Smart tourism destinations really make sustainable cities: Benidorm as a case study

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Abstract

Purpose – *Tourism sustainability is a challenge for 21st-century destinations – this paper aims to analyse smart destinations' sustainability through a case study of Benidorm, the first world destination to be certified under the UNE 178501 standard as smart tourism destination (STD).*

Design/methodology/approach – *The methodological component has been divided into developing a framework for measuring sustainability through economic, social and environmental open data. Moreover, studying the plan's contribution "Benidorm, Destino Turístico Inteligente y Sostenible" to the city's sustainability through a time series analysis.*

Findings – *The main contribution shows that Benidorm's transformation into an STD leads to more sustainable cities. Thus, the conversion of Benidorm into an STD has a sustained effect in the medium and long term, contributing to the sustainability of the city.*

Research limitations/implications – *An open question as a limitation is the subjectivity of the distribution of the relative weight of each indicator. However, statistical analyses are developed to explore the relationship between indicators and global sustainability.*

Practical implications – *The debate to contextualise this paper is bridging the gap between sustainability and tourism intelligence, giving an original framework for measuring destination sustainability that provides a reasonable starting point for comparing tourism sustainability in different destinations.*

Social implications – *Tourists in the 21st century prefer environmentally friendly tourism. Marketing campaigns based on destination sustainability must be based on data rather than mere slogans.*

Originality/value – *To the best of the authors' knowledge, the originality of this paper provides a flexible framework for measuring sustainability from open data sources, being one of the first empirical analyses to study the effects on the sustainability of converting a mature destination into an STD.*

Keywords *Smart destinations, Tourism marketing, Benidorm, Sustainability data science, Time-series analysis, Urban sustainability science, Smart tourism destinations*

Paper type *Case study*

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1. Introduction

Globally, tourism is critical for achieving the much-needed economic recovery in the post-COVID-19 era. However, many of the industry's challenges before the Pandemic demand shock are still pending, especially when it comes to a necessary paradigm shift towards a new tourism model based on smart and sustainable growth. Among the lessons to be learned from the health and economic crisis, the success of a tourism model is not only measured by the number of tourists it receives annually. However, offering quality tourism capable of reducing the environmental impact of these activities on the territory, maximising the economic and socio-cultural implications, improving the experiences of tourists and visitors and the standard of living of citizens.

To achieve these objectives, the concept of the smart tourism destination (STD) has emerged strongly in recent years, linked to the development of smart cities (Boes, Buhalis, & Inversini, 2015; Buhalis & Amaranggana, 2015; Gretzel, Sigala, Xiang, & Koo, 2015; Ivars-Baidal, Celdrán Bernabéu, & Femenia-Serra, 2017), although the main goal is the intensive use of technology to enhance the travel experience, in addition to increasing the quality of the services provided by destinations. Technology alone does not make a destination smart. A profound modernisation process is needed at all levels, starting with the city's tourism intelligence strategy, which should lead to a new destination model that is more innovative, accessible and sustainable in its three aspects (economic, socio-cultural and environmental).

This paper's aim is not to list the bibliographical sources on these concepts again, as this work has been done satisfactorily by recognised authors before. Instead, the contribution comes from a more critical point of view, focusing on the gaps in the practical implications (Perles Ribes & Ivars-Baidal, 2018; Coca-Stefaniak, 2020; Coca-Stefaniak & Seisdedos, 2020; Day, Morrison, & Coca-Stefaniak, 2021; Femenia-Serra & Ivars-Baidal, 2021; Marinello, Butturi, Gamberini, & Martini, 2021). Recognising, therefore, that the term STD is an ambitious concept, with significant development opportunities but which has not yet achieved some of its fundamental objectives, the most prominent of which is the sustainability of tourist destinations.

Thus, many international tourist destinations have started to work towards this goal, including Benidorm, the subject of the case study. Benidorm is a Spanish municipality in the province of Alicante, in the Valencian Community. It is located on the shores of the Mediterranean Sea, in the Marina Baja region and is the most densely populated municipality with a population density of 1792 inhabitants/km^2 (Figure 1).

In 1956, the Town Council approved the town planning to create a town conceived for leisure, based on wide avenues following the configuration of the beaches, an urban planning model related to the pioneering tourism at the time. From that moment on, there was a decisive shift from traditional activities (fishing and agriculture) towards the tertiary sector, led by tourism, which has become the basis of the town's prosperity since then and to this day. Benidorm is an eminently touristic city thanks to its climate and average temperatures, which oscillate all year round between 10˚C in winter and 26˚C in summer. Benidorm has undergone an extraordinary urban transformation since the middle of the 20th century. Known as the "New York of the Mediterranean", Benidorm is the city with the most skyscrapers in Spain or the city with the most skyscrapers per inhabitant in the world. It is one of the most important and well-known tourist destinations in Spain and the whole of

Figure 1 Benidorm's evolution

Source: Prepared by the authors using CANVA

the Mediterranean thanks to its beaches and leisure activities, reaching a population of 400,000 in summer. It is not in vain that Benidorm is the third city with the most hotel beds in Spain after Madrid and Barcelona.

The instrument used by Benidorm to become a STD is called the Plan "Benidorm, Destino Turístico Inteligente y Sostenible" and has been carried out during the years 2015–2020. This Plan has meant a significant effort with a budget of €4,023,058.74, contributed 60% by Red.es and 40% by Benidorm Town Council, co-financed by the European Development Fund (ERDF) through the Spanish Multi-regional Operational Programme (POPE). This call is part of the National Plan for Smart Territories in Spain, giving continuity to the previous National Plan for Smart Cities.

The general objective of this Plan has been to consolidate the transformation of Benidorm as a tourist destination into a STD. Taking advantage of innovation and technology to turn the city into a territory accessible to all and guaranteeing a sustainable tourism model.

Among the actions carried out by Benidorm to become certified as STD:

- to increase the interoperability of the different administrations and agents in Benidorm, promote transparent and universal access to the public data of the services (both for consultation and reuse) by citizens, visitors, professionals and companies, encouraging business growth and entrepreneurship with these actions;
- create a centre for the control, analysis and validation of tourism data and information that will enable the STD's management body to have them at its disposal for the comprehensive management of the STD;
- increase energy efficiency, mainly associated with tourism activity, reducing its carbon footprint;
- promote the participation of citizens, tourists and visitors to obtain metrics and behavioural patterns that allow measuring the degree of satisfaction-optimising the provision of public services; and
- contribute to the development, maturation and testing of standards related to STD and facilitate the reuse or replication of the proposed actions in other entities or cities, based on and supported by standards.

As a result, Benidorm's new tourism model, seeking the most significant benefit for tourists, inhabitants and businesses, is based on smart and sustainable growth. Currently, Benidorm continues to work to remain a pioneering city in the fields of intelligence and sustainability, with the implementation of the Smart Destination Living Lab, to measure all the impacts of the axes of the STD related to the 17 SDGs aligned with the 2030 Agenda, being also the first tourist destination to implement a unit of these characteristics.

There is a broad theoretical consensus that sustainability is fundamental in managing tourist destinations as a real challenge in the current management of tourist destinations in the 21st century. Although, there is a preliminary step to managing the sustainability of tourism destinations, which is its measurement. In this regard, more than 100 articles in the current literature focus on indicators related to sustainable tourism. Forty-three papers contain case studies on tourism indicators, 38 specifically on the European Tourism Indicator System for Sustainability (ETIS) (Font *et al.*, 2021) or the proposal of sustainability indicators for tourism destinations of the UNWTO (World Tourism Organisation UNWTO 2005). As for the most widely used, the ETIS is a system of indicators suitable for all tourism destinations, which encourages them to adopt a smarter approach to tourism planning, functioning as a management tool, which supports the management of tourism destinations, characterised by being:

- a management tool that supports destinations that want to adopt a sustainable approach to their management;
- a monitoring system, easy to use to collect detailed data and information and allowing destinations to track their performance from year to year; and
- a helpful reporting tool for policymakers, tourism businesses and other stakeholders.

Although this is a crucial standardisation exercise, these tools are poorly implemented due, on the one hand, to the scarcity of available information and, on the other hand, to the lack of adaptation of existing indicators to current information needs (Tudorache, Simon, Frenţ, & Musteaţă-Pavel, 2017; Gasparini & Mariotti, 2021). Thus, among the specific articles on ETIS, more than 17% of the papers openly identified challenges related to the difficulty of implementing ETIS. They identified the difficulty of involving stakeholders to provide data, the lack of availability or reliability of data, the cost or the lack of applicability of some indicators. Therefore, the lack of real progress and accelerated technological change is forcing policymakers to rethink these indicator systems, changing them for more flexible systems adapted to the information available for each specific case (Ivars-Baidal, Vera-Rebollo, Perles-Ribes, Femenia-Serra, & Celdrán-Bernabeu, 2021).

However, sustainability is an inseparable part of the smart destination concept, at least from a theoretical point of view. From the literature reviewed, it can be stated that there is currently no accepted standard for measuring the sustainability of tourism destinations (Önder, Wöber, & Zekan, 2017). It can also be stated that the available information is heterogeneous, inaccessible and, mainly, outdated, according to our analysis. This situation contrasts, in principle, both with the precepts of smart destination development and with the results of related work, where sustainability is identified as one of the critical areas for the application of analytical techniques based on data science technologies for STD (Montero & López-Sánchez, 2021).

As suggested by (Butler, 1999), "without measures or indicators of tourism development, the use of the term sustainable is meaningless and becomes advertising jargón." Far from responsible management, even more, talking about the public function of tourism marketing, that must be socially responsible. For this reason, this work attempts to close the existing gap in the relationship between sustainability and intelligence, which is evident both in research and in the management of tourist destinations (Perles Ribes & Ivars-Baidal, 2018, Femenia and Ivars-Baidal *et al.*, 2021; Marinello, Butturi, Gamberini, & Martini, 2021).

In this context, this paper analyses the contribution of STD to the sustainability of cities through the Benidorms case study. It proposes the measurement of the global sustainability of tourist destinations based on a common core of economic, social and environmental indicators, using open data sources. Those common indicators could be complemented with specific indicators based on the information needs of each destination. The basic idea is to offer added value, precisely in the weakest points identified in previous works, which are the lack of access to information and its continuity and promote standard indicators to favour a framework for comparative analysis. In this way, progress would be made in both objectives, which are not necessarily antagonistic: to obtain a comparative framework between tourist destinations and, on the other hand, to provide valuable information according to the specific needs of each particular destination.

Based on this preamble, the following research questions are posed:

Q1. Has the transformation of Benidorm into a Smart Tourist Destination contributed to making a more sustainable city?

Q2. Could the evolution of Benidorm's tourism sustainability from existing sustainability indicators be estimated?

Q3. Could it qualify the implementation of the Plan "Benidorm, Destino Turístico Inteligente y Sostenible" as a successful public management action in terms of tourism sustainability?

Based on these questions, the following general objective (GO) is established:

GO1. To determine whether the transformation of Benidorm into a Smart Tourist Destination has led to greater sustainability of the city.

To achieve this generic objective, it has been established the following specific objectives (SO):

- SO1. To obtain the current Benidorm's tourism sustainability indicators;
- SO2. Develop a model for estimating Benidorm's tourism sustainability based on the indicators obtained; and
- SO3. To analyse the effect of the Strategic Plan "Benidorm, Destino Turístico Inteligente y Sostenible" on the city's overall sustainability.

To conclude this part, in the following sections of this work, the methodology used to achieve the research objectives in Section 2; the main results and conclusions obtained in Sections 3 and 4, respectively; and finally, the discussion and limitations in Section 5 are presented.

2. Material and methods

Regarding the research methodology used, firstly, two phases have been established. The first is related to identifying indicators and estimating the tourism sustainability of Benidorm. The second phase consists of conducting a statistical analysis of time series (ITSA), through which it will be studying the contribution of the Strategic Plan "Benidorm, Destino Turístico Inteligente y Sostenible" to the global sustainability of the city. The most important methodological aspects of each phase are presented below.

2.1 Measuring sustainability through open data sources

Providing a flexible framework, our methodological proposal, far from trying to find the "ideal indicators" for measuring the sustainability of a tourist destination, is based on the available indicators, which also maintain a periodicity of publication. There are 17 sustainability indicators for which there are public and updated data. In the following, they are classified in Table 1 according to the type of sustainability.

As shown in the table above, the source on which the analysis has been based in the open data publication "Benidorm en Cifras", a biannual publication of Benidorm Town Council. Furthermore, the "Instituto Nacional de Estadística" (INE), attached to the Ministry of Economic and Digital Transformation of the Government of Spain. The first source has obtained data on indicators related to environmental sustainability, while the second, data mainly on economic and social indicators. They are classified into the three global sustainability categories: economic, social and environmental sustainability. Regarding economics, has been chosen the indicators of overnight stays by type of establishment, including the total number of overnight stays. Also, it included the average percentage of occupancy by type of establishment. Moreover, the RevPAR as an indicator of hotel profitability, one of the most widely used when analysing the economic performance of tourism activity. Related to social sustainability, have been selected the resident population and total tourist number per year, because social sustainability depends on the balance between both, avoiding situations of social stress caused, for example, by the recent phenomenon of over-tourism. Tourism employment is considered a fundamental element of

Table 1 Global sustainability indicators

Economic sustainability	*Unid*	*Source*
Hotels overnights	Annual number	www.ine.es/
Apartaments overnights	Annual number	www.ine.es/
Campings overnights	Annual number	www.ine.es/
Overnights totals	Annual number	www.ine.es/
Average hotels	%	www.ine.es/
Average apartaments	%	www.ine.es/
Average campings	%	www.ine.es/
Hotels RevPAR	%	www.ine.es/
Social sustainability		
Citizens	Annual number	www.ine.es/
Tourists	Annual number	www.ine.es/
Tourists Number 100 Inhabitants	Annual number	www.ine.es/
Hotel Rooms 100 Inhabitants	Annual number	www.ine.es/
Percentage Hotel Rooms100 Inhabitants	%	www.ine.es/
Average Employee	Annual number	www.ine.es/
Environmental sustainability		
Water Waste	m3 annually	https://benidorm.org/es/
Solid Waste	tom annually	https://benidorm.org/es/
Electric Waste	kwh annually	https://benidorm.org/es/

Source: Prepared by the authors

social balance as well. Finally, in the table, the environmental indicators comprise the three significant resource consumption generated by tourism, water, electricity and solid waste.

However, the relative weights of the indicators and the subsequent ranking differ significantly between studies (Mikulić, Kožić, & Krešić, 2015). This work proposes an interrelation between the different indicators and types of sustainability, distributing the scores among the available 17 indicators, depending on their relative weight, based on the opinion of an experts' group, complementing this task with statistical analyses such as Correlation, V Cramer and CPA. To subsequently carry out a regression model complementary to the proposed global sustainability estimation model.

2.2 Analising public policy plan "Benidorm, destino turÚstico inteligente y sostenible" through interrupted time series analysis

SEGITTUR, depending on the Secretary of State, Spanish Ministry of Tourism, is the body responsible for implementing the STD methodology. Based on the analysis of tourist destinations concerning five strategic axes: governance, innovation, technology, sustainability and accessibility. The aim is to promote a global vision of the territory, including all areas that influence and participate in its tourism development. An STD is «an innovative tourist destination, built on an infrastructure of state-of-the-art technology guaranteeing the sustainable development of the tourist area, accessible to everyone, which facilitates the visitors' interaction with and integration into their surroundings, increases the quality of the experience at the destination, while also improving the quality of life of its residents» (Segittur, 2015)

The methodological process is divided into two phases, the first of diagnosis and planning, through the review of 96 requirements and 262 indicators, to know the starting point, subsequently designing the action plan that integrates the destination's strategy for getting the following goals:

- to be an innovative destination;
- to have an advanced technological infrastructure;

- to guarantee sustainable development in the tourist territory; and
- to be an accessible destination.

The implementation of this plan will entail a diagnostic report that can be extended to the destination's tourism area and those other managing areas responsible for the public services that directly or indirectly enable tourism activity in any tourist destination. Only those destinations that obtain a score of 80% or more in the degree of compliance with the requirements set out in the STD methodology are recognised with the STD label.

For the case study, the instrument used by the city of Benidorm to become a STD is called the Plan "Benidorm, Destino Turístico Inteligente y Sostenible", which has been carried out over the years 2015–2020. Once identified the available indicators about the Benidorm global sustainability for the decade (2009–2019), it has been performed an interrupted time series statistical analysis (ITSA), which addresses the main objective of our research to find out whether Benidorm's development as a smart destination has contributed positively to the tourist sustainability of the city.

The development of the ITSA allows us to understand whether, after the intervention to turn Benidorm into a smart destination, one of these scenarios will be triggered:

- It has no effect on the sustainability of the city.
- It has only an immediate effect.
- It has a sustained, medium to long-term effect.
- It has both an immediate and sustained effect on the sustainability of Benidorm.

To reach these conclusions, starting from the analysis of the following model:

$$Y = b0 + b1 * YEARS + b2 * DTI + b3 * TIME \quad SINCE + e$$

Table 2 shows the variables included in the model:

As shown in the table above, SUSTAINABILITY (Y) will be the dependent variable of the proposed analysis model. While the explanatory variables will be, on the other hand, the time horizon or period under study (YEARS), the year from which the intervention or implementation of the analysed public policy takes place (DTI) and a variable that weighs the number of years since Benidorm started the process through which it has become a STD (TIME SINCE). As for the programming component of the model, the editor used for the execution of the code in the RStudio console as an integrated development environment (IDE) for the R programming language. The ITSA analysis technique is especially recommended for those cases in which the result of an intervention or implementation of a specific public policy is analysed. For our case study, the development of Benidorm as a STD, a process that began in 2014. It is essential to bear in mind that the data must include observations before and after the public intervention for the correct functioning of the model, which has been discussed in detail in the preceding table.

Table 2 ITSA Benidorm sustainability model (2009–2019)

Variables	*Meaning*	*Description*
Y	Sustainability	Index (from 54 to 10,850)
YEARS	Time	Time (from 2009 to 2019)
DTI	Policy STDs	Post (=1) and pre (=0) intervention
TIME SINCE	Time passed since 2014	Time passed since the intervention

Source: Prepared by the authors using R Programing

Once the methodological component has been explained, the main results are described in the next section through the fourth point, first the statistical analysis of the fundamental sustainability indicators, the second to estimate Benidorm's tourism sustainability, with the third, the statistical components of the Benidorm's tourism sustainability estimation model, finally the analysis of the contribution of Benidorm's development as an STD to the city's tourism sustainability.

3. Results

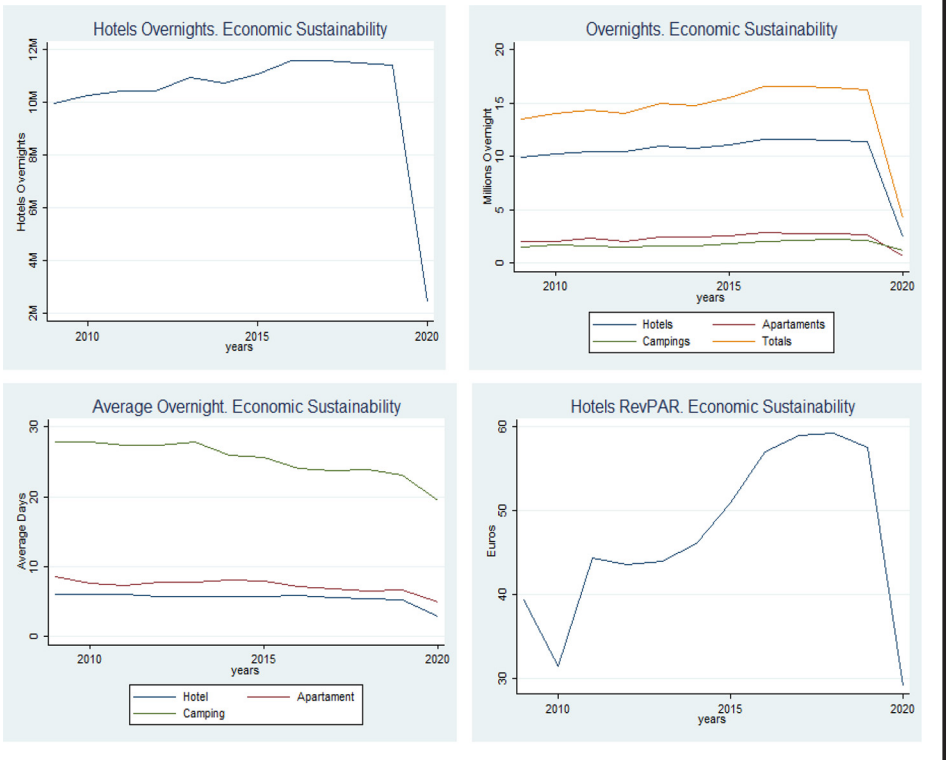
3.1 Basic analysis of sustainability indicators

This first statistical analysis by indicator typology (economic, social and environmental) is a first approximation of the performance of each indicator by analysing their evolution over time. The available open data indicators will be classified according to the contribution to the tourism sustainability of the city. In other words, we have economic, social and environmental indicators.

Below, in Figure 2, identify the temporal evolution of the economic indicators available to analyse Benidorm's tourism sustainability.

As shown in Figure 2, hotel overnight stays are much higher than any other indicator related to accommodation, flats or campsites, with an average during the period studied of 10,830,345 overnight stays. This indicator grew steadily from 2009 to 2016. There was a relative slowdown from this year onwards, with an annual decrease until the present day. On the other hand, RevPAR has been growing steadily since 2011, when the international

Figure 2 Economic indicators



Source: Prepared by the authors using stata

economy recovered after the financial 2008 crisis. This indicator reached a minimum in 2010, and it began a growth path that continued until the demand shock in 2020 because of the health crisis caused by COVID-19.

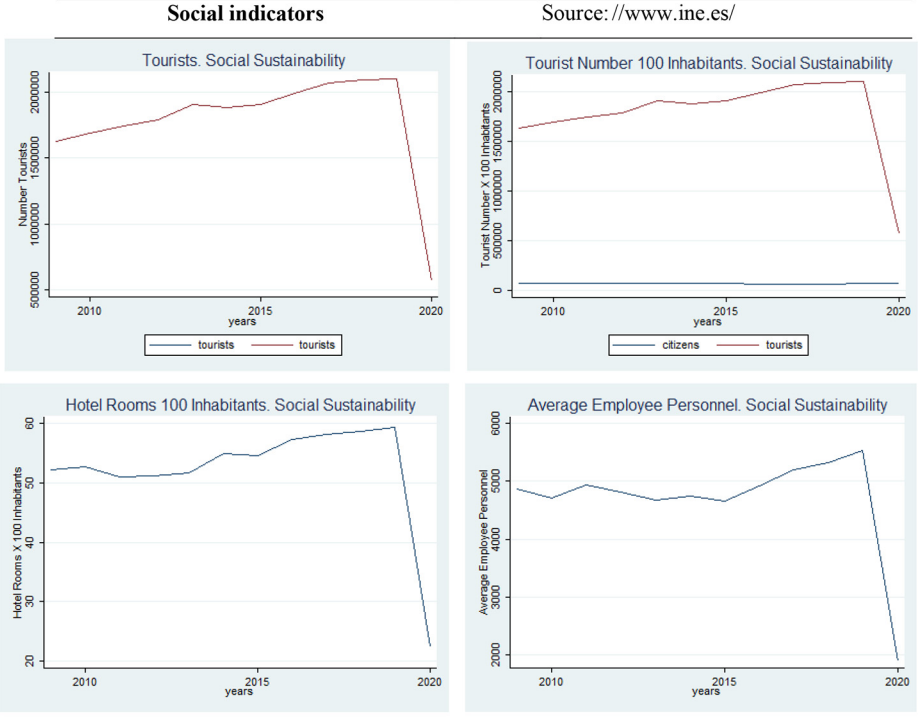
As shown in Figure 3, identify the temporal evolution of the social indicators available to analyse Benidorm's tourism sustainability.

The figure above shows that the number of tourists and tourists per 100 inhabitants have maintained a positive growth path from 2009 until the demand shock resulting from COVID-19. While the number of inhabitants has not fluctuated dramatically over the past years, maintaining a slightly increasing path. This situation means that Benidorm is the Spanish city with the most significant tourist pressure because of its inhabitants. For this reason, it is essential to analyse the evolution of social indicators, which are closely related to the social balance. On the other hand, the tourism employment indicator maintained a positive growth path until the limitations because of the massive lockdowns decreed by most countries at the international level.

Below, in Figure 4, identify the temporal evolution of the environmental indicators available to analyse Benidorm's tourism sustainability.

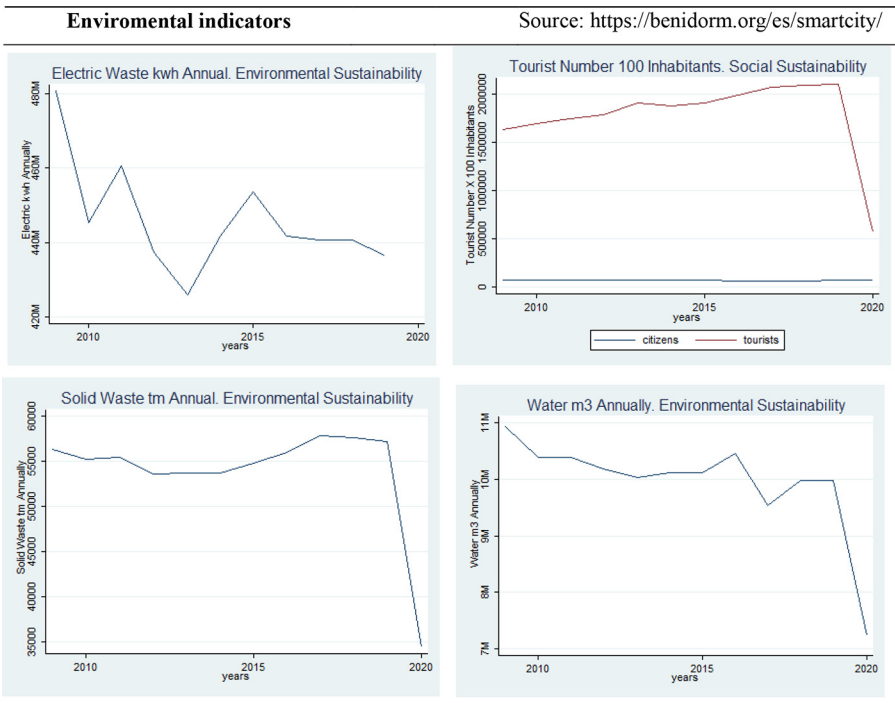
The figure above shows the environmental sustainability indicators, electricity and water consumption, have followed a downward trend throughout the decade studied (2009–2019). In contrast, the solid waste generation indicator has followed a positive growth path, more limited from 2018 onwards. That could be a consumption behaviour, extensible to most cities in Spain. However, it has an exceptional singularity for the case study of Benidorm as a result of the high tourist pressure. Although the number of

Figure 3 Social indicators



Source: Prepared by the authors using stata

Figure 4 Environmental indicators



Source: Prepared by the authors using stata

tourists has continued to grow during this decade, electricity consumption has been downward. That means electricity consumption related to tourism has not generated such a significant increase in aggregate electricity consumption data to reverse the public policies of responsible consumption implemented by Benidorm Town Council in recent years. For example, plans to rationalise light and energy-saving LED luminaires for public lighting. Scepecifily, the "Plan Municipal de Eficiencia Energética", which Benidorm City Council has managed to reduce electricity costs by almost 52%, thanks to the implementation of lighting with 'LED' technology and the energy-saving policies implemented in recent years, reducing the electricity bill from three million euros at 2011, to one million and haft approximately at 2021. It is reducing 2.3 million kilowatts between 2012 and 2021.

3.2 Estimating the sustainability of tourism in benidorm

Currently, there is neither a generally accepted definition of sustainable tourism nor a widely used method for its measurement. Despite standardisation efforts and a reasonably up-to-date regulatory framework on sustainable tourism, based on the United Nations resolution of 21 December, 2020, on promoting sustainable tourism, including ecotourism, for poverty eradication and environmental protection (UNGA, 2020), as well as the approval of the European Sustainable Tourism Strategy of 25 March, 2021.

There is, therefore, an evident lack of precision in both the conceptualisation and the practical application component of this concept, which has often been relegated to mere rhetorical use (Hughes, Weaver, & Pforr, 2015). Therefore, in this article, we want to bridge the gap between sustainability and its measurement.

From the 17 sustainability indicators, it has been constructed Figure 5, the data set containing the historical data series of these indicators for the period (2009–2019). Having explained the methodological component in the previous sections, estimating Benidorm's tourism sustainability for the period under study (2009–2019), as shown in Figure 5.

The table above presents Benidorm's tourism sustainability estimation model. The indicators are ordered by economic, social and environmental sustainability. According to the methodology described, indicators score distribution is based on its relative contribution of them to global sustainability, established by a group of experts. As shown, the indicators with the most significant impact are the environment, water and electricity consumption and solid waste generation. While with a middleweight, tourism employment ranks second and finds economic indicators as total overnight stays or the RevPAR.

These are followed by social indicators such as tourists and citizens. The method weight the contribution of each indicator by distributing a maximum score of 17 points for each of the 17 available indicators, being the sustainability the dependent variable of the model, establishing three additional requirements:

- The indicator in question must perform better than the previous year.
- The indicator must also perform better than its average for the entire study period. If these two requirements are met, an indicator will receive the maximum score set by the experts; otherwise, it will receive half the score.
- The mean statistic value has been applied in the first and last years of the series, 2009 and 2020.

Benidorm's tourism sustainability estimation model shows that sustainability has developed positively with an upward trend until 2019. In 2020, there is a drastic contraction of the economic and social sustainability indicators because of the demand shock caused by the COVID-19 crisis.

This work has been complemented with a series of statistical analyses to identify the existing relationships between the different indicators and the potential for linking them

Figure 5 Estimating Benidorm's tourism sustainability through open data indicators

Years	Hotels_overni	Apartament	Campings_o	Overnights_to	Avera	Avera	Averag	Hotels	Citizens	Tourists	Tourists_n	Hotel_roo	Percenta	Average_	Water_waste	Solid_waste_	Electric_waste	Sustainability
2009	9952784,00	2008200,00	1512489,00	13473473,00	6,10	8,52	27,81	39,40	71034,00	1628480,00	2292,54	37061,00	52,17	4869,00	10929819,00	56338,00	480741982,00	88,10
2010	10246433,00	2053553,00	1685738,00	13985724,00	6,10	7,66	27,80	31,40	71198,00	1691456,00	2375,71	37487,00	52,65	4718,00	10385870,00	55225,00	445224030,00	86,50
2011	10433699,00	2316049,00	1623523,00	14373271,00	6,00	7,31	27,37	44,40	72062,00	1748563,00	2426,47	36710,00	50,94	4945,00	10381728,00	55496,00	460588633,00	65,00
2012	10418344,00	2083412,00	1564344,00	14066100,00	5,82	7,82	27,26	43,60	72991,00	1788946,00	2450,91	37369,00	51,20	4819,00	10183717,00	53651,00	437377080,00	75,50
2013	10933561,00	2422809,00	1584187,00	14940557,00	5,74	7,75	27,76	43,90	73768,00	1907146,00	2585,33	38092,00	51,64	4683,00	10022550,00	53668,00	425989615,00	96,00
2014	10727129,00	2437816,00	1586027,00	14750972,00	5,71	8,11	25,86	46,00	69010,00	1882029,00	2727,18	37920,00	54,95	4749,00	10107892,00	53691,00	441746207,00	54,00
2015	**11064330,00**	**2599203,00**	**1844750,00**	**15508283,00**	**5,80**	**8,02**	**25,65**	**51,00**	**69045,00**	**1908489,00**	**2764,12**	**37657,00**	**54,54**	**4664,00**	**10110257,00**	**54830,00**	**453599202,00**	**89,50**
2016	11597878,00	2862889,00	2089062,00	16549829,00	5,84	7,14	24,05	57,00	66642,00	1993415,00	2991,23	38199,00	57,32	4919,00	10459810,00	55964,00	441648968,00	103,00
2017	11585630,00	2827130,00	2118340,00	16531100,00	5,60	6,81	23,78	59,00	66831,00	2073180,00	3102,12	38910,00	58,22	5203,00	9533980,00	57809,00	440703892,00	108,50
2018	11503040,00	2747861,00	2235149,00	16486050,00	5,50	6,55	23,94	59,18	67558,00	2094153,00	3099,79	39595,00	58,61	5314,00	9986516,00	57659,00	440752316,00	96,50
2019	11416723,00	2692265,00	2140116,00	16249104,00	5,32	6,64	23,14	57,48	68721,00	2101420,00	3057,90	40753,00	59,30	5534,00	9980490,00	57138,00	436450864,00	106,50
Averages	10898141,00	2459198,82	1816702,27	15174042,09	5,78	7,48	25,86	48,40	69896,36	1892479,73	2715,75	38159,36	54,69	4947,00	10189329,91	55588,09	445892980,82	88,10
Score	**12**	**4**	**3**	**13**	**9**	**2**	**1**	**10**	**8**	**11**	**7**	**6**	**5**	**16**	**17**	**14**	**15**	**Score**
	6	2	1,5	6,5	9	1	0,5		8	5,5	3,5	3	2,5		8,5	14	15	86,50
	6	2		6,5	4,5		0,5	5	8	5,5	3,5			8	8,5	7		65,00
					4,5	2	0,5		8	5,5	3,5	3	2,5		17	14	15	75,50
	12	2	1,5	6,5		1	1	5	8	11	3,5	3	2,5		17	7	15	96,00
		2	1,5			2	0,5	5			7		5	8	8,5	7	7,5	54,00
	12	4	3	13	9	1		10	4	11	7				8,5	7		89,50
	12	4	3	13	9			10		11	7	6	5	8			15	103,00
	6	2	3	6,5				10	4	11	7	6	5	16	17		15	108,50
	6	2	3	6,5			0,5	10	4	11	3,5	6	5	16	8,5	7	7,5	96,50
	6	2	1,5	6,5		1		5	4	11	3,5	6	5	16	17	7	15	106,50

Source: Prepared by the authors using excel

concerning global sustainability, with a regression model complementary to the estimation model implemented.

3.3 Statistical support for the Benidorm global sustainability estimation model

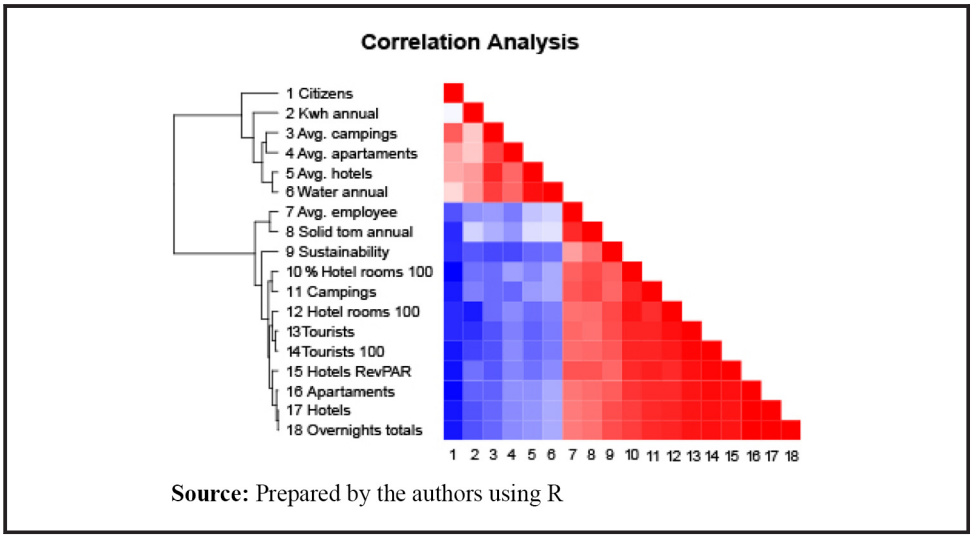
Once applied Benidorm's tourism sustainability estimation model, understanding the concept in its most global meaning: economic, social and environmental, based on the availability of data and taking into account the distribution of the score for each indicator attributed by the group of experts. A complementary study of the statistical significance of the results has been developed.

Firstly, with an approximation to the relationship between the different indicators by analysing correlations and the V Cramer analysis, which explains the degree of association between the explanatory variables and the variable of interest in the model of global sustainability. (Figure 6)

The previous figure shows the covariance analysis results, which indicate the degree of joint variation of two or more variables concerning their means. There is a high relationship between the different indicators related to overnight stays regardless of business activity (Hotels, Apartments or Campsites). The RevPAR indicator is a metric that provides an idea of the number of rooms rented in a hotel and the revenue generated from these bookings. This indicator has a high relationship with overnight stays in general, especially with campsites 0.90 and flats 0.86 as competitive activities. An increased association between this and hotel overnight is observed concerning tourist employment, significantly 0.97, contributing considerably to tourist employment. Also, there is a strong relationship between the number of tourists and environmental sustainability indicators, mainly solid waste and water consumption. Therefore, hotel overnight stays are highly associated with solid waste generation 0.97 and water consumption 0.85. The indicator with the best performance is overnight stays in campsites, with lower relative consumption in both water and solid waste generation

About the V Cramer analysis, the RevPAR hotel profitability index and overnight stays in campsites, both with an index of 0.6, are strongly associated with sustainability, followed by annual kilowatts of electricity consumption and solid waste generated annually.

Figure 6 Indicators Correlation Analysis



Source: Prepared by the authors using R

Likewise, the previous analyses is completed with a principal component analysis (PCA), which allows us to "condense" the information provided by the multiple indicators used to estimate global sustainability into just a few components. That makes it a valuable tool to apply before using the regression model (Figure 7).

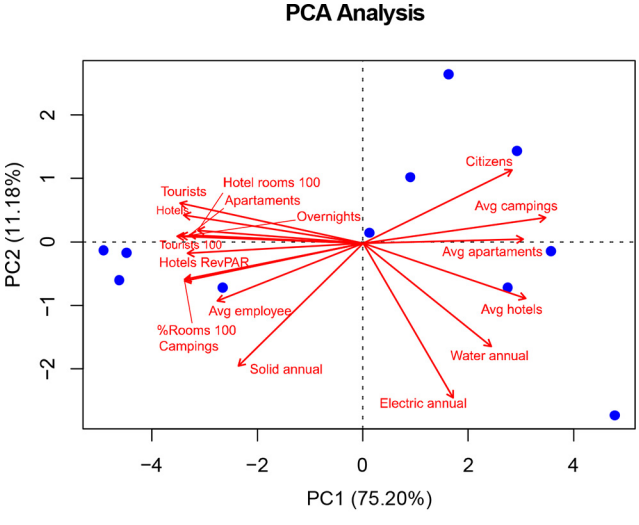
The previous figure shows that the principal component PC1 accumulates 75.20% of the data variability and the main component PC2 gets 11.18% of the data, reaching 86.38%. The indicators condition the year's distribution marked by the spatial disposition of the red lines to reflect the correlation of the variable's actual value to Principal Components 1 and 2. The years (represented by the blue dots) in the two-dimensional space reflect in a simplified way the value they mean in terms of the original data of the indicators, in such a way that those years with close coordinates in the Principal Components behave similarly. In turn, the arrows indicating a similar direction suggest that the indicators have a relationship between them, jointly conditioning the coordinates of our years.

After the PCA Analysis, a first model was developed in which the dependent variable was Sustainability and the regressor variables were the first eight Principal Components. After constructing this first multiple linear regression model, the Stepwise algorithm was applied as an automatic variable selection method, applying the bidirectional methodology testing the input and output of variables. Finally, the method arrived at the final regression model based on PC1 and PC7, below (Figure 8).

Concerning the regression model presented in the previous figure, the R^2 statistic is 0.7094, which means that PC1 and PC7 indicators obtain 70% of the deviation of the estimated variable in the regression model. Therefore, the variability of sustainability as a dependent variable is 70% explained by the economic, social and environmental indicators elected for estimating global sustainability. On the other hand, a one-unit increase in PC7 leads to 29.28 units in global sustainability. PC7 is, therefore, the intercept that best explains the dependent variable. Below are the positive and negative impacts and the absolute impacts of the different indicators that make up global sustainability (Figure 9).

The most significant positive impact on sustainability indicators is employment generated by tourism activity and the RevPAR profitability indicator. In contrast, the most significant

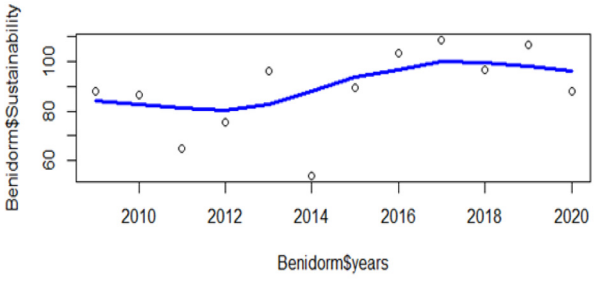
Figure 7 Indicators PCA analysis



Source: Prepared by the authors using R

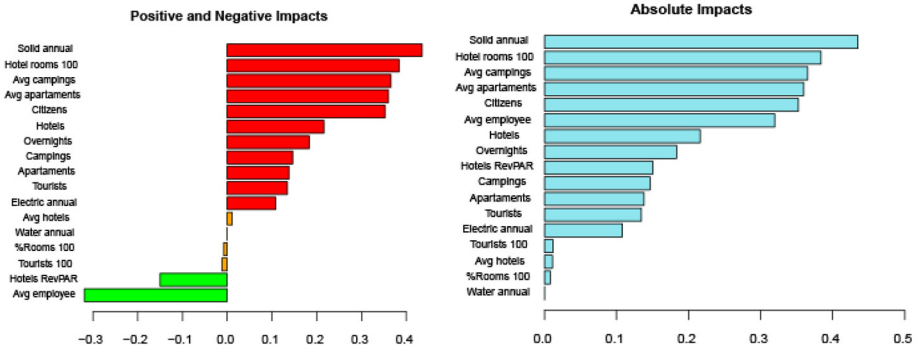
Figure 8 Sustainability regresion method

(Intercept):88.1000 3.1312 28.136 2.75e-09 ***
PC1: -3.0043 0.9185 -3.271 0.0113 *
PC7: 29.2825 9.8527 2.972 0.0178 *
Signif. codes: *0.05
F: 9.766 on 2 and 8 DF, p-value: 0.007128



Source: Prepared by the authors using R

Figure 9 Indicators Impacts Analysis



Source: Prepared by the authors using R

negative impact indicators are solid waste generation and all indicators related to overnight stays or average occupancy. In absolute value, solid waste generation, the existing hotel infrastructure with the number of hotel rooms per 100 inhabitants, and all indicators related to overnight stays and average occupancy have the most global impact on overall sustainability. As mentioned above, the scarce relative effect of drinking water consumption concerning global sustainability is explained by the fact that the data are aggregated. Therefore, to improve the model's estimation capacity, it would be necessary to use water and electricity indicators that exclusively attribute the part of consumption linked to tourist activity. The current water and electricity consumption indicators are a first approximation of the available data at an aggregate level. On the other hand, studies on consumption linked

to the tourism sector are limited and, in many cases, outdated, among the most recent publications (Sánchez-Galiano, Martí-Ciriquián, & Fernández-Aracil, 2017; Nuez & Osorio, 2019; Rico, Olcina, Baños, Garcia, & Sauri, 2020; Bianco, 2020).

3.4 Analysis of the contribution of benidorm's development as an smart tourist destination to the city's tourism sustainability

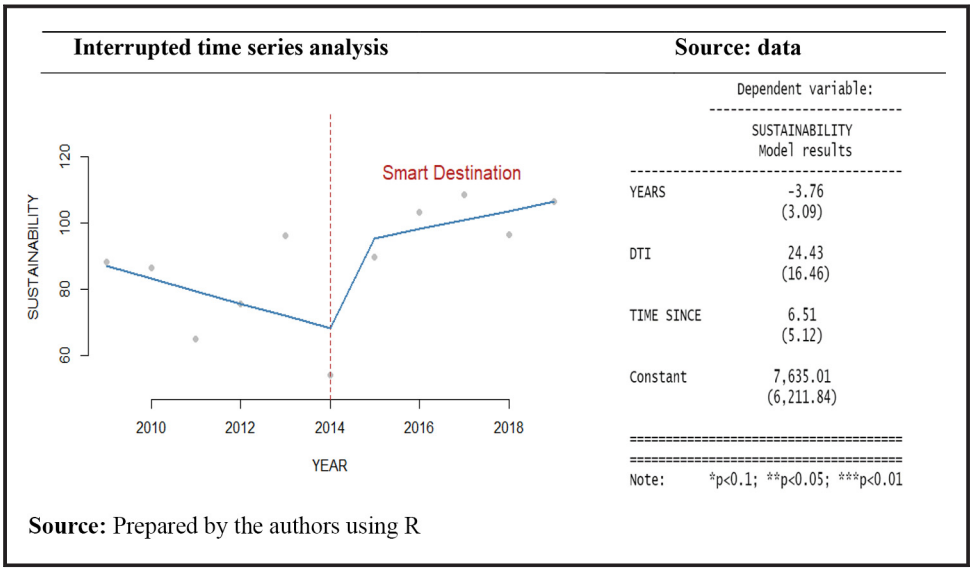
Benidorm is one of the emblematic Mediterranean coastal destinations. It is a clear representation of a tourist area born under the Fordist model characteristic of mass tourism in the '50s. For this reason, it has made a notable effort to reconvert itself as a more sustainable model. Related, the contribution analysis of the Plan "Benidorm, Destino Turístico Inteligente y Sostenible" to the sustainability of the city, using the following model:

$$Y = b0 + b1 * YEARS + b2 * DTI + b3 * TIME\ SINCE + e$$

Furthermore, a statistical analysis technique is especially recommended for cases like those from the interrupted time series analysis to understand the result of an intervention or implementation of a specific public policy, obtaining the results presented in Figure 10.

The coefficients result obtained in the figure above shows the graph slope relating the sustainability and years has changed after the 2014 public intervention when the strategy to turn Benidorm into an STD began. So, the b3 appreciates the before and after intervention slope difference, representing this public intervention's positive and sustained effect. Note how b2 = 0, which means no immediate impact in the short term. Thus, it can be affirmed is happening the scenario that the public policy implemented, the Plan "Benidorm, Destino Turístico Inteligente y Sostenible", has a sustained effect in the medium-long term on the tourist sustainability of the city of Benidorm". Likewise, the figure above shows how the temporal coefficient YEARS indicates sustainability before the intervention, having a negative value, which shows that sustainability followed decreasing evolution over time before the public intervention. Specifically, tourism sustainability decreased 3.76 points in the index for each year elapsed. In contrast, the positive DTI coefficient indicates an increase in tourism sustainability after the public intervention. The effect is confirmed to be

Figure 10 Interrupted time series analysis (ITSA)



Source: Prepared by the authors using R

positive, increasing sustainability by 24.43 points. Finally, the TIME SINCE coefficient indicates that the trend has changed after the intervention. The sustained effect is positive and significant, meaning that for each year that passes after the intervention, sustainability increases by 6.51 points in the index. The results are conclusive as tourism sustainability has an evident trend change before and after starting the process that has turned Benidorm into an STD.

4. Conclusion

The following are the main findings that answer the research questions. Regarding the first question, Q1: Has Benidorm's transformation into a Smart Destination contributed to making a more sustainable city? Information obtained affirms that the development of Benidorm as an STD has made a positive contribution to the sustainability of tourism in the city. Through the analysis carried out, it knows that although this contribution does not have a disruptive effect in the short term, it does produce a change in trend that has a positive and sustained impact in the medium and long term. That suggests that the city's sustainability is improving despite being a mature destination and the high tourist pressure that the city bears annually.

About the second question, Q2: Could the evolution of Benidorm's tourism sustainability from existing sustainability indicators be estimated? Firstly, 17 Benidorm's tourism sustainability indicators have been identified through official open data sources at the municipal and state levels. From these indicators, the Benidorm tourism sustainability has been estimated using a flexible model based on the sum of the relative weightings for each indicator concerning global sustainability, based on the opinion of a group of experts. The sustainability estimation model was complemented with a series of statistical significance analyses and a linear regression model, from which it concludes that the economic, social and environmental indicators elected explain 70% of the variability of global sustainability. The most positive indicators are tourism employment and hotel RevPAR profitability. While those with the most significant negative impact are the generation of solid waste, the number of hotel rooms per 100 inhabitants or electricity consumption. According to the expert panel's opinion, drinking water consumption, the indicator with the highest relative impact, has no statistical significance in the regression model. The sustainability estimation model would be improved by obtaining disaggregated water and electricity consumption data related to tourism industry consumption.

Related to the last question, Q3: Could it qualify the implementation of the Plan "Benidorm, Destino Turístico Inteligente y Sostenible" as a successful public management action in terms of tourism sustainability? The answer is yes, for several reasons. Among the most important, the Strategic Plan has concluded with the certification of Benidorm as the first Smart Tourist Destination in Spain, a distinction awarded by the "Instituto para la Calidad Turística Española" under the UNE 178501 standard, the first standard of its kind in the world. Secondly, it can be affirmed that the commitment to the development of a smart destination within the Plan "Benidorm, Destino Turístico Inteligente y Sostenible" has had a positive and sustained effect in the medium-term on the global sustainability of the city, which indicate a good practice of the local government that also gives Benidorm a competitive advantage over its competitors. Finally, it should be noted that Benidorm has been able to adapt the mass tourism developing a high-density tourist area, creating today the most sustainable and efficient urban-tourist model on the Costa Blanca, with an advanced environmental infrastructure based on integrated management systems for the main inputs (electricity, drinking wáter and solid waste generation), the basis of its sustainable development model.

5. Discussion

The debate to contextualise this work is bridging the gap between sustainability and tourism intelligence. This research represents a departure from previous related research, offering a framework based on official open data sources to measure the sustainability of a tourism destination. Estimating sustainability through available sustainability indicators helps assess the impact of sustainable tourism development policies. A learning process to improve the community's overall understanding of economic, social and environmental issues, through the use and re-use of these available data sources, as in the case of Benidorm, a commitment to place the tourist at the centre of tourism policies, anticipating their needs and giving them new answers to their needs through innovation, new technologies and sustainability.

The implications of this work have an eminently practical component. Thus, the measurement of sustainability through a global sustainability estimation model, designed from a standard set of indicators applicable to different tourist destinations, provides a reasonable starting point to have a framework for comparing tourism sustainability in different destinations as a point to be addressed in the future related research.

Likewise, it represents one of the first pieces of empirical evidence that converting a tourist destination into an STD contributes to the sustainability of tourism cities in the medium and long term. The ultimate objective is to provide tourist destinations with a flexible tool adaptable to data availability for measuring tourism sustainability. To overcome the current use of this term as a slogan or advertising jargon, in practice, as we have identified, there are very few cases in which destinations effectively manage tourism sustainability.

Destinations that carry out this work, such as Benidorm, are gaining a competitive advantage in a global market, becoming more eco-friendly. Tourists in the 21st century are characterised, as well as being very well informed, by preferring a sustainable tourism offer (Solís-Radilla, Hernández-Lobato, Callarisa-Fiol, & Pastor-Durán, 2019; Molinillo, Anaya-Sánchez, Morrison, & Coca-Stefaniak, 2019). Tourism destinations must respond adequately to the challenge of sustainability as one of the most critical issues in today's tourism industry.

6. Limitation

While many opportunities can be seised using the model of measuring the sustainability of a tourism destination through available open data sources, there are also challenges and open questions as limitations of this work that need to be addressed and overcome for a successful implementation, among the most important the subjectivity of the distribution of the relative weight of each indicator. However, this work has been contrasted with a panel of experts to establish a distribution score between the different indicators based on the relative importance of each one concerning the overall concept of sustainability. Also, carried out a statistical significance analyses of the relationship between the different indicators and indicators concerning overall sustainability. On the other hand, the minimum number of indicators required for each type of sustainability (economic, social and environmental) to guarantee a correct estimation of global sustainability has yet to be defined. Although the applied regression analysis obtains a high R-squared value, the variables or indicators used are statistically significant.

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