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Sustainable Tourism Development Index: A Scientifically Practical Proposal

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Abstract

Sustainable tourism development requires self-limitation and the delimitation on national or regional development, within the frame of Carrying Capacity (CC), while maximizing economic benefits evaluated in the Tourist Satellite Account (TSA). *Sustainable Tourism* should be determined by Carrying Capacity while *Development* level should be depicted on Tourism Satellite Account, at national or at local level. The research question of this study is to define where the "golden ratio" is located between sustainability and economic benefits maximization. Tourism experts and academics evaluated the sub-criteria, based on the Analytic Hierarchy Process (AHP), which form the Sustainable Tourism Index, within the framework of environmental protection, natural sources savings, eco-friendly practices, green investments, and of the highest contribution to GDP, to employment, to local income and to local and federal tax revenues. The results will support local and federal policy makers to design and apply tourism development ensuring sustainability.

Keywords: Sustainability, Tourism development, Carrying Capacity, Tourism Satellite Account, Analytic Hierarchy Process

1. Introduction

1.1 Introduce the Problem

Tourism creates significant and multifaceted impact to tourist destinations. As in any human activity, tourism does not always bring only positive effects, but also negative consequences where it develops, anarchically or unplanned. The negative effects are caused by overtourism because the consequences of tourism development in some areas exceed the limits of physical, ecological, social, economic, psychological, and/or political capacity.

Tourism Sustainability presupposes and requires the control and limitation of the negative consequences of tourism development. The “Guide for Policy Makers” of United Nations’ Environment Programme (UNEP) and United Nations World Tourism Organisation (UNWTO) defines Sustainable tourism development as “Tourism that takes full account of its current and future economic, social and environmental impacts, addressing the needs of visitors, the industry, the environment and host communities". Sustainable Tourism may be defined with many more terms worldwide beyond a single definition (Linnerud & Holden, 2016). Hall (2011) believes that the cornerstone of their sustainable tourism policy paradigm is the notion of so-called “balance”.

The "real balance" in tourism development should exist with economic benefits as a counterweight to sustainability. It is therefore understood that the desired balance is achieved by minimizing the negative effects and maximizing the positive benefits. Sustainability refers to acknowledgment of all impacts caused by the tourism industry development, while economic benefits from tourism are depicted in Tourism Satellite Account. Sustainable tourism development may be achieved within the boundaries of Carrying Capacity, and economic benefits maximization should be evaluated by the TSA.

1.2 The Aim of the Research

The aim of this paper is to propose a single index that will determine the optimal level of tourism development that maintain the balance between development level and sustainability preservation. To achieve the objective of the research, on one hand, an analysis of the factors that make up the Carrying Capacity was carried out, and on the other, the macro-economic figures that attribute the effects of tourism to the economy were selected. With this data, a questionnaire was created which tourism experts and academics of the sector were asked to answer.

1.3 Structure of the Paper

The paper is developed as follows: After the introduction, Section 2 includes the literature review of the carrying capacity and on the TSA. Section 3 presents the methodological framework, the methodological tool and the sample of the research. Section 4 presents the results of the research. Conclusion and policy proposals are discussed in Section 5, followed by Section 6 where research limitations are specified and further research is proposed.

2. Literature Review

Carrying Capacity is referred as "the maximum number of people who can use a place without causing irreversible changes to the natural environment and without drastically reducing the quality of experience gained by tourists-visitors of the place" (Hudson & Hudson, 2015). Intended tourism development of a particular destination and the essential requirement of its’ carrying capacity, constitute a dynamic process attributed to the interconnectedness of the life cycle (Butler, 1997, p. 116; Martin & Uysal, 1990).

Obviously, unlimited growth in any destination is impossible, but it could very well be cyclical in nature (Baum, 1998; Butler 2004), either through the redevelopment of the

tourism destination's life cycle, or through permanent closure (Tooman, 1997).

30 years ago, Butler (1999) had emphasized the importance of boundaries in the use and development of tourism and had suggested what changes in the physical and social environment can and should be accepted to reduce the negative effects of tourism development that they had appeared since then, in the 60s. Since the 1980s, however, there has been a rapid increase in the sustainability and respect of environmental resilience limits by tourism interventions. The growing interest in sustainable development has been fueled by the broadening and enrichment of information and knowledge about the environment and the consequences of tourism development (Holden et al., 2013 & 2014). Both sustainability and the limits of tourism development were issues of concern before the Brundtland report (Gossling & Hall, 2005), but sustainability has since been at the center of debates on tourism and its management policies. New carrying capacity types referring to tourism sustainability appeared along with emerging alternative forms of tourism, such as green, soft, responsible, ecotourism and others (Coccossis & Mexa, 2004).

Carrying capacity of tourism covers three main categories of impacts from the operation of tourism: a) physical-ecological, b) socio-demographic and c) political-economic (Coccossis & Mexa 2004). The effects of tourism therefore are categorized in three main axes: a) the natural and man-made environment, which includes the tourist infrastructures, the social environment concerning the population and social structure and dynamics and c) the economic environment in which institutional and organizational issues are involved.

The indicators proposed to estimate the Bearing Capacity are divided into three different types, according to the above categories (Coccossis & Mexa (2004):

• Physical-Ecological Indicators including Natural Environment and Biodiversity, Air Quality, Noise Pollution, Energy, Water, Waste, Cultural Heritage, Tourism Infrastructure, Land, Landscape, Transport and Mobility.

• Socio-demographic indicators including Demographics, Tourist Flow, Employment, Social Behaviour, Health and Safety, Psychological Issues.

• Politico-economic indicators including Profits, Investments, Employment, Public Expenditures and Revenues from Tourism and Tourism Development Policy.

Carrying capacity was initially applied to control the management and operation of national parks, but later it was also used for tourist resorts, tourist towns (Wise, 2017) and tourist islands (Scoullos, 2004).

The carrying capacity of an area can be calculated based on specific factors and natural resources, but also with tourism impact tables. The various studies to assess carrying capacity seem to focus on specific objectives, such as the environment and biophysics (Liu & Borthwick, 2011; Simon et al., 2004; Zacarias et al., 2011) or the economic consequences of tourism development (Navarro et al., 2012).

It is therefore understood that apart from the negative effects and the burden of the increase in demand for goods and services due to tourism, this same increase in consumption causes

economic effects that deserve to be studied.

The most reliable known method worldwide for the valuation of the economic effects of tourism, is the Tourism Satellite Account as the accounting system that on the one hand completely satisfies the achievement of the measurement of tourism economic effects and on the other hand is based on the System of National Accounts 2008 (SNA 08), in European System of Accounts 2010 (ESA 10), and is in full harmony with the principles of tourism statistics of the World Tourism Organization (WTO, 2008), the United Nations and the OECD Tourism Council.

TSA has become a major operational component of tourism development and policy analysis (Sharma & Olsen, 2005) because of the consistent accounting of tourism activity that can be set alongside national income accounts (Jones & Munday, 2007). The Canadian state was the first country to launch a National T.S.A. in 1994 (Smith, 1995) and remains the leader in TSA development for its provinces and territories. Outside of Canada, many countries prepare and implement TSA on a regular basis, such as the USA (Franks & Osborne, 2019; International Trade Administration, U.S. Department of Commerce, 2020), Canada (Meis, 1999), Australia (Lim et al., 2013). Brazil, New Zealand, India, Egypt, Japan, China, Philippines, Indonesia, Saudi Arabia, South Africa, Thailand. There are also many European countries that have progressed well in the development of TSA, including Austria, Norway, Switzerland, Spain, Italy, France, Germany, Croatia (Ivandic & Marušić, 2017), Serbia (Jovanović & Vukasovic, 2014). Several countries have started the process of building and operating TSA with the support of the European Commission and the OECD.

The development of regional TSA has contributed to improve measurement of the economic contribution of tourism to regions, providing more precise international comparability of tourism statistics (Frenț & Frechtling, 2022). Among the countries having developed regional tourism satellite accounts are Spain and Norway. Croatia applies a specific determinist model that integrates symmetrical input-output tables and the tables of the tourism satellite account, to give an overview of the role of tourism in the economy (Ivandić & Šutalo, 2019, p.389). Croatia recorded a remarkable increase in tourist arrivals, revealing tourism as the main pillar of its economy in the last decades (Kovačević, 2020), and aims to fully develop its national and regional TSA. The Tourism Satellite Account (TSA) can and has been applied to assess individual tourism activities. such as domestic tourism, but also special and unusual conditions, such as that of the COVID-19 pandemic and its effects on the economic contribution of tourism (Wu, et al. 2022). It is estimated that more than 60 countries out of the 156 members of the UNWTO have developed their national T.S.A. to date, and this number is constantly increasing.

Even though Greece, an EU member country, has not yet fully developed nor does it operate a national TSA, researches relevant to the Greek TSA were published, referring to the attempt of producing a Greek Tourism Satellite Account (Giannopoulos & Boutsinas, 2014), of constructing an Information System of the Greek Tourism Satellite Account (Diakomihalis & Pappas, 2023), the impact of yachting (Diakomihalis & Lagos, 2008), of cruise and of total maritime tourism (Diakomihalis, 2007), on the Greek Economy. Besides, the paper “Tourism

Satellite Account Support Using Online Analytical Processing" has been published, referring to the attempt of producing a Greek Tourism Satellite Account.

3. Methodology

3.1 The Methodological Framework

The methodological tool for the development of the Sustainable Tourism Development Index (STDI) is based on Carrying Capacity and TSA. It is accepted that optimal Tourism Development might result from the Carrying Capacity consideration of a specific region and the economic development will be reflected in the economic benefits depicted on the Tourism Satellite Account for the same area. An STDI should inevitably proceed from the marriage of tourism sustainability and tourism development. The methodological tool satisfying the boundaries of tourism sustainability is that of the Carrying Capacity and that of tourism development will be the Tourism Satellite Account, as the proper tourism accounting tool.

The tourist burden of an area can be captured through various indicators. Empirical criteria are used to measure the carrying capacity of tourism development, which have been used in similar cases in other places and countries (benchmarking). After a brainstorming among Greek academics the following ten more significant indicators to define the level of Carrying Capacity, considering the tourism load in an area, have been proposed:

1. Land Capacity (LC) might be determined by several indices regarding specific factors related to land use and land availability, such as forests, ecosystems, water, existing building density and more.

2. Special Tourist Infrastructure (STI) refers to investments for facilities and services required for tourism development such as transport, accommodation, food services, museums, information centres.

3. Technical Infrastructure (TI) includes Water Supply, Sewage Systems and Road Network. The evaluation of the capacity of the technical infrastructure (TI) is based on the existing situation and information about the intended design.

4. Tolerable Tourism Population Index (TTPI), which considers not only the local population, but also considers the tourist crowd. Represents the number of tourists per day at its peak, over total population of the area.

   Coast Capacity Indicators include six different indices which depict the ability of the coastal area to serve the local residents of the area as well as tourists, including also the holidaymakers and visitors. Since the aim of the study is to construct an STDI, all six coast capacity indicators will be included to build up the STDI.

5. Coastal Area (CA) is estimated in m^2 rated with rates for *Excellent or Very Good Beaches*, *Good Beaches*, and *Bad Beaches*. For each specific study certain assumptions might be adopted to estimate the capacity of the shores, depending on the conditions and characteristics of the area under study.

6. Theoretical Capacity (TC) determines the density of people having a swim. In this case, coefficient of certain square meters / person is assumed that constitutes the acceptable density of swimmers.
7. Estimation of Real Capacity (RC) of the coasts are given as a percentage of Theoretical Capacity. A saturation factor is applied in order to estimate the actual beach capacity of swimmers.
8. Swimmers per Day (SpD) can be estimated using the permanent population of the area and the rest of the area's population, applying a coefficient of accessibility in the area from the major urban centers of the prefecture. Besides, tourists and visitors traveling daily from areas outside the prefecture, ought to be estimated with a variable accessibility factor.
9. Coverage Index (CI) indicates the number of swimmers per day and peak hour, over the real capacity. The coverage index is correlated with the estimated Real Capacity so that there is an indicative quantitative order of the degree of coverage-use of the coasts on peak days and hours.
10. Users / Linear Coast (ULC) indicates the number of users per linear meter of shoreline. It expresses the number of swimmers in relation to the availability of the length of the swimming beaches.

Carrying Capacity indicators' significance is rather simple to interpret, to the level that they are affected by tourism development load, and they are determined depending on their relevant gravity, such as:

- excessive / intensive tourism development
- large / almost exclusive tourist development
- main development in relation to other sectors / branches
- significant but not major growth
- small or very small tourist development

The load of tourism development regarding the Carrying Capacity of a certain tourism destination area may be evaluated with other indices, as well, such as:

- low level
- tolerable level or satisfactory
- critical or high
- exercise of carrying capacity

Academic experts in national and satellite accounting, in Greece, have proposed the following eleven more significant economic impacts of tourism development in an area, resulting from a relevant brainstorming:

1. Tourism Consumption by product category is one of the most important economic benefits for a tourism destination for increasing the demand for domestic goods and services.
2. Consumption by category of tourists will reveal the consumption characteristics of tourists and visitors having different nutritional habits, affected by factors such as age, sex, educational background, marital status, etc.
3. Consumption of domestic products is considered a very significant impact for the economy of tourism destinations since it will affect domestic production.
4. Consumption of imported products is a value to be considered as being less positive for local economy, since it affects major macroeconomic values not like the domestic products consumption, but only for its trade and transport margins.
5. Production of tourism industries will influence the total supply of goods and services and therefore will boost employment.
6. Production of non-tourism industries will also be driven to increase since tourism consumption does not consist only of tourism products.
7. Trade margin is linked to the production and consumption quantities and values. It might be a remarkable part of total consumption by residents and by visitors.
8. Transport margin, likewise, is linked to the production and consumption of total goods and services, especially for remote tourism destination areas, such as islands.
9. Number of jobs is always a core benefit of any industry and investment, being also a major tourism impact in a tourism destination region.
10. Equivalent full-time jobs is one of the core impacts of tourism to be evaluated, because it makes tourism employment comparable to employment of all other activities and industries.
11. Tourism Investments should be evaluated apart from other capital acquisition and investments, to reveal their significance and contribution not only to visitors but also to residents.

3.2 Methodological Tool and Sample Research

The Analytic Hierarchy Process (AHP) is a Multicriteria Decision Model (MCDM) developed by Thomas Saaty and it has been applied in various research areas requiring analysis of alternative options in planning, evaluation, resource allocation and conflict resolution.

Decision-making hierarchy models of consistent matrices allow to produce precise or approximate gravities (Saaty, 1986, 1994). The research aim has been built hierarchically at levels according to the criteria and sub-criteria, which are determined by their priorities. They are compared pair-wise with evaluations expressed in a scale from 1 which to 9. The following rules are applicable in the judgmental matrix:

$$A_{ij} > 0;\ a_{ij} = 1/a_{ji}$$

$$a_{ii} = 1 \text{ for all } i$$

The matrix is accepted as consistent if the following relation is valid for all recordings of the matrix:

$$a_{ij} = a_{ik} \times a_{kj}$$

The level of inconsistency is evaluated with Consistency Ratio less than 0.1 are acceptable (Saaty, 1994). The research Criterion and the Sub criterion are estimated by their significance using the hierarchical aggregation rule (Subramanian & Ramanathan, 2012).

Significance of Sub Criterion A1 to the ultimate problem or research goal is given:

A1=Σ[(Significance of A1 with respect to Criterion Cj) x (Importance of Criterion Cj)]

The hierarchical construction of Criteria is illustrated in the following Table 1, including the decisions C1, C2, C3, and C4, compared in pairs in terms of their degree of significance and finally in participation to the fulfilment of the research goal.

Table 1. Pairs of comparison of criteria

GOAL	C1	C2	C3	C4
C1				
C2				
C3				
C4				

Table 2 below presents the alternatives sub-criteria SC1, SC2, SC3, and SC4, compared in pairs in terms of their degree of significance and finally in participation to the fulfilment of the criterion they belong to.

Table 2. Pairs of comparison of sub-criteria

C1	SC1	SC2	SC3	SC4
SC1				
SC2				
SC3				
SC4				

Saaty (1994) insisted that either the qualitative or the quantitative scale of measuring the significance of Criteria or Sub criteria, must reflect ideas, values, thoughts, and feelings. He proposed a scale of reasons that clearly captures both quantitative and qualitative information, considering the ability to express quality preference in nine levels, expressing the satisfactorily levels.

In a pairwise comparison the decision maker declares his / her preferences for each comparable decision pair, X and Y, based on the following rating main levels of comparative significance:

1. Equivalent.
3. Moderate.
5. Strong.
7. Very Strong.
9. Absolute.

Besides the five main levels of comparative significance judgments, four (4) intermediate evaluations (2, 4, 6, 8) may also be applied.

The questionnaire which has been constructed according to the Analytic Hierarchy Process methodology, included the Sub criteria for each of the two Criteria, as illustrated on Table 1. It was sent personally by email, to Academics, who are expert scholars in Carrying Capacity and Tourism Satellite Account, methodologies, theoretically and practically. The research sample comprised of 34 faculty members of Tourism Management departments of Greek Universities. Finally, 33 questionnaires were completed and received. The time of the research was November - December 2022.

The results have presented the importance of each Sub-Criterion, and finally their gravity has been determined, along with their ranking in significance.

3.3 The Proposed Sustainable Tourism Development Index

The SDTI, as explained earlier, will be the result of the evaluation of the proposed Criteria and Sub-criteria, regarding tourism sustainability and tourism development. The intended index therefore will be grounded on the **TCC-TSA** model as an outcome of the ***f (Carrying Capacity, Tourism Satellite Account)*** formula.

The TCC-TSA model, including only 5 Sub-criteria of TCC and 5 of TSA, should be enriched with more factors of each part of it. Based on the experts' brainstorming and the featuring of the most significant Sub-criteria, the TCC-TSA model extended including ten sub-criteria of the TCC and eleven sub-criteria of TSA.

The evaluation of each Carrying Capacity factor and each TSA factor will determine the composition of the TSDI depending upon the experts' decision.

Table 3. Sustainable Tourism Development Index (STDI) with the TCC-TSA model

Tourism Carrying Capacity	
	1. Land Capacity (LC)
	2. Special Tourist Infrastructure (STI)
	3. Technical Infrastructure (TI)
	4. Tolerable Tourism Population (TTP)
	5. Coastal area (CA)
	6. Theoretical Capacity (TC)
	7. Real Capacity (RC)
	8. Swimmers per Day (SpD)
	9. Coverage Index (CI)
	10. Users / Linear Coast (ULC)
Tourism Satellite Account	
	1. Consumption by product (CoP)
	2. Consumption by category of tourists (CPcT)
	3. Consumption of domestic products (CDP)
	4. Consumption of imported products (CIP)
	5. Production of tourism industries (PTI)
	6. Production of non-tourism industries (PnTI)
	7. Trade margin (TdM)
	8. Transport margin (TtM)
	9. Number of jobs (NJ)
	10. Equivalent full-time jobs (EftJ)
	11. Tourism Investments (TouI)

The final formula to calculate the STDI will therefore be:

STDI = TCC [(LC) + (STI) + (TI) + (TTP) + (CA) + (TC)+ (RC) + (SpD) + (CI) + ULC)] + TSA [(CoP) + (CpT) + (CDP) + (CIP) + (PTI) + (PnTI) + (TdM) + (TtM) + (NJ) + (EftJ) + (TouI)] = 1,000

The Analytical Hierarchy Process is the method used to reveal the experts' evaluation of the Criteria and Sub criteria. Stakeholders will be asked to evaluate the importance and significance of each factor as to its participation to the final goal, which is the formation of the Sustainable Tourism Development Index.

STDI will have a total value of one unit (1,000). Therefore, the sum of TCC and TSA Sub criteria evaluations will sum up to 1,000. Depending on the specific area under study, the level of tourism development, the dependence of the local economy on other industries and the specific environmental circumstances, will form the **ad-hoc STDI**, depending on the significance attributed to each Sub criterion of TCC and TSA Criteria.

4. Results

The gravity of each criterion and their participation to the final goal, is assessed by Analytic Hierarchy Process, alike the sub-criteria evaluation regarding their gravity to the criterion they belong to (that is given by the Local values) as well as to their contribution to the final research goal (that is given by the Global values).

The registration and processing of the questionnaires has been conducted with the Expert Choice ™ software. Table 4 illustrates the local (L) and global (G) priorities of the criteria and sub criteria towards the final goal. The global priorities for each alternative are then summed to yield overall or synthesized priorities. The preferred alternative is the one with the highest priority.

Table 4. Tree view of Criteria and Sub-Criteria for Sustainable Tourism Development Index (STDI)

	Local	***Global***
Tourism Carrying Capacity	**0,558**	**0,558**
1. Land Capacity (LC)	0,104	0,058
2. Special Tourist Infrastructure (STI)	0,172	0,096
3. Technical Infrastructure (TI)	0,130	0,073
4. Tolerable Tourism Population (TTP)	0,077	0,043
5. Coastal area (CA)	0,082	0,046
6. Theoretical Capacity (TC)	0,101	0,056
7. Real Capacity (RC)	0,100	0,055
8. Swimmers per Day (SpD)	0,083	0,046
9. Coverage Index (CI)	0,071	0,040
10. Users / Linear Coast (ULC)	0,080	0,045
Tourism Satellite Account	**0,442**	**0,442**
1. Consumption by product (CoP)	0,096	0,042
2. Consumption by category of tourists (CPcT)	0,078	0,034
3. Consumption of domestic products (CDP)	0,128	0,056
4. Consumption of imported products (CIP)	0,056	0,025
5. Production of tourism industries (PTI)	0,066	0,029
6. Production of non-tourism industries (PnTI)	0,072	0,032
7. Trade margin (TdM)	0,049	0,022
8. Transport margin (TtM)	0,040	0,018
9. Number of jobs (NJ)	0,123	0,054
10. Equivalent full-time jobs (EftJ)	0,146	0,065
11. Tourism Investments (TouI)	0,146	0,065

Table 5. The Criteria for Sustainable Tourism Development Index (STDI)

Criteria	Significance
Tourism Carrying Capacity	**0,558**
Tourism Satellite Account	**0,443**

The participation of only two criteria results in a clear illustration of their significance. It is therefore obvious that Carrying Capacity is considered more significant to determine the sustainability index, compared to the economic benefits measured by the TSA (table 5). The comparison of the two criteria's significance is also depicted in the Figure 1 below.

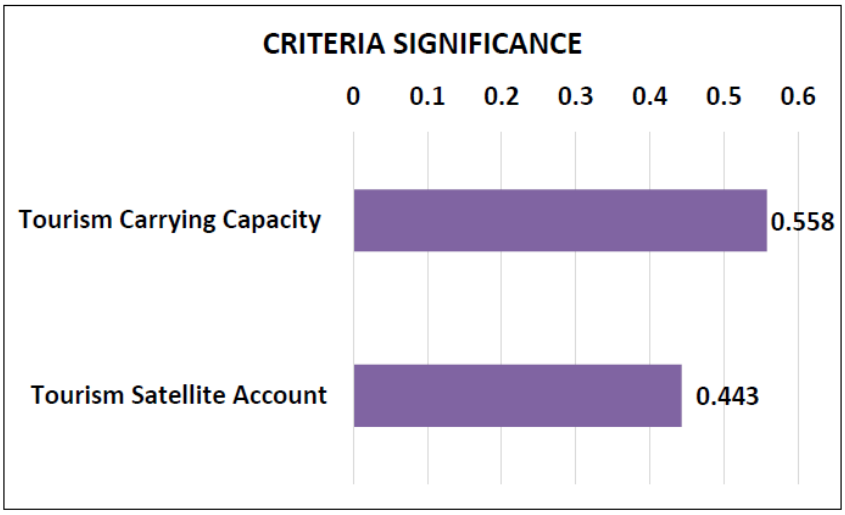

Figure 1. Criteria evaluation for Sustainable Tourism Development Index (STDI)

Table 6. The Sub-Criteria for Sustainable Tourism Development Index (STDI)

Sub-Criteria	Criterion they belong to	Significance	Ranking
2. Special Tourist Infrastructure (STI)	**TCC**	0,096	**1**
3. Technical Infrastructure (TI)	**TCC**	0,073	**2**
20. Equivalent full-time jobs	**TSA**	0,065	**3**
21. Tourism Investments	**TSA**	0,065	**4**
1. Land Capacity (LC)	**TCC**	0,058	**5**
13. Consumption of domestic products	**TSA**	0,056	**6**
6. Theoretical Capacity (TC)	**TCC**	0,056	**7**
7. Real Capacity (RC)	**TCC**	0,055	**8**
19. Number of jobs	**TSA**	0,054	**9**
8. Swimmers per Day (SpD)	**TCC**	0,046	**10**
5. Coastal area (CA)	**TCC**	0,046	**11**
10. Users / Linear Coast (ULC)	**TCC**	0,045	**12**

4. Tolerable Tourism Population (TTP)	**TCC**	0,043	**13**
11. Consumption by product	**TSA**	0,042	**14**
9. Coverage Index (CI)	**TCC**	0,040	**15**
12. Consumption by category of tourists	**TSA**	0,034	**16**
16. Production of non-tourism industries	**TSA**	0,032	**17**
15. Production of tourism industries	**TSA**	0,029	**18**
14. Consumption of imported products	**TSA**	0,025	**19**
17. Trade margin	**TSA**	0,022	**20**
18. Transport margin	**TSA**	0,018	**21**

The significance of sub criteria is related to the criteria evaluation as expected (Table 6). Therefore, the sub criteria of greatest importance are those included in the Carrying Capacity criterion. Specifically, Special Tourist Infrastructure (STI) is the most important of all Sub criteria (ranking in 1st place) with 0,096 (out of 1,000), followed by Technical Infrastructure (TI) with 0,073 (in 2nd place). The next in ranking Sub criteria, namely "Equivalent full-time jobs" and "Tourism Investments" belong to TSA Criterion. The Sub criteria in the last six positions, namely, "Consumption by category of tourists", "Production of non-tourism industries", "Production of tourism industries", "Consumption of imported products", "Trade margin", and "Transport margin", belong to TSA Criterion. The evaluation of the Sub criteria significance is also depicted in the Figure 2 below.

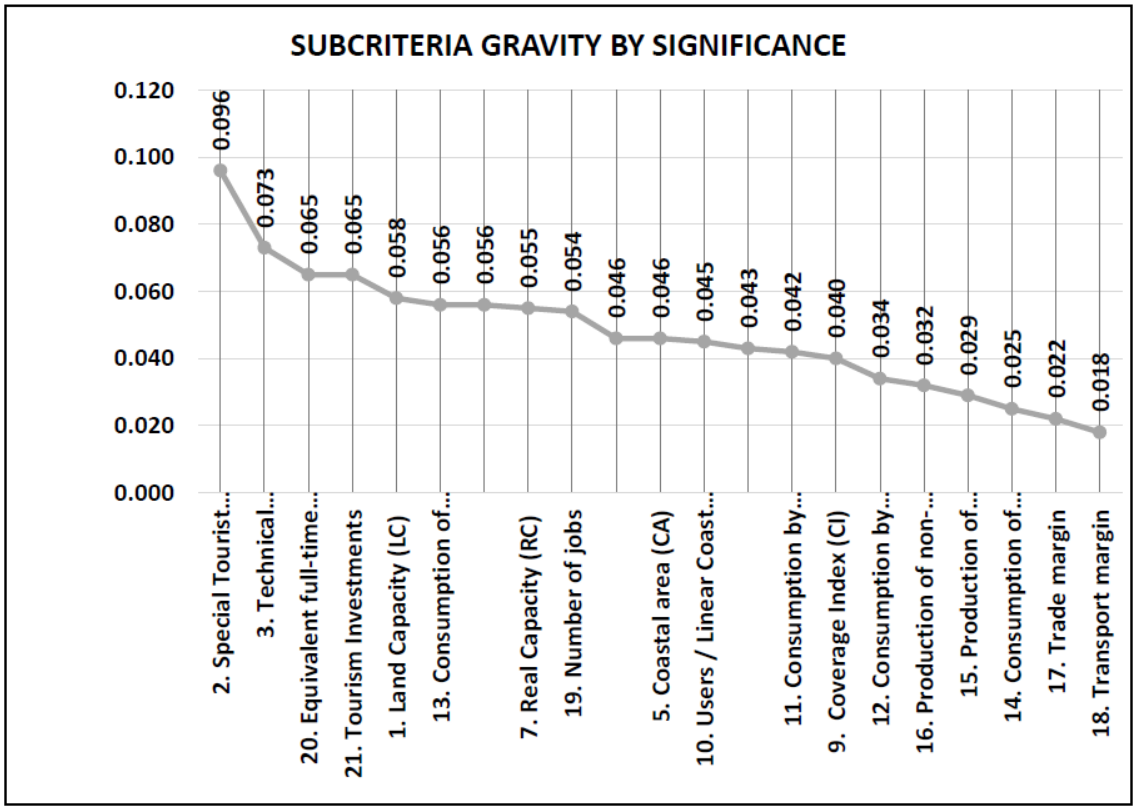

Figure 2. Sub-Criteria evaluation for Sustainable Tourism Development Index (CCI)

The STDI evaluation based on the research results will be as follows:

$$\textbf{STDI} = F\{_{TCC,TSA}\} = (0{,}096\ STI) + (0{,}073\ TI) + (0{,}065EFTJ) + (0{,}065TouI) + (0{,}058LC) + (0{,}056GDP) + (0{,}056TC) + (0{,}055RC) + (0{,}054NJ) + (0{,}046SpD) + (0{,}045ULC) + (0{,}043TTP) + (0{,}042CoP) + (0{,}040CI) + (0{,}034CpCT) + (0{,}032PnTI) + (0{,}029PTI) + (0{,}025CIG) + (0{,}022TdM) + (0{,}018TtM) = 1{,}000$$

The STDI is composed by 21 factors, which have been evaluated as sub-criteria composing Carrying Capacity and TSA of a specific tourism destination area. Their evaluation and ranking indicate the significance ought to be given for tourism planning and development. The evaluation is attributed as a percentage to the value of the goal which takes the value of a unit.

5. Conclusion and Policy proposals

Tourism brings significant economic benefits to countries and regions that are tourist destinations, in terms of GDP, employment, public revenues, investments, etc., but its development requires the consumption of significant resources from many sectors.

Sustainable tourism development requires the cooperation of various entities for a common tourism policy that includes a continuous process and monitoring of the impacts of tourism to prevent and deal with them in a timely manner, with the aim of preventing negative impacts and achieving sustainability. Carrying capacity identifies and highlights the limits of the development of a tourist destination by also suggesting the number of tourists that each area can support.

Understanding the effectiveness of several interventions in reducing the environmental impact of tourist behaviors can guide the development and implementation of the United Nations policies that intend to change undesired tourist behaviors (Greene at al, 2023).

A sustainable tourism development should be the guiding policy at national and local level, ensuring the protection of the natural and cultural environment.

The optimal degree of tourism development should consider the limits and constraints determined by the factors of carrying capacity and the level of economic benefits from tourism.

Academics and experts in Carrying Capacity and Tourism Satellite Account, evaluated and determined the participation of each element in a single indicator that will yield the optimal degree of tourism development for a specific region.

The specifics regarding geomorphology, coasts, soil, greenery, settlements, infrastructure, water sufficiency, electricity, waste and sewage management, transport issues, etc. as the case may be, must be considered and recorded by the local experts for issues related to the Carrying Capacity Indicators, to define the framework of Sustainable Tourism Development.

The economic benefits approach includes Tourism Consumption by products and by category of tourists, Consumption of domestic and of imported products, Production of tourism and non-tourism industries, Trade and Transport margin, Number of jobs and Equivalent full-time

jobs and finally Tourism Investments. The constraints imposed by the Tourism Satellite Account concern the boundaries of the national and local economy, including natural resources, structure of the economy, production, imports, employment, tax regime, etc. The ranking of each sub-criterion according to its importance in the formation of the final Sustainable Tourism Development Index (STDI), is a guide for the factors that must be considered by tourism operators to contribute to the determination of the level of development, the mode of tourism development and the type of tourism product that suits every tourist destination.

6. Research Limitations and Further Research Proposal

The research results can in no way be a panacea for all cases of research to determine Sustainable Tourism Development, without considering the individual importance of each CC indicator and each TSA result, as assessed by stakeholders. The objective of the research as defined from the beginning is the synthesis of an index for the evaluation of the specific conditions concerning each region or destination. The differentiation of the data is completely understandable and acceptable because there are differences both in the geomorphological characteristics and the natural environment as well as in those of the social structure, culture, and culture of the inhabitants. At the same time, the level of tourism development and its economic effects are intertwined with the overall economy of the host country, with the sectors that benefit the country and its comparative advantages related to the tourism product offered.

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Authors contributions

Mr. Diakomichalis Nikolaos was responsible for study design and revising. Prof. Diakomihalis Mihail was responsible for data collection and processing. Mr. Diakomichalis Nikolaos drafted the manuscript and Prof. Diakomihalis Mihail revised it. All authors read and approved the final manuscript. Both authors contributed equally to the study.

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The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Data sharing statement

No additional data are available.

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