DEVELOPING A STATISTICAL FRAMEWORK FOR MEASURING SUSTAINABLE TOURISM IN SMALL TOURISM ISLANDS: THE CASE OF LANZAROTE

Javier Mendoza-Jimenez
jamendoza@fg.ull.es
Universidad de La Laguna

Raúl Hernandez-Martin
raulhernan@ull.es
Universidad de La Laguna

Alberto Gonzalez-Yanes
jgonyanp@gobiernodecanarias.org
Instituto Canario de Estadística (ISTAC)

Nota biográfica de los autores

Javier Mendoza Jiménez es licenciado en Administración y Dirección de Empresa con Master en Estudios Europeos por la Universidad de Letonia. Actualmente cursa el doctorado en Desarrollo Regional en la ULL. Trabaja en la Cátedra de Turismo CajaCanarias – Ashotel – ULL.

Raúl Hernández Martín es profesor en el Departamento de Economía Aplicada y Métodos Cuantitativos de la ULL, y Director de la Cátedra de Turismo CajaCanarias – Ashotel – ULL, y del Programa de Doctorado en Turismo de la ULL. Su investigación se centra en los impactos económicos del turismo, las cuentas satélites del turismo y el desarrollo del turismo en islas.

J. Alberto González Yanes es Jefe de Servicios de Estadísticas Económicas del Instituto Canario de Estadística. Licenciado en Matemáticas por la Universidad de La Laguna

abstract

There is a rising concern about how to make the increasing tourism activity sustainable which results in more attention being paid into the measure of sustainability from both international organizations and scholars. However, the majority of existing methodologies are still developed at national level, leaving the sub national activities still as an almost unexplored field.

In this article, we use the island of Lanzarote, in the Canarian archipelago, as a case study to develop a statistical framework that addresses the problem of measuring sustainability on small tourism islands. We propose a basic scheme of economic, social and environmental indicators to measure tourism sustainability and highlight the need to develop sub national statistics in order to have more accurate data that allow a proper measuring and comparison with other destinations. We believe that our statistical framework can be replicated in other destinations.

Key words: tourism sustainability, subnational statistics, indicators.

Introduction

The term *sustainability* has become a central topic associated with human activities since the Brundtland Commission defined sustainable development as “development that meets the needs of current generations without compromising the ability of future generations to meet their own needs" (WCED, 1987, p. 41). Since then, a myriad of projects, political strategies, development planning and similar have used this concepts as one of the pillars to look into the future of public and private entities at every management level in the world.

However, the definition above does not provide some clear bases to facilitate the measuring of sustainability – not even the environmental one – and continuous discussions are being held in national and international forums about what are, and how to quantify them, sustainable activities. Of course, we do not mean that there are not some guidelines on how to measure sustainability but they still constitute an amalgam of methods in order to characterize all the dimensions of sustainability although they qualify as laudable attempts to achieve that.

Most of the efforts to quantify the different aspects of sustainability have been made on the environmental side. One relevant initiative being currently developed is the System of Environmental Economic Accounting (SEAA). This is a shared initiative designed between the United Nations, the European Union, the FAO, the OECD and the World Bank focused on: using similar accounting principles, define the relation among individual environments, assess the impact of human activities and using a rigorous spatially based approach (United Nations, European Union, Food and Agriculture Organization of the United Nations, Organisation for Economic Co-operation and Development, & World Bank Group, 2014).

However, reducing sustainability to a figure is virtually impossible and therefore some authors, specially Bell & Morse (2004, 2008) have stood for a definition that characterize this concept more like a band of equilibrium within which the object analyzed (regions, activities, policies, etc.) might be considered to be sustainable. Together with that, sustainability is a transversal topic that does not consider a single dimension. On the contrary more and more studies conceived sustainability as a multidimensional framework (Dillard, Dujon, & King, 2008; Munda, 2005; Seghezzo, 2009) overcoming the mere environmental focus.

Another feature of sustainability is the issue of the scale. Nature is interconnected and even if one country would manage to be completely sustainable by, let´s say, obtaining all its energy from renewable sources, it would be still affected by other countries performances that produce negative externalities that are translated into it. Therefore, it is important to define at

which level we want to evaluate sustainability and how we are going to take into account the external influences that might happen.

Albeit statistics in this issue are generally collected at national level, there are numerous examples of suggested tools and methodologies to measure it at subnational level (Graymore, Sipe, & Rickson, 2008, 2010; Ramos, 2009). Besides, sustainability within corporations and public organizations have been widely researched and the Triple Bottom Line (here in after TBL) has become one of the most spread used tools. Many researchers like Dwyer, (2015); Milne & Gray, (2013); Shnayder, Van Rijnsoever, & Hekkert, (2015) have used the Elkington (1997) initial study and have referred the TBL as a milestone in the field of sustainability.

Tourism is not unaware to the efforts to improve sustainability in human development. As one of the most noticeable activities, its international tourism figures beat records year after year, reaching the 1.2 billion international arrivals in 2015[1] and overcoming food as the third biggest export industry in the world with more than 1,522 $ billions in earnings. Tourism activities have worldwide impact and influence but nevertheless the study of tourism has had to adapt itself to the creation of a whole new branch of the discipline, sustainable tourism (Mowforth & Munt, 2015).

There is a rising concern about how to make the increasing tourism activity sustainable, which results in more attention being paid into the measurement of sustainability from both international organizations and scholars. Still, the majority of existing methodologies are developed at national level, leaving the sub national activities as an almost unexplored field of research.

In this paper, we use the island of Lanzarote, in the Canarian archipelago, as a case study to develop a statistical framework that addresses the problem of measuring sustainability on tourism activities. We have followed Dwyer, Dragićević, Armenski, Mihalič, & LK Cvelbar, (2014) and enounced an Importance - Performance analysis applied to a tourism destination and to obtain the correspondent weights for each category of indicators. We rely as well on previous studies that intended to measure destinations´ sustainability at sub national level like Wise (2016) using the Triple Bottom Line, the European Tourism Indicator System (European Union, 2016) and the work of Gallego-Galan & Moniche-Bermejo (2014) in the case of Andalusia.

[1] According to the data of the World Tourism Organization

This paper proposes a basic scheme of economic, social and environmental dimensions to measure tourism sustainability and highlights the need to develop sub national statistics in order to have more accurate data that allow a proper measuring and comparison with other destinations.

1. The Island of Lanzarote

1.1) Territorial and environmental description

846 km^2 shape the island of Lanzarote, which represents 11% of the total area of the Canary. The Island is placed the easternmost in the Archipelago, 100 km distance from the western coast of Morocco and being the closest one to the continental Spain and administratively is divided in 7 municipalities (see figure 1)

Figure 1: Administrative division of Lanzarote

Source: Authors' elaboration.

UNESCO declared the island Reserve of the Biosphere in 1993 and it has keep that condition since then. The environmental protected areas of Lanzarote cover the 42,15 % of the island[2] and include both inland and maritime areas. Among the protected natural spaces, the National Park of Timanfaya is the main tourism attraction of the island. The area were the park is now located was brutally modified by a series of eruptions happened between 1730 and 1736 resulting in a change in the morphology of the zone and impeding the habitation of the area. In

[2] Data from the Situation Report of Gobierno de Canarias in 2014

1974, more than 5,000 ha were categorized as a National Park. 1,575,029 tourists visit the park in 2014[3] and the entrance is strictly controlled with the charge of a fee.

Consequently, the island of Lanzarote, in spite of the harsh environmental conditions, has a unique natural richness and landscapes that is under different spheres of protection and that must coexists with the pressure that the massive affluence of tourists causes into the environment. This means that tensions may arouse (and they actually do) in order to balance the environmental sustainability and the satisfaction of tourists.

1.2) Tourism supply in Lanzarote:

A first glance of the significance of tourism for the island of Lanzarote can be extracted from available accommodation for tourists. There is a total 71.803 places in hotels and apartments in the whole island, which means that almost half of the local population could be accommodated into them.

Tourism influences the economic structure of Lanzarote given that the main enterprises, with more than 50 workers, are concentrated in this sector. Consequently, tourism, since it presents a solid base for development, can be the engine to help the island to attract foreign and local investments.

Regarding the distribution of the businesses in the sector, restaurants and similar, land transportation of passengers and accommodations cope the first 3 positions by number (which is not strictly related with the revenue they produce).

The hotel sector offers more than the 50% of the accommodation places in the island, with a total of 73 establishments from the total of 287 tourism establishments in the island[4]. Accommodation is characterized by the presence of a high number of 4 and 5 starts hotels, a 57.53% of the total. The table 1 shows the distribution by municipalities.

[3] Data from the Spanish National Parks network

[4] The official number of establishments is not clear since there are discrepancies between ISTAC and Cabildo de Lanzarote.

Table 1: Number of hotels in Lanzarote classified by category and municipality

	LANZAROTE*	Arrecife	Teguise	Tías	Yaiza
Total categories	73	9	19	16	28
1, 2, 3 Stars	31	7	7	4	12
4, 5 Stars	42	2	12	12	16
% of 4,5 Stars	57,53%	22,22%	63,16%	75,00%	57,14%

Source: Authors' elaboration with data from ISTAC

*There is not available data for all the municipalities

Lanzarote enjoys a relatively high level of occupancy. In 2015 the level reached 61.29%, which meant a decrease from 2014[5]. By categories, the 4 and 5 stars hotels overcome those of lower category and also the rural houses, a segment still far away from its full potential (table 2).

Table 2: Occupation rate by category of hotel and municipality

	LANZAROTE*	Arrecife	Teguise	Tías	Yaiza
Total categories	73,76 %	58,1 %	71,09 %	77,3 %	76,38 %
1, 2, 3 Stars	68,94 %	55,43 %	70,15 %	55,03 %	75,76 %
4, 5 Stars	76,49 %	63,85 %	71,48 %	80,79 %	76,88 %
Rural houses**	53,59 %				

Source: Authors' elaboration with data from ISTAC

*There is not available data for all the municipalities

** There is not disaggregated data for municipality

The revenue per available room (RevPAR) in Lanzarote reaches 62.04 € in average, with an acute difference between the 4 and 5 stars hotels (70.16 €) and the 1, 2 and 3 starts hotels (43.02 €). The total income of hotels for 2015 was more than 390 million €[6]. In the context of the archipelago, RevPAR of Lanzarote is slightly behind Gran Canaria and Tenerife and similar to Fuerteventura. The table 3 shows the data from all the islands.

[5] Data from Association of Hotels and Apartments Businessmen of Lanzarote (ASOLAN)
[6] Data from ISTAC.

Table 3: RevPAR and Total Income by hotels' category and island.

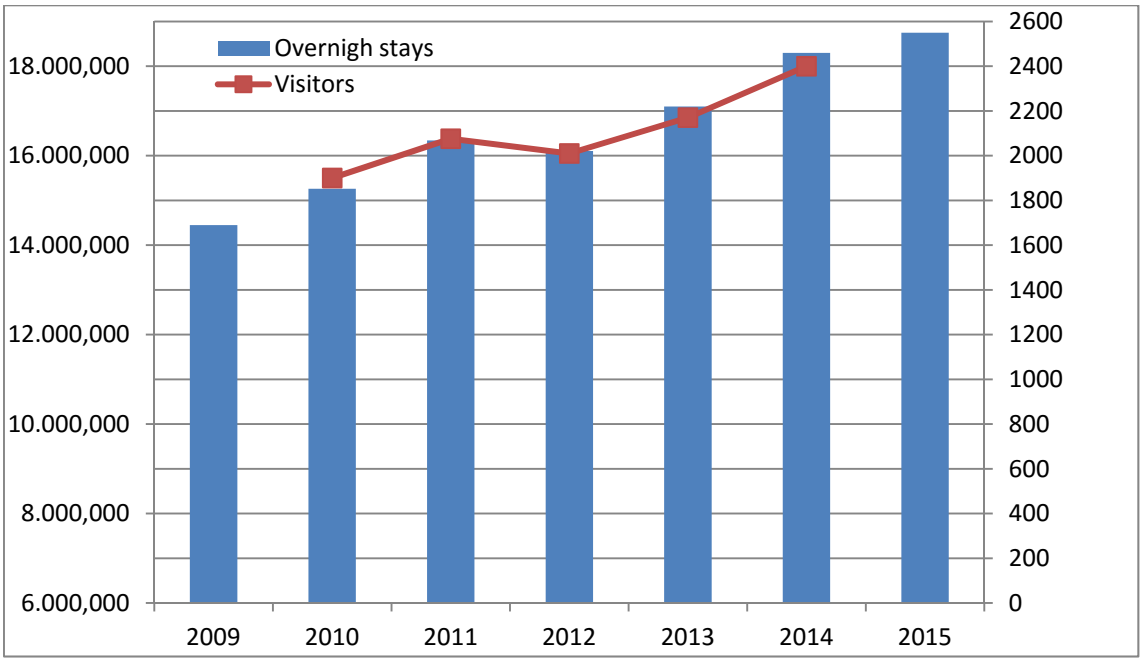
	Lanzarote	Fuerteventura	Gran Canaria	Tenerife	La Gomera	La Palma	El Hierro
Average REVPAR (€)	62,04	63,37	73,72	67,49	31,28	22,17	17,24
1,2,3 Stars	43,02	48,03	44,29	40,73	41,67	23,56	.
4, 5 Stars	70,16	68,23	93,76	76,65	25,44	21,54	.
Total Income (thousands of €)	390.642,76	452.866,61	798.170,40	987.890,41	10.377,68	15.865,11	1.044,59
1,2,3 Stars	81.000,22	82.445,751	194.198,52	151.995,82	4.973,34	5.244,84	.
4, 5 Stars	309.642,55	370.420,86	603.971,88	835.894,58	5.404,33	10.620,26	.

Source: Authors' elaboration with data from ISTAC

1.3) Tourism demand in Lanzarote:

Lanzarote received 2.399.751 tourists in 2014, which spent more than 18 millions of overnight stays in an average length of stay of 9 days. However the trend in both the number of tourists and the overnight stays have followed in general a growing path with the exception of 2012 (see figure 2).

Figure 2: Evolution of the number of visitors and the overnight stays in Lanzarote



Source: Authors' elaboration with the data from ISTAC

The structure of tourists' arrivals shows that 87.26 % of tourists are foreigners with a total of 305.668 tourists coming from Spain. By countries, UK clearly leads the figure of tourists with

almost half of the total. Germany and Ireland follow them at a long distance. The daily average expenditure of tourists has been on the raise from the year 2009 to reach 128.04 €[7] in 2015. From this amount, 34.21 € were spent at the destination and 93.83 € in the country of origin. For the whole trip, the average expenditure by tourist was 1.156 €, according to the most recent data of 2015, being flight tickets the category with the highest weight. The geographical characteristics of the destination, mainly reachable by plain, also condition the structure of tourists' spending and may influence in the total amount that is spent at the destination.

2. Why Lanzarote?

The Island of Lanzarote presents several characteristics and determinants that qualify it to be the object of a case study. Firstly, being an island the territory has clearly delimited borders; this may ease the analysis of the tourism's impact and help to isolate spreading effects and external influences. In addition, a islander nature also may imply some difficulties to diversify their industries and leave them vulnerable to changes in the external environment (Bojanic & Lo, 2016). Therefore, increasing the dependency of Lanzarote from tourism due to the reduce possibilities of finding a substitutive industry.

Another feature for Lanzarote is that the type of tourism the island holds. The more majority of activity is developed under the *sun and sand* type, with high presence of the coastal tourism. Therefore, results obtained for many of the activities developed in Lanzarote may be more easily comparable afterwards to territories with similar activities. At the same extent, the above mentioned fact of the islander nature of the territory could also make more straightforward the process of application in other similar territories, specially the Small Island Developing States - that were first recognized as a distinctive group of countries by the UN in June 1992 and recognized as "ecologically fragile and vulnerable" (United Nations, 1992, p. 193)

The specialization of the productive system towards the tertiary sector, and more concretely the touristic one, is another of the peculiarities that strengthens the suitability of Lanzarote to be a representative case study. Tourism performance determines to great extent the economic situation of Lanzarote (and the Canary Islands in general). This high dependency from the tourism sector adds economic and social pressure to the environmental one and influences the options for the island development. Therefore, it makes even more important to gather information on the relation between tourism and territory through the construction of a set of indicators that would be relevant for the decision making process of the public and private stakeholders.

[7] Data from ISTAC

The scarcity of resources - specially of drinkable water - constitutes one of the main issues when trying to balance the relationship between economic activity and environment. The scant contribution of the agriculture to the local economy - with few agricultural products harvested and produced - adds an additional constraint to tourism activity since it has to be nourished by importing products and desalinating water from the sea.

Regarding the collection of statistics, the presence of the Canary Islands Institute of Statistics (ISTAC), which was recognized by the UNWTO as a reference organization for the elaboration of regional statistics, ensures the accuracy on the methods and the information used in the elaboration of statistics. In addition, the island has a specific data center that offers many relevant statistical data and reports concerning different aspects of Lanzarote

Lanzarote is one of the symbols of sustainable tourism any time that in 1995, on the frame of the World Conference on Sustainable Tourism was signed the *Charter for sustainable tourism* - also known as the Lanzarote Declaration, which among other principles explicitly cited that "Tourism development shall be based on criteria of sustainability, which means that it must be ecologically bearable in the long term, as well as economically viable, and ethically and socially equitable for local communities", and as well "Tourism should contribute to sustainable development and be integrated with the natural, cultural and human environment; it must respect the fragile balances that characterize many tourist destinations, in particular small islands and environmentally sensitive areas". (UNWTO, 1995, p. 3)

This case study aims to measure the impacts that tourism may have in all the three areas of sustainability, economic, social and environmental, by establishing a suitable methodology and an attached set of indicators to be used in subnational territories. We believe that Lanzarote, for all the above-mentioned reasons present many characteristics to be considered a suitable starting point to reach this goal.

3. Methodology of the study

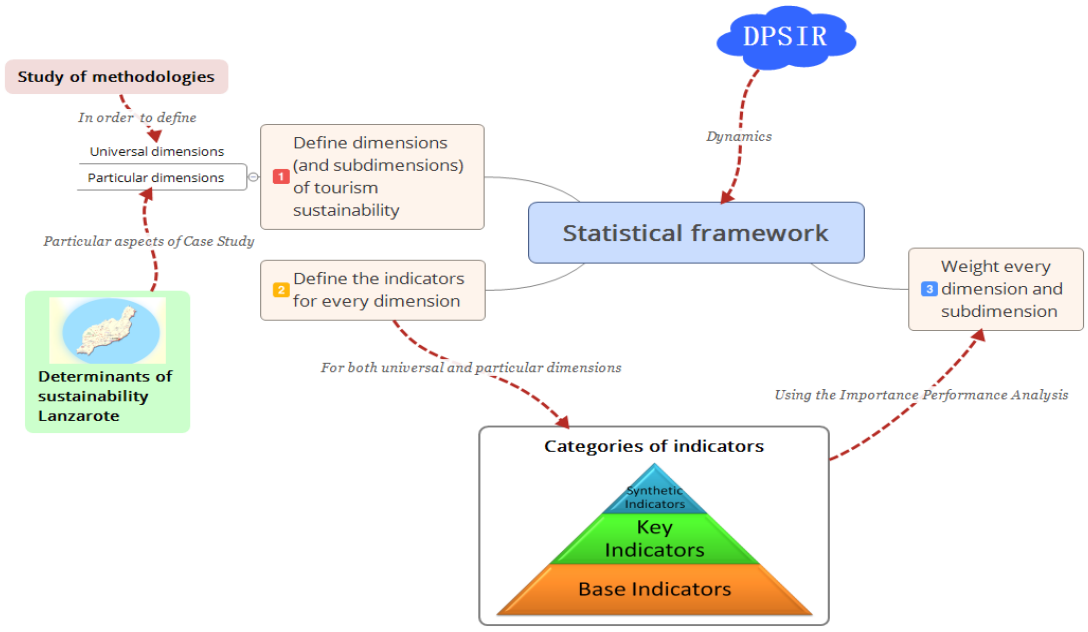
The construction of a proper statistical framework to measure the relation between tourism and sustainability in a small territory is framed into different steps. The starting point is the definition of the dimensions and subdimensions of tourism sustainability. Two types of dimensions are determined: universal dimensions, which are the result of a in depth study of universally recognized methodologies; and particular dimensions, extracted from the analysis of specialized documents of Lanzarote that offer information about the determinants of sustainability in the three areas considered.

Following the proposal of dimensions, the Delphi method is used in order to assign indicators for each one of them. The result is a pyramidal scheme where in each step we will allocate different types of indicators.

Once those are defined, the last step is to determine the weight of every dimension in the scheme. To deal with this issue, the *Importance Performance Analysis* (here in after IPA) is the designated method that will be employed

The result of fulfilling those previous steps is the proposal of a statistical framework to characterize the relationship between tourism and sustainability. To close the circle, we will apply the DPSIR analysis in order to obtain a more dynamic vision of the above-mentioned relationship. Therefore, the proposed scheme shows not only the relative measures and weights but also how changes in some dimensions may affect others. This paper includes only the theoretical proposal, which will be completed with the actual results in future studies. A more detailed description of each step is offered in the following points and a graphical summary of the methodology can be seen in the next figure 3:

Figure 3: Scheme of methodology



Source: Authors' elaboration

4. The dimensions of tourism sustainability

4.1) Universal dimensions of the tourism sustainability

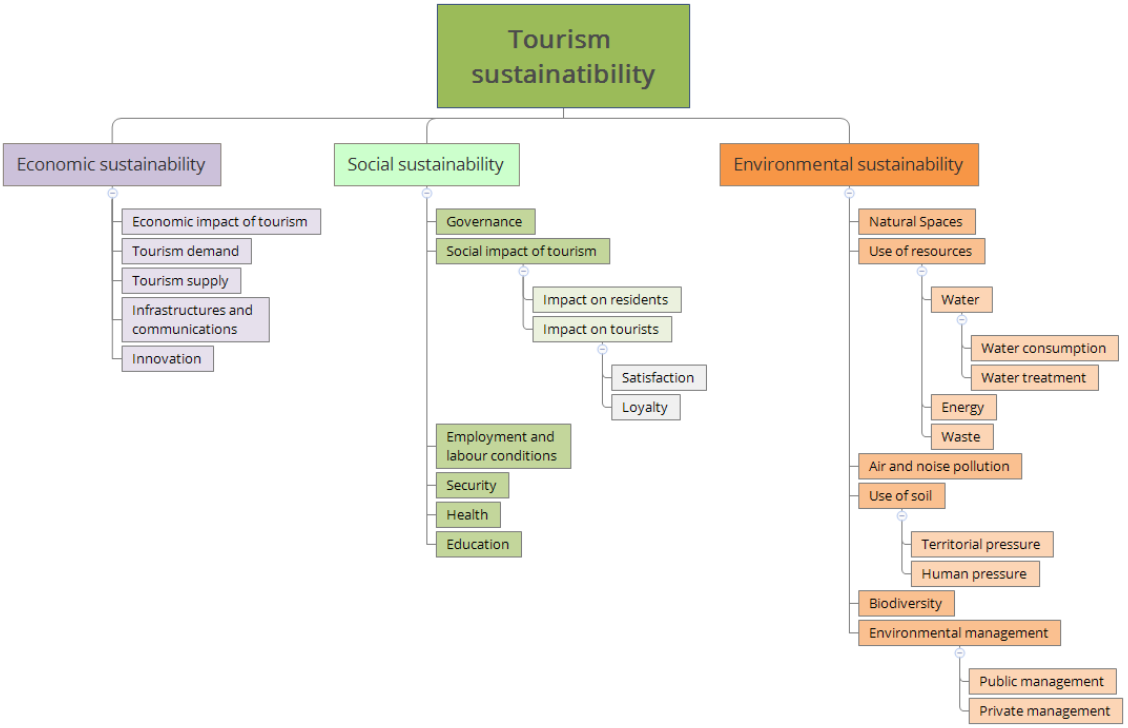
The dimensions to vertebrate the definition of tourism sustainability should be applicable in different context. However, there is not a consensus in the literature about the main dimensions to consider when measuring tourism sustainability. Iniesta-Bonillo, Sánchez-Fernández, & Jiménez-Castillo, (2016) proposed to model sustainability based on economic, cultural and environmental aspects. Others like Chu & Choi, (2000) added to those the social, ecological, political and technological dimensions. Mowforth & Munt, (2015) highlighted the importance of other forces like globalization for the tourism sustainability while Xu et al. (2016) highlight the importance of taking into account the residents' opinions.

We have followed the guidelines that the International Network on Regional Economics, Mobility and Tourism & World Tourism Organization (2012) provided about the construction of a regional systems of statistic. Three clear dimensions were proposed regarding the relation between tourism and sustainable development: environmental dimension, the impact on the social and cultural dimensions of the resident population and the economic contribution and impact. Those are the pillars of the proposed structure grouping the social and cultural dimensions into the social sustainability.

Taking that as starting point, we have reviewed international methodologies on sustainability in order to classify their proposed dimensions and sub dimensions into those three previously mentioned. The methodologies were the European Tourism Indicator System (ETIS), the Global Reporting Index, the Triple Bottom Line, the Statistical System of Andalusia (SAETA), the World Trade Competitive Index (WTCI), the Municipal System of Sustainability Indicators (MSSI) - that have being defined under the umbrella of the Ministry of Environment of Spain - and the United Nations 2030 sustainable development goals (which we have assigned to every dimension).

Obviously, not all of the methodologies selected are directly related with tourism. Even though, they do show aspects to be considered regarding sustainability and, therefore, it will be our task to adapt them in order to quantify and qualify the relationship between tourism and territory. The proposed organization into dimensions and subdimensions of the economic, social and environmental sustainability can be seen in the next figure.

Figure 4: Universal dimensions of tourism sustainability.



Source: Authors' elaboration.

4.2) Particular dimensions of tourism sustainability

The dimensions hereby proposed are meant to be comparable and applied into other regions and destination further than Lanzarote. Nevertheless, for this specific case study we need to take into account that the island possesses a series of characteristics that may (and do) condition the relationship between tourism and the territory. Consequently, in addition to those universal dimensions is necessary to settle down also some particular dimensions to be related with the some determinants of Lanzarote´ sustainability.

The first stage is to delimit which are the determinants of sustainability in the specific case of Lanzarote. In our case, we have stood in a series of official documents for each one of the general dimensions in order to extract from them the most influential factors. The result is expressed in the table 4 indicating as well the documents where the information has been collected.

Table 4: Determinants of sustainability in Lanzarote.

Dimension	Base documents	Defined determinants of sustainability
Environmental sustainability	*Report of Environmental Sustainability;* Cabildo de Lanzarote Strategy Lanzarote 2020	Soil Hydric Resources → water production, consumption and management Energy Generation Air Quality Solid Waste Protected Areas Biodiversity Pressure over the coast Landscape and Heritage
Economic sustainability	Survey of Island's issues; Cabildo de Lanzarote	Economic Performance Tourism Sector and impacts in other sectors (agriculture) Infrastructure Transports and Communication Air connectivity Prices
Social sustainability	Survey of Island's issues; Cabildo de Lanzarote	Employment Health Governance Education Safety Culture and Leisure

Source: Authors' elaboration

The process of allocation of the determinants identified into the previous dimensions results in some of those determinants not finding accommodation in any of the above dimensions. Consequently, those will be identified as the particular dimensions for this case study. In the case of Lanzarote, four particular dimensions were established: Impact of tourism in other sectors, Air connectivity, Water production and Pressure over the coast

This does not mean that more particular dimensions cannot be added and neither that other case studies should fundament into the same particular dimensions. On the contrary,

depending on the region it could be more likely to found particular dimension in the social sphere than in other two since there is not a predominant one.

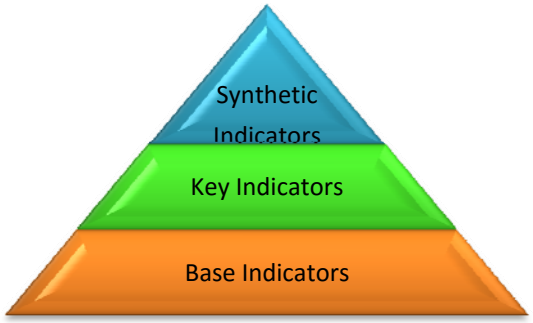
The skeleton for the relationship among tourism and territorial sustainability has been defined. Thus, the next stage we have to perform is to add the "muscles" to that skeleton by adding the different indicators to endow them with information that can be later worked with help in the decision making process of different stakeholders.

5. The process of defining indicators

There is a vast literature on the key elements that an indicator must have to be useful. In the area of sustainability, the UNESCO proposed that the indicators for measuring the environmentally sound and sustainable development (ESSD) should take into account the following considerations: simplicity, scope, quantification, assessment, sensitivity and timeliness (Harger & Meyer, 1996). Another approach relates with the different type of indicators. Heink & Kowarik, (2010) studied several articles about the different categories of indicators and concluded that those have been described as a type of measure - whether descriptive, normative or hybrid – as parameter values or as descriptive and hybrid components.

This paper will not address deeply that issue since it relates into methodologies with recognized indicators. It will focus more in detail in how those indicators have to be organized. We have decided to use a Delphi technique to determinate which of them should be use to measure each of the dimension and organize the results into a pyramidal scheme. This type of hierarchy allows constructing related levels offering more summarized information when going up on the scale. Therefore, we can build different levels of information that may be useful depending on the field they are intended to use (see figure 5)

Figure 5: Structuring of indicators.



Source: Authors' elaboration

This structure including several lays of indicators have been used for example by Navarro Jurado et al., (2012) to determine the carrying capacity in the Costa del Sol in the south of Spain and by Aivazian, (2016) to define the quality of life. We have established a 3-level pyramid with the so-called base indicators in the bottom, the key indicators in the middle and the synthetic indicators on the top. The definition and process of selection are explained following this point.

5.1) Base indicators

There is a vast choice of indicators attempting to measure sustainability, therefore, one of the main problems in this topic is to choose the best indicators in order to obtain the most accurate results. To solve this situation we have resorted to apply a Delphi technique and to involve a group of recognized experts in the selection of the indicators. The Delphi technique is broadly accepted by its simplicity and effectiveness and it has been used in the field of sustainable tourism before, for example, by Green, Hunter, & Moore, (1990) and Miller, (2001).

To build a suitable list of indicators we asked the group of experts to review indicators from a set of the international methodologies and other relevant statistical sources. More specifically, we have listed indicators in each of the categories considered above that lately the experts valued. The sources used where:

- European Tourism Indicators System for sustainable destination management (ETIS)
- Global Reporting Index (GRI)
- System of Analysis and Statistics of Tourism of Andalusia (SAETA)
- World tourism & travel competitiveness index (WTTCI)
- OECD Environmental Indicators
- United Nations World Tourist Organization (UNWTO)
- Spanish System of Tourism Environmental Indicators, Ministry of Environment of Spain
- Literature on the Drivers, Pressure, States, Impacts and Responses methodology in tourism sustainability like Bidone & Lacerda, (2004); Gari, Newton, & Icely, (2015); Ness, Anderberg, & Olsson, (2010)
- Spanish National Institute of Statistics (INE) and Institute of Statistics of the Canary Islands (ISTAC)
- Spanish Studies from the Alliance for Tourism Excellence (Exceltur)
- System of Municipal Indicators of the Iberoamerican Observatories for Sustainability

Previously to their evaluation we had eliminated those that were equal and/or overlapped with another in order to avoid redundancy. After that, it was elaborated a first series of indicators with a total of 108. From those, 41 indicators are related to the Economic sustainability; 38 indicators to Social sustainability; and 29 indicators to Environmental sustainability.

5.2) Key indicators

With the base indicators we have the pieces of the puzzle to assemble our statistical framework. However counting with too many pieces can lead to an overwhelming process where to define which of those indicators are really relevant would not be a straightforward task. We start from the idea that the indicators are needed to provide information that lately can be transformed into useful knowledge for the decision-making. Because of this, we need to shorten the tremendous amount of indicators and keep working with a core of a much more reduced number.

The same group of experts shortened the list of base indicators into a more manageable number of them, concretely 45 indicators. The criteria for that were: i) determine which indicator offered the information those experts considered to be the most important in every dimension; ii) assess the availability of information to build the indicator; iii) evaluate the possibilities of application in other regions.

5.3) Synthetic indicators

At the top of the pyramid we have placed the synthetic indicators that constitute the final aggregation of the information that we have collected in the former steps. The first step to build this type of indicators is to determine the guidelines of normalization that the indicators of the previous level have to follow in order to be integrated later on. As a general guideline, the normalized value of the indicators should be between in the interval [-1 – +1/]. After that process we would obtain a list of normalized values that we could use to construct the synthetic indicators. However, a big problem remains as it is the issue of the assignation of a weight to every indicator in order to add it up to compose the ad hoc synthetic indicator. The next section explains the way in which we intend to solve this problem.

6. How to assign weights to every indicator? The Importance Performance Analysis (IPA)

One of the capital topics when building a system of indicators is the relative weight that should be assigned to each one of them. The OECD (2008, p. 31) highlights that “regardless of which method is used, weights are essentially value judgments”. Fernández & Sanchez Rivero, (2009)

enounced a sustainability tourism index (STI) and compared it with the WTTC (World Travel and Tourism Council) and the environmental sustainability index (ESI) of the WEF (World Economic Forum). In their paper the authors based their calculations upon the Spanish system of environmental tourism indicators (SSETI) and lately used the STI to define the dimensions of the so-called DPSIR (Drivers, Pressure, States, Impacts and Responses) model.

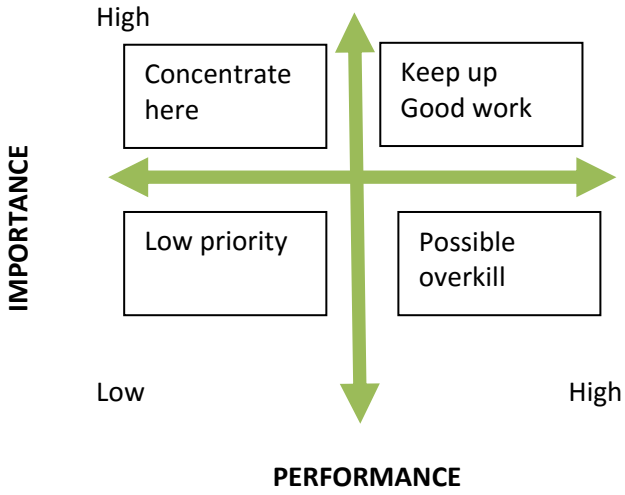
Another experience, can be seen in Peral, Lozano, Casas, & Oyola, (2010) who solved the issue of weighting by applying Principal Components Analysis to them and calculating every weighting coefficient as the multiplication of two factors: the explained variance of every principal component selected and the absolute value of the correlation of every indicator with the component.

The two previous examples, and the literature in general, lack an involvement of the tourism agents on the development of a statistical framework. To tackle this, we have opted for the Importance Performance Analysis as a methodology that allows both obtaining direct involvement of the stakeholders (not only) in the tourism sector and gathering direct information from them about which is the importance of the considered factors in each case.

At this point, a clarification needs to be done; the proposed structure of indicators may (and probably will) vary depending on the context where it is applied. The same it is true for the weights used to each one of them since they will be based on representatives´ opinions of the region/destination where the analysis will be performed.

The key objective of IPA is diagnostic in nature, facilitating the identification of attributes for which, given their importance, a product or service underperforms or overperforms (Larry Dwyer et al., 2014). The graphical representation is a two-dimension grid linking the importance and the performance of a considered issued (figure 6)

Figure 6: Graphic representation of the IPA model.



Although several limitations apply to the IPA (Larry Dwyer, Cvelbar, Edwards, & Mihalic, 2012), it has been praised as a quantitive, theoretically robust method that is relatively easy to apply in empirical studies (Azzopardi & Nash, 2013). The incidence of this methodology into tourism sector analysis has been scarce (Oh, 2001). Nevertheless, it has been previously used for measuring aspects of tourism sustainability by Sörensson & von Friedrichs, (2013), who assessed which of the social and environmental factors the tourists valued in terms of sustainability for a destination. Also it has been implemented when measuring tourism in small island such as the study that Ziegler, Dearden, & Rollins, (2012) developed about the tourists satisfaction in Isla Holbox in Mexico; and to analyze the hotel industry in Hong Kong (Chu & Choi, 2000). Most of the studies, consequently, are aimed to discover the factors assessed by the tourists inside the different locations but they have not addressed the whole tourism sector.

An exception to this lack of integration can be found in Dwyer et al. (2014) where the authors evaluated through surveys the opinion of different stakeholders in Serbian tourism sector on the importance for tourism sustainability and competitiveness and the performance (compared with neighbor countries) of 51 previously identified activities. We start precisely from this point to build our model to achieve a correct weighting of the indicators that can then be used. The importance for tourism development of each one of the dimensions pre defined and as well their satisfaction with their performance will be evaluated through a series of interviews with relevant stakeholders from Lanzarote using a Lickert scale from 1 – 5. Although the Likert scale has been confronted with other types of scales like the visual analogue scale (Harland, Dawkin, & Martin, 2015; Voutilainen, Pitkäaho, Kvist, & Vehviläinen-Julkunen, 2015) and the fuzzy rating scale (Lubiano, Salas, De la Rosa de Sáa, Montenegro, & Gil, 2017), it is still commonly used in survey research using primary and secondary data to measure the respondent attitude by asking insofar to which they agree or disagree with a particular questions (Awang, Afthanorhan, & Mamat, 2016)

7. The interrelation of the dimensions: the DPSIR model

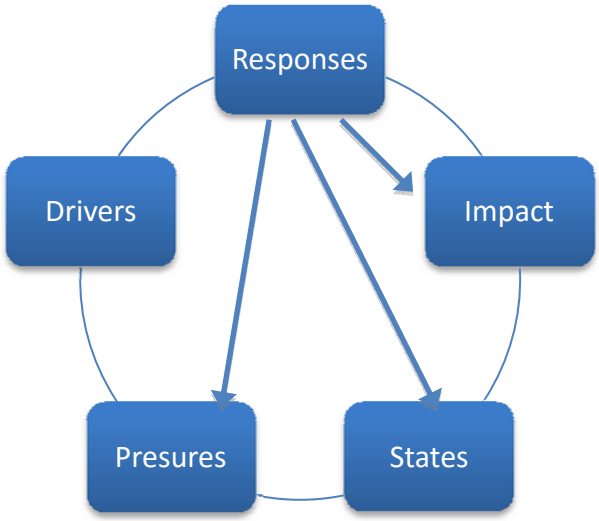
We have defined the different dimensions of tourism sustainability and allocated the indicators that will provide the information in order to measure it afterwards. Consequently, we have a statistical framework that we can elaborate and compare both in the space and in time. However, we find in this system (and in most statistical systems in general including those that we used as a base for this one) a big limitation regarding its dynamicity.

The statistical framework proposed does not really offer so far information about the **interrelations** of the different dimensions and sub dimensions. In other words, with our system we may know how the different indicators behave in space in/or in time but we still lack information about how they influence each other.

To overcome this limitation, we have opted to apply to our system the so-called DPSIR (Drivers, Pressures, States, Impact and Responses) model. The history of this model starts with efforts of the National Canadian Statistics Agency that developed a *Stress and Response* framework that lately would evolve into the more spread and know Pressure – State – Response (PSR) used for example by Hughey, Cullen, Kerr, & Cook, (2004); Tscherning, Helming, Krippner, Sieber, & Paloma, (2012); Zhang, Ma, Zhan, & Chen, (2012). The PSR can be attributed to the OECD. This model helps to the decision making by perceiving the environmental, economic and other interconnected factors (OECD, 2003).

From that point the DPSIR was the result of the works of the European Environment Agency (EEA) according to Ness, Anderberg, & Olsson, (2010) or the pioneer efforts of the OCDE (Bidone & Lacerda, 2004) or even the Agency for the protection of the Environment of USA (Skondras & Karavitis, 2015). Whatever their origins are, the model is consider useful in order to structure and organize indicator in a logic manner (Tscherning et al., 2012), to provide useful information for decision makers (EEA, 1999), and to increase awareness, identify strategies, manage results, wide research fields and develop a series of interdisciplinary indicators (Breslow, 2015). The DPSIR has five clear elements that interrelate as a chain of events as can be seen in the figure 7.

Figure 7: Representation of the DPSIR model.



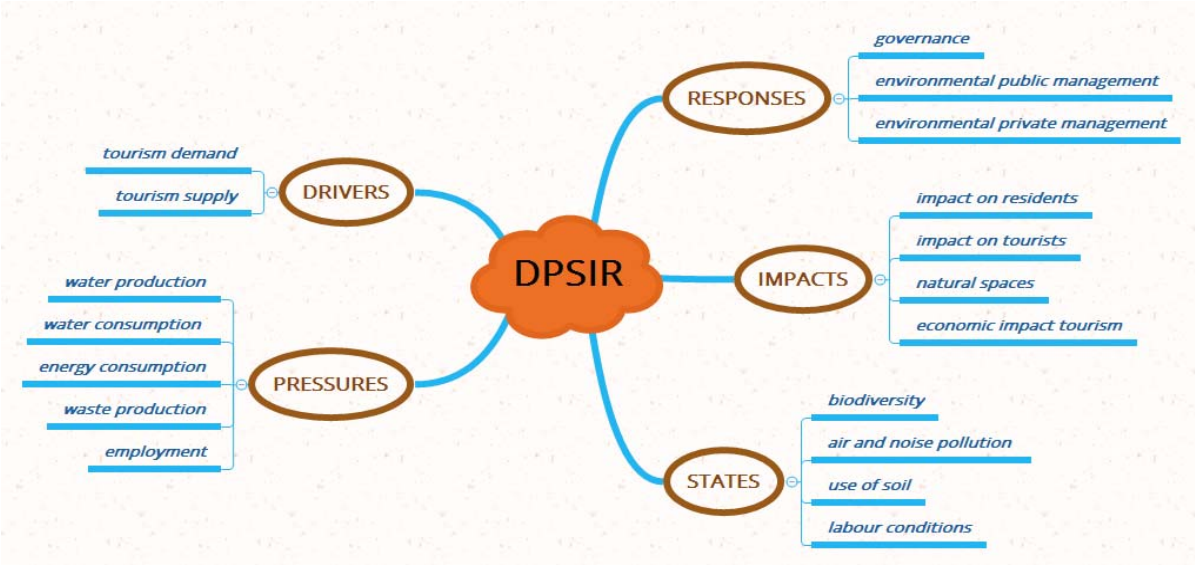
One of the problems that present the DPSIR model is the definition of each one of its components. A different field of application may change the role that a factor plays in the whole scheme and thus, this would not allow its universalization inside a single category. For example, the initial works of the EEA by Gabrielsen & Bosch, (2003) were too focused on the environmental field.

The risk of having the different components of the model in close compartments has been pointed out by Ness et al. (2010) who also criticizes its narrow utility, more attached to environmental issues. The unidirectional approach of the model and the hierarchical view of the human - environment relationship (Breslow, 2015) and the lack of measurement of the interrelation among factors (Skondras & Karavitis, 2015) other than the effects of the responses are other critics the model has to bear with.

Although it has been generally applied to evaluate and measure, and eventually, to provide a guide for environmental management (Gregory, Atkins, Burdon, & Elliott, 2013), there are recent examples of its application on the field of tourism sustainability. Fernández & Sanchez Rivero, (2009) provide an excellent example of the possibilities that this model gives for the tourism sustainability and Navarro Jurado et al., (2012) also used it when defining the carrying capacity of a destination.

Therefore, we consider that there are enough arguments to justify the use of the DPSIR in our model in order to, as mentioned above, build the dynamic part of it. Therefore, we have combined the defined dimensions into the different factors of the model and the result is organized as shown in figure 8.

Figure 8: Proposal for the DPSIR model.



Source: Authors' elaboration

We have included the demand and supply of tourism as the drivers in our case. Those are linked to pressures related fundamentally with the resources' exploitation and, in the social side, with the creation of employment associated to the touristic activities. All those factors influence in the state of the natural environment, meaning the biodiversity and the use of soil, and the labour conditions as a representative of the social sustainability also related with the economic sphere. We have opted for splitting that dimension into two since employment is referred mostly to the total number of persons and the labour conditions are linked with the job characteristics.

The results will be visible in the shape of impacts in all the spheres considered. To describe those changes we propose, in the social one, the residents and tourists' satisfaction and, environmentally, the variations related with the natural spaces since they may suffer some bad consequences of an inconvenient development of tourism activities (or benefiting from a correct one). Finally, the economic impact of tourism may reflect the impact of a variation on tourism activities.

To face that situations, the responses can come from both the private and the public side but those will be framed by the governance that have the power to push or discourage more sustainable actions depending on their strategy.

8. Conclusions

This paper has proposed the steps to build a statistical framework in order to measure the sustainability of the tourism activities. We have put in place the fundamentals of the model

and completed it with some factors adapted to the case study of Lanzarote. The resulting scheme is the starting point to be replicated in other destinations taking into account that diverse determinants and characteristics may result into changes to the dimensions considered and their weights.

The scheme needs to be completed with the results. In order to do that, one of the future lines of research should be to persevere in the development of the statistics at subnational level, which would provide the model with more accurate information. The second line is the extrapolation of the model into other destination with similar or different characteristics in order to check its robustness and consistency.

The scheme proposed is not an immutable model that should be transposed as a whole every destination, but we considered that it could provide a good guidance in order to fulfill the still incomplete task of measuring the sustainability of the tourism activities.

9. References

Aivazian, S. (2016). Synthetic indicators of quality of life: Construction and utilization for social-economic management and comparative analysis. *Austrian Journal of Statistics*, *34*(2), 69–77.

Álvarez-Uria Tejero, P., & Sabanes, M. (2015). *Estrategia Lanzarote 2020. Por un desarrollo sostenible* (p. 120). Lanzarote: Cabildo de Lanzarote. Retrieved from www.datosdelanzarote.com

Awang, Z., Afthanorhan, A., & Mamat, M. (2016). The Likert scale analysis using parametric based Structural Equation Modeling (SEM). *Computational Methods in Social Sciences*, *4*(1), 13.

Azzopardi, E., & Nash, R. (2013). A critical evaluation of importance–performance analysis. *Tourism Management*, *35*, 222–233.

Bell, S., & Morse, S. (2004). Experiences with sustainability indicators and stakeholder participation: a case study relating to a "Blue Plan"project in Malta. *Sustainable Development*, *12*(1), 1–14.

Bell, S., & Morse, S. (2008). *Sustainability indicators: measuring the immeasurable?* Earthscan.

Bidone, E., & Lacerda, L. (2004). The use of DPSIR framework to evaluate sustainability in coastal areas. Case study: Guanabara Bay basin, Rio de Janeiro, Brazil. *Regional Environmental Change*, *4*(1), 5–16.

Bojanic, D. C., & Lo, M. (2016). A comparison of the moderating effect of tourism reliance on the economic development for islands and other countries. *Tourism Management*, *53*, 207–214. http://doi.org/10.1016/j.tourman.2015.10.006

Breslow, S. J. (2015). Accounting for neoliberalism: "Social drivers" in environmental management. *Marine Policy*, *61*, 420–429. http://doi.org/10.1016/j.marpol.2014.11.018

Chu, R. K., & Choi, T. (2000). An importance-performance analysis of hotel selection factors in the Hong Kong hotel industry: a comparison of business and leisure travellers. *Tourism Management*, *21*(4), 363–377.

Dillard, J., Dujon, V., & King, M. C. (2008). *Understanding the social dimension of sustainability*. Routledge.

Dwyer, L. (2015). Triple Bottom Line reporting as a basis for sustainable tourism: opportunities and challenges. *Acta Turistica*, *27*(1), 33–62.

Dwyer, L., Cvelbar, L. K., Edwards, D., & Mihalic, T. (2012). Fashioning a destination tourism future: The case of Slovenia. *Tourism Management*, *33*(2), 305–316.

Dwyer, L., Dragićević, V., Armenski, T., Mihalič, T., & Knežević Cvelbar, L. (2014). Achieving destination competitiveness: an importance–performance analysis of Serbia. *Current Issues in Tourism*, 1–28.

EEA, E. (1999). Environmental indicators: Typology and Overview. *European Environmental*.

Elkington, J. (1997). Cannibals with forks. *The Triple Bottom Line of 21st Century*.

European Union. (2016). The European Tourism Indicator System ETIS toolkit for sustainable destination management. Eurodirect.

Fernández, J. I. P., & Sanchez Rivero, M. (2009). Measuring tourism sustainability: proposal for a composite index. *Tourism Economics*, *15*(2), 277–296.

Gabrielsen, P., & Bosch, P. (2003). Environmental indicators: typology and use in reporting. *EEA, Copenhagen*.

Gallego-Galan, I., & Moniche-Bermejo,, A. (2014). New utilities for Regional TSA information system: Sustainable Tourism Indicator System for Andalucía (pp. 1–15). Presented at the II International Seminar on Regional Tourism: Moving towards a Regional TSA approach, Venice.

Gari, S. R., Newton, A., & Icely, J. D. (2015). A review of the application and evolution of the DPSIR framework with an emphasis on coastal social-ecological systems. *Ocean & Coastal Management*, *103*, 63–77. http://doi.org/10.1016/j.ocecoaman.2014.11.013

Graymore, M. L., Sipe, N. G., & Rickson, R. E. (2008). Regional sustainability: How useful are current tools of sustainability assessment at the regional scale? *Ecological Economics*, *67*(3), 362–372.

Graymore, M. L., Sipe, N. G., & Rickson, R. E. (2010). Sustaining human carrying capacity: a tool for regional sustainability assessment. *Ecological Economics*, *69*(3), 459–468.

Green, H., Hunter, C., & Moore, B. (1990). Assessing the environmental impact of tourism development: Use of the Delphi technique. *Tourism Management*, *11*(2), 111–120.

Gregory, A. J., Atkins, J. P., Burdon, D., & Elliott, M. (2013). A problem structuring method for ecosystem-based management: The DPSIR modelling process. *European Journal of Operational*

Research, *227*(3), 558–569. http://doi.org/10.1016/j.ejor.2012.11.020

Harger, J., & Meyer, F.-M. (1996). Definition of indicators for environmentally sustainable development. *Chemosphere*, *33*(9), 1749–1775.

Harland, N., Dawkin, M., & Martin, D. (2015). Relative utility of a visual analogue scale vs a six-point Likert scale in the measurement of global subject outcome in patients with low back pain receiving physiotherapy. *Physiotherapy*, *101*(1), 50–54.

Heink, U., & Kowarik, I. (2010). What are indicators? On the definition of indicators in ecology and environmental planning. *Ecological Indicators*, *10*(3), 584–593.

Hughey, K. F., Cullen, R., Kerr, G. N., & Cook, A. J. (2004). Application of the pressure–state–response framework to perceptions reporting of the state of the New Zealand environment. *Journal of Environmental Management*, *70*(1), 85–93.

Iniesta-Bonillo, M. A., Sánchez-Fernández, R., & Jiménez-Castillo, D. (2016). Sustainability, value, and satisfaction: Model testing and cross-validation in tourist destinations. *Journal of Business Research*.

International Network on Regional Economics, Mobility and Tourism, & World Tourism Organization. (2012). A Closer Look at Tourism: Sub-national Measurement and Analysis - Towards a Set of UNWTO Guidelines. UNWTO, Madrid.

Lubiano, M. A., Salas, A., De la Rosa de Sáa, S., Montenegro, M., & Gil, M. Á. (2017). An Empirical Analysis of the Coherence Between Fuzzy Rating Scale- and Likert Scale-Based Responses to Questionnaires. In B. M. Ferraro, P. Giordani, B. Vantaggi, M. Gagolewski, M. Ángeles Gil, P. Grzegorzewski, & O. Hryniewicz (Eds.), *Soft Methods for Data Science* (pp. 329–337). Cham: Springer International Publishing. Retrieved from http://dx.doi.org/10.1007/978-3-319-42972-4_41

Miller, G. (2001). The development of indicators for sustainable tourism: results of a Delphi survey of tourism researchers. *Tourism Management*, *22*(4), 351–362.

Milne, M. J., & Gray, R. (2013). W (h) ither ecology? The triple bottom line, the global reporting initiative, and corporate sustainability reporting. *Journal of Business Ethics*, *118*(1), 13–29.

Mowforth, M., & Munt, I. (2015). *Tourism and sustainability: Development, globalisation and new tourism in the third world*. Routledge.

Munda, G. (2005). “Measuring sustainability”: a multi-criterion framework. *Environment, Development and Sustainability*, *7*(1), 117–134.

Navarro Jurado, E., Tejada Tejada, M., Almeida García, F., Cabello González, J., Cortés Macías, R., Delgado Peña, J., … Solís Becerra, F. (2012). Carrying capacity assessment for tourist destinations. Methodology for the creation of synthetic indicators applied in a coastal area. *Tourism Management*, *33*(6), 1337–1346. http://doi.org/10.1016/j.tourman.2011.12.017

Ness, B., Anderberg, S., & Olsson, L. (2010). Structuring problems in sustainability science: The multi-level DPSIR framework. *Geoforum*, *41*(3), 479–488.

http://doi.org/10.1016/j.geoforum.2009.12.005

OECD. (2003). OECD Environmental indicators: development, measurement and use. OECD, Paris.

OECD. (2008). Handbook on constructing composite indicators: methodology and user guide. OECD.

Oh, H. (2001). Revisiting importance–performance analysis. *Tourism Management*, *22*(6), 617–627.

Peral, F. J. B., Lozano, M. G., Casas, F. M. G., & Oyola, M. L. (2010). Indicadores sintéticos de turismo sostenible: una aplicación para los destinos turísticos de Andalucía. *Rect@: Revista Electrónica de Comunicaciones Y Trabajos de ASEPUMA*, (11), 85–118.

Ramos, T. B. (2009). Development of regional sustainability indicators and the role of academia in this process: the Portuguese practice. *Journal of Cleaner Production*, *17*(12), 1101–1115.

Seghezzo, L. (2009). The five dimensions of sustainability. *Environmental Politics*, *18*(4), 539–556.

Shnayder, L., Van Rijnsoever, F. J., & Hekkert, M. P. (2015). Putting your money where your mouth is: why sustainability reporting based on the triple bottom line can be misleading. *PloS One*, *10*(3), e0119036.

Skondras, N., & Karavitis, C. (2015). Evaluation and comparison of DPSIR framework and the combined SWOT-DPSIR analysis (CSDA) approach: towards embracing complexity. *Global Nest Journal*, *17*(1), 198–209.

Sörensson, A., & von Friedrichs, Y. (2013). An importance–performance analysis of sustainable tourism: A comparison between international and national tourists. *Journal of Destination Marketing & Management*, *2*(1), 14–21.

Tscherning, K., Helming, K., Krippner, B., Sieber, S., & Paloma, S. G. y. (2012). Does research applying the DPSIR framework support decision making? *Land Use Policy*, *29*(1), 102–110. http://doi.org/10.1016/j.landusepol.2011.05.009

United Nations. (1992). United Nations Conference on Environment & Development, Rio de Janerio, Brazil, 3 to 14 June 1992. United Nations. Retrieved from https://sustainabledevelopment.un.org/content/documents/Agenda21.pdf

United Nations, European Union, Food and Agriculture Organization of the United Nations, Organisation for Economic Co-operation and Development, & World Bank Group. (2014). System of Environmental-Economic Accounting 2012: Experimental Ecosystem Accounting. United Nation.

UNWTO. (1995). Charter for Sustainable Tourism. UNWTO. Retrieved from http://www.e-unwto.org/doi/pdf/10.18111/unwtodeclarations.1995.21.13.1

Voutilainen, A., Pitkääho, T., Kvist, T., & Vehviläinen-Julkunen, K. (2015). How to ask about

patient satisfaction? The visual analogue scale is less vulnerable to confounding factors and ceiling effect than a symmetric Likert scale. *Journal of Advanced Nursing*.

WCED. (1987). *Report of the World Commission on Environment and Development: Our Common Future* (p. 300). WCED. Retrieved from http://www.un-documents.net/our-common-future.pdf

Wise, N. (2016). Outlining triple bottom line contexts in urban tourism regeneration. *Cities*, *53*, 30–34.

Xu, S., Barbieri, C., Anderson, D., Leung, Y.-F., & Rozier-Rich, S. (2016). Residents' perceptions of wine tourism development. *Tourism Management*, *55*, 276–286.

Zhang, X., Ma, C., Zhan, S., & Chen, W. (2012). Evaluation and simulation for ecological risk based on emergy analysis and Pressure-State-Response Model in a coastal city, China. *Procedia Environmental Sciences*, *13*, 221–231.

Ziegler, J., Dearden, P., & Rollins, R. (2012). But are tourists satisfied? Importance-performance analysis of the whale shark tourism industry on Isla Holbox, Mexico. *Tourism Management*, *33*(3), 692–701.