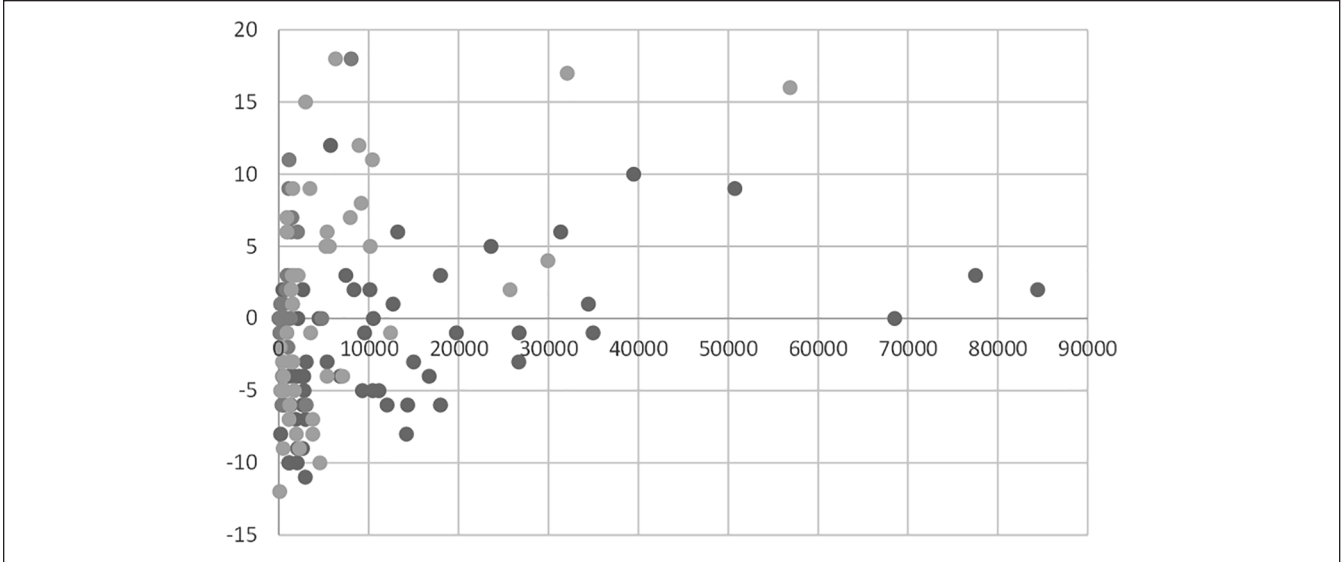


Figure 3. Ranking differences for scenarios 1 and 3, by number of tourist arrivals.

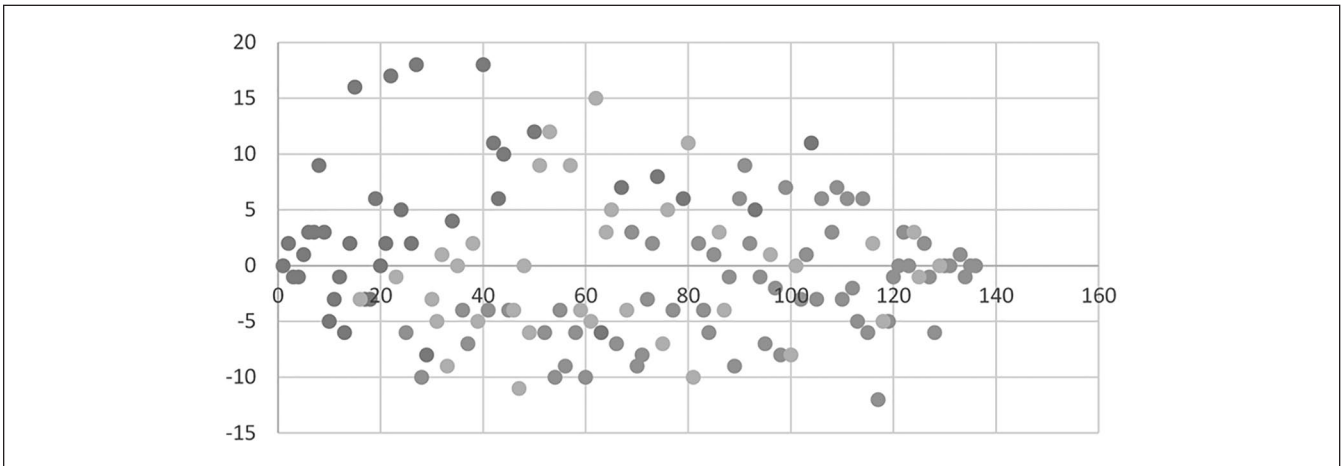


Figure 4. Ranking differences for scenarios 1 and 3, by WEF ranking.

We applied the DP_2 distance method and the exploratory factor analysis to compare the results. In addition, different weights used in other studies were again used here to calculate the indexes. Doing so led to the conclusion that different weights can produce different results that benefit or harm certain countries. Therefore, it would be of great interest to use weights provided by a panel of experts.

The use of the different indexes proposed in this article allows a more thorough study for each scenario of weights, with which the subjectivity of the weights taken can be compensated to some extent.

If it were also possible to assign reference values (aspiration and reserve) provided by experts, then absolute rather than relative results for tourism competitiveness could be obtained. Such results would enable competitive

and noncompetitive destinations to be specified, instead of only producing a competitiveness ranking.

Our proposed methodology also allows for adjusting the allowable compensation between the different pillars when producing the final index. Thus, the compensatory measures of the countries are transparent, as the richest countries have benefited by compensating for their deficiencies with very high values in other indicators.

Therefore, it would be interesting for experts to identify the compensatory measures for the indicators, which would provide a truer reading of tourism competitiveness. Experts should be neutral because otherwise, they may seek to favor their own countries. They could be experts from the United Nations World Tourism Organization (UNWTO), as this organization seeks to promote tourism equally in all countries, and they have the most expertise in this area.

It would also be of interest, as a future line, to improve the selection of indicators, developing a system of indicators more in line with the measure of tourism competitiveness.

The indicators obtained are useful for several reasons: they can serve as an alert, help formulate decision-making strategies, and easily communicate an area's situation. This system is useful for simulating different scenarios and for monitoring and controlling competitiveness.

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