

## Article

# Developing an Indicator-Based Framework to Measure Sustainable Tourism in Romania. A Territorial Approach

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**Abstract:** Sustainable tourism is gaining importance in national agendas to encourage economic growth, social inclusion, and the protection of cultural and natural assets. More than 13 million tourists (10.6 mil. Romanians and 2.6 mil. foreigners) visited Romania in 2019, the fifth consecutive year of growth for the tourism sector. The authors have selected 10 statistical indicators to highlight the main components for tourism sustainability by using the principal component analysis (PCA). The current patterns of sustainable development of tourism and the territorial inequalities at a micro-scale were assessed based on a sustainable tourism index (STI). In addition, to observe the way indicators interact and determine each other and to analyze the territorial disparities, the hierarchical ascending classification was used. The study was performed using the statistical data available at NUTS5/LAU level provided by the National Institute of Statistics. In addition, various data and information extracted from documents published by the UNWTO, National Institute for Research and Development in Tourism, the World Bank, EUROSTAT, etc., were also used. By applying an STI, the authors were able to assess the tourism development level at a national scale in Romania, delineating the most advantaged/disadvantaged areas. The analysis of sustainable tourism in Romania shows that tourism performance is more consolidated in the big cities, the Black Sea coast, the Danube Delta and the Carpathian Mountains. Studies such as the present one are meant to provide a methodological framework that will be useful to perform a quantitative assessment of the sustainable level of tourism development in terms of economic, social and environmental performance.

**Keywords:** tourism sustainability; economic; social; and environmental indicators; territorial disparities; Romania



**Citation:** Mitrică, B.; Șerban, P.-R.; Mocanu, I.; Damian, N.; Grigorescu, I.; Dumitrașcu, M.; Dumitrică, C. Developing an Indicator-Based Framework to Measure Sustainable Tourism in Romania. A Territorial Approach. *Sustainability* **2021**, *13*, 2649. <https://doi.org/10.3390/su13052649>

Academic Editors: Bart Neuts, João Martins, Milada Šťastná and John Martin

Received: 12 February 2021  
Accepted: 24 February 2021  
Published: 2 March 2021

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## 1. Introduction

More than 1.5 billion international tourists were recorded in 2019, the ninth consecutive year of growth for the tourism sector and a four percent increase on the previous year. The United Nation World Tourism Organization (UNWTO) forecasts that this figure will grow to 1.8 billion by 2030, heightening the collective need to ensure that growth and sustainability go hand-in-hand in the tourism sector [1]. However, these estimations will be subject to significant revision given the major impacts of the COVID-19 pandemic on the tourism sector [2,3]. Europe, in particular, due to its rich cultural and natural heritage, has brought tourism to the forefront, a context that drew more attention to sustainability in tourism development [4,5]. Within the EU-28 states, tourism is generally seen as a convergence factor, one of the foremost economic growth sectors [6], sustainable tourism becoming an central part of tourism planning and management [3].

The tourism industry has experienced a rapid evolution in recent decades, as it is a consequence of a higher standard of living, as well as of an increasingly stressful lifestyle, tourism being a form of leisure and entertainment. This development of tourism involves not only the expansion of areas used as tourist destinations but also the involvement of several economic factors from activities adjacent to tourism, social factors, environmental organizations, and so on. Therefore, tourism is a multi-sectoral industry that requires an organization in line with the current norms of economic development and which observes the principles of inter- and intra-generational equity as promoted by sustainable development. Nevertheless, the tourism industry is now at risk, the COVID-19 pandemic and the probability of future pandemics have raised new challenges for the development of sustainable tourism [5].

To this end, the United Nations has called for statistics to be the base of the process to define indicators for the Sustainable Development Goals (SDGs), the 17 global goals that explicitly call for more integrated policies for sustainable development [7]. An initiative entitled Towards a Statistical Framework for Measuring the Sustainability of Tourism (MST) was launched by the UNWTO with the support of the United Nations Statistics Division (UNSD). The aim was to develop a statistical framework to measure the role of tourism in sustainable development, including its dimensions—economic, environmental and social [8]. The existence and monitoring of indicators associated with the sustainability of tourism objectives is fundamental to evaluate a tourism destination in order to adopt sustainability principles [9].

Due to its economic and employment potential, as well as its social and environmental implications, tourism plays an important role within the EU. To monitor the tourism policies in Europe, the regional policy and the sustainable development policies, tourism statistics are used [10].

The sustainable development of tourism entails not only the protection of the environment, but also equal opportunities for the communities development in which the tourist activities take place. A lower degree of economic and social development of communities in tourist areas not only hinders the development of tourism but distances itself from the concept of sustainability which argues that communities must benefit from the tourism development. The involvement of the local population in the development of business in tourism and adjacent activities is a priority of sustainable development in the tourism industry. “Green” or alternative tourism is seen as a form of tourism that is different from “mass” tourism in that it does not cause environmental change [11], creating the impression that mass tourism is not sustainable tourism [12]. The development of small-scale tourism with a view to minimize negative environmental effects is not entirely possible because it is impossible to avoid these effects [12]. Environmental issues must not take precedence over other aspects of sustainable development [13]. That is why social aspects have been taken into account by many authors [14–19]. Alternative tourism must be based on the scientific literature that supports the involvement of communities in the development of tourism [20–23]. Tourism participants must consider the equal distribution of maximized economic benefits, minimizing the socio-cultural impact on host communities, as well as on tourists, together with the protection and improvement of the natural environment by way of tourism activities [24]. Therefore, the economic component, the environmental component and the social component form the complete framework of the tourism sustainable development. It is argued that the links between the tourism industry (seen as an economic activity) and the social and natural environment are reciprocal, not one-way [25]. To conclude, we share the same opinion as Ludwig et al., who stated that resource issues are not environmental issues, but rather human issues; hence, there is a need to address sustainable tourism strategies through projects on a large, regional scale (not just at the local level) [26], as well as on a multi-sectoral scale (not just strictly related to tourism) [27]. Hence, the role of tourism in territorial development is emphasized, a role that is manifested through collaboration and not competition with other economic sectors [27].

Despite the variety and complexity of Romania's natural and anthropic tourism potential, the tourism industry is not very well-developed. The arguments for this situation are different. The accession of Romania to the European Union in 2007 represented the facilitation of goods and people transportation between the states of the community space. That moment was seen by policy makers as an opportunity for the development of Romanian tourism. The Romanian cultural heritage, difficult to quantify, can be capitalized by the tourism industry [28] but, at the same time, can be preserved through appropriate forms of tourism that respect the principles of sustainable development. Globalization does not mean "cultural levelling" [29] and the Romanian space had and has sufficient ethno-cultural resources to maintain its specificity and authentic values in different regions of the country [30–33].

One direction of sustainable urban development is the creation and expansion of a smart cities network. This direction is based on identifying and developing new strategies to increase the performance and sustainability of cities. Information and communication technology contributes to this goal. Tourism is an important economic activity that must be adapted to smart development [34].

Another way of developing tourism in Romania is seen through cross-border collaboration. Such an opportunity is explored by identifying the directions of collaboration between the cities of Timișoara (Romania) and Novi Sad (Serbia) designated as European Cultural Capitals in 2021 [35].

The low performances in engendering tourist flows in Romania are attributed to the poor packaging of cultural and natural attractions [36]. On the other hand, the promotional strategies adopted by tourism development agencies were inappropriate [37].

The quality of the tourist infrastructure and the number of accommodation units are correlated with the attractiveness of the tourist objectives [38]. Tourist demand and supply are inter-conditioned, each influencing the development and evolution of the other. Thus, the tourist offer determines the tourist flow size but also the territorial disparities of these flows [39,40].

Urban sprawl has remarkable effects on the development of tourism in certain cities of Romania. The emergence of accommodation units in the suburbs can be seen as a viable alternative to city center accommodation, offering tourists a quiet location. Chaotic peri-urban development negatively affects the cultural identity of cities [41].

In the hilly and mountainous rural areas of Romania, tourism is seen as a means of economic development along with agriculture and industry. The impact of the tourism industry on the sustainability of rural localities in Romania were addressed based on three composite indices (demographic stability, public utilities and socio-economic sustainability) revealing the significant positive effect of tourism on rural areas, which translated into higher values of all analyzed indices [42].

The importance of World Heritage Sites (WHS) on the sustainable development of local tourism is discussed in the literature. The conclusion of the study is somewhat surprising; the authors considered that the presence of WHS does not generate significant differences in the tourist development of Romanian rural areas, this paper including several indicators related to the tourism impact on the local communities development [43].

The tourism activities practiced in the naturally protected areas of Romania must respect the integrity of the natural landscapes and ecological biodiversity, creating, at the same time, opportunities for the development of the community. The current stage of ecotourism development and a set of directions to guide efforts to capitalize through ecotourism areas where nature and local culture occupy a central place were approached [44]. Related to the promotion of ecotourism in Romania and its impact on the perception of the tourist has concluded that there is lack of legislative framework for green-labelling of accommodation units that can affect the destination brand in the long run [45].

Additionally, based on a tourism index, the regions of Romania were grouped into mature tourist destinations, less attractive or in the early stage, the research outlining also different actions for improving tourism competitiveness in developing regions [46].

Some papers aimed to assess the current situation regarding the sustainable aspect of the Romanian tourism market, to identify sustainably innovative products [47], to apply the concept of mosaic eco-development, which has in view the implementation of sustainable development principles to smaller areas and gradual expansion to cover the entire national territory [48].

Sustainable tourism grows in importance in national agendas for fostering economic growth, social inclusion, the protection of cultural and natural assets. The multidisciplinary Working Group of Experts for Measuring the Sustainability of Tourism (MST) requires a coverage of economic, environmental and social factors; a framework built on existing statistical standards; an integrated statistical framework focused initially on linking economic and environmental dimensions; focus on sub-national spatial scales; and the use of several indicators to assess sustainability instead of a single or composite indicator [49]. In this view, the paper aims to (1) identify the indicators needed to assess the local tourism sustainability level (NUTS5), (2) analyse the territorial disparities of the indicators employed, and (3) develop a composite index for each territorial level to measure sustainable tourism. The paper considers all forms of tourism, namely the tourism activity, in general. Due to the rapid expansion of the tourism sector, achieving a socially sustainable level of development has become more difficult [50].

## 2. The National Strategic Actions for the Tourism Sector in Romania

The statistical-territorial levels of the Romanian administrative system are NUTS 2 (eight development regions without administrative and legal status), NUTS 3 (41 counties and the Bucharest Municipality), and NUTS 5 (320 towns and 2861 communes) (Figure 1). The counties' populations vary between 226,665 inh. to 953,158 inh., while the Bucharest Municipality registers 2,133,941 inh.



**Figure 1.** Romania's administrative organization at NUTS5 and NUTS3 level.

At the national level, the Master Plan for the Development of National Tourism, 2007–2026 was put together in 2007 at the initiative of the Romanian Government. The immediate objective of this document is to create a general framework of policies for the sustainable development and management of the tourism industry regarding natural and cultural resources. The Master Plan is split up into two main parts: (1) the analysis of the

existing situation of Romanian tourism and (2) vision, objectives, and targets. The success of the tourism sustainable development depends not only on the attractive landscape and the tourist facilities but also on the competitiveness and quality of services. The vision of this strategic document is to transform Romania into an excellent tourist destination based on its natural and cultural heritage, corresponding to European Union standards regarding the supply of products and services and the achievement of the environmentally sustainable development of the tourism sector [51]. The National Strategy for the Development of Ecotourism in Romania, 2016–2020 aims to create a functional correspondence between the real premises of Romanian tourism in special natural spaces, the environmental protection requirements and the current trends of the international tourism and ecotourism market. In order to achieve this goal and its orientation towards a sustainable direction, financing mechanisms and programs for the conservation of biodiversity must be developed, the revision of the legislative instruments related to this field, awareness among the factors involved, education at the local level with the aim of orienting towards the principles of sustainable thinking and strengthening institutional capacity to implement environmental legislation [52].

### 3. Data and Methodology

The process of measuring the sustainability of the tourism sector is continuous and requires constant monitoring. For the current study, the National Institute of Statistics was the main provider of the statistical data available at NUTS5/LAU levels, the Population and Housing Censuses (2011) [53] and TEMPO ONLINE data base (2018) [54]. In addition, various data and information provided by the United Nation World Tourism Organization, National Institute for Research and Development in Tourism (INCDT), the World Bank, EUROSTAT, etc., are also employed [7,8,55–57].

The use of indices of sustainable tourism development based on indicators belonging to the environmental, social and economic component has been a pre-existing concern in this field of research [58–65]. Many of the proposed indices relied on only one of the components [66]. At the same time, international organizations such as the United Nations Commission on Sustainable Development [67], the Organization for Economic Cooperation and Development [68–70], the United Nations Environment Programme [71] and the World Tourism Organization [72] have become involved in the development of an evaluation methodology for the sustainable development of tourism.

Given the local specificity of the environmental, social and economic problems the tourism industry faces, there is no universal list of indicators used to assess the levels of sustainability of tourist destinations [73]. The World Tourism Organization encourages the development of methodologies and technologies that capture the specificities of each territory [74]. Even so, there are certain indicators that can be used in more than one case to assess sustainable tourism [75–77].

Indices were put forward (developed, created) to sum up the proposed indicators, depending on the local particularities, but methodological difficulties arose. One of these difficulties was the use of a weighted composite index (assuming a certain degree of subjectivity of the specialist who lends greater importance to certain indicators) [78–81] or the use of an unweighted composite index (considering indicators as having the same importance in the index) while maintaining a balance between indicators. At the same time, the use of a composite index compared to the use of non-aggregated indicators aims at creating an overview of the level of sustainability by using a single data set [82]. It is considered that a composite index is more than the sum of the indicators used and provides an overview of the overall picture [83]. Simple indicators are used to detect a specific impact following the measures that were taken [84]. Some papers prefer the use of simple, unaggregated indicators in an index because aggregating indicators is an arbitrary operation [85]. Another methodological difficulty highlighted the static or dynamic measurement of tourism sustainability [86]. The static measurement provides information on how the indicators used are spread throughout the territory, thus making comparisons

between destinations/tourist areas. The dynamic measurement of sustainability highlights the evolution of indicators for a certain destination/tourist area, and can be useful in assessing the direction of evolution in the sense of progress or regression to the objectives of sustainable development in tourism. This methodological difficulty is solved by proposing a composite vector index (differential dynamic index) that includes both the dynamic component and the static component [86].

The authors have developed the Sustainability Tourism Index (STI) as a composite indicator. The STI should meet some key requirements in terms of the variable selection (e.g., relevance for the territorial level, availability, data continuity, homogeneity and spatial scale) and of the provision of an exploratory analysis focused on the overall composition of the integrated indicators [87–91]. Although there are a variety of data sources, the selection of indicators encounters some limitations due to the territorial level/LAU (the lowest level) approach which restricts the database, thus making the selection more difficult. Statistics are not static; they are constantly shifting, the data series being a dynamic phenomenon. With this in mind, the user needs for data are increasing and the production methods to collect and compile statistics are exposed to exogenous events or dynamics [56].

The authors have selected 12 statistical indicators to underline the main components for tourism sustainability (Table 1).

The principal component analysis (PCA) was used to select the final indicators for STI computation. The PCA implied the extraction of a group of variables—linear combinations of the original variables together with the relations between them, having in view the hypothesis of the existence of redundant information in the plurality of relations. PCA was used as an intermediate stage, following which the Hull score was computed. The variables measuring different measurement units were initially standardized using the min–max normalization technique [91–93]. In order to observe the correlations between the variables, we examined the rotated component matrix by Varimax [94]. The question often asked in the PCA refers to the number of components to be kept. We used the graphical representation of eigenvalues, so-called “scree”, to select the principal components [95,96]. Therefore, the twelve variables were reduced to the components that most adequately explain the total variance, taking into account the correlations between the variables and removing the highly correlated ones. Finally, ten variables were selected to be used for computing the STI as a Hull score.

$$\text{STI} = 50 + 14 * (\text{ANTH-TOUR-RES} + \text{TOUR-INT} + \text{TOUR-EMPL} + \text{ACCOMM-OCCUP} + \text{WATER} + \text{NAT\_GAS} + \text{POP-DENS-POP-AGING} + \text{ACCESS} + \text{PROT-AREA})/10 \quad (1)$$

In order to observe the way in which the 10 indicators interact and determine each other, we propose the use of a methodology that would give us the possibility to visualize the whole table of indicators without uniting them in an index. We can achieve this by analyzing the proposed indicators using an appropriate methodology—hierarchical ascending classification (HAC)—so that the tourism industry reveals its essential feature—a number of environmental, social and economic factors that interact and determine each other and not just a disparate amount of factors taken separately. To assess the level of sustainable development in tourism, we used aspiration values for the indicators, depending on the characteristics of the studied area. The administrative units with similar parametric values were deemed significant and included into one and the same class to form a territorial typology. It has been noticed that this data exploration technique (HAC) enabled an easier and more accurate hierarchization of a vast amount of data [97]. Grouping the LAUs into a specific class was carried out using the nearest neighbouring method, while the individualization of the classes involved an algorithm, namely identifying pairs of neighbour elements within a set of objects so that each element of the pair should be close to the other element. Then, the nearest neighbouring elements were progressively aggregated into a joined link. Ultimately, the alternation of a similitude graph with the building of a binary tree through successive integrations was achieved, just as in the case of the successive graph method [92,93,97–100].

**Table 1.** Tourism sustainability indicators.

	Description (i), Data Sources (ii) and Measurement Unit (iii)	Acronyms	Influence of Indicators on STI	Expression of Influence
1. Natural tourism resources	(i) Complex index depending on the position on relief units, the presence of special elements of geomorphology, vegetation, fauna or hydrology and the degree of landscape attractiveness.; (ii) Ministry of Public Works, Development and Administration; (iii) unit.	NAT-TOUR-RES	If ↑ NAT-TOUR-RES, then STI ↑	+
2. Anthropic tourism resources	(i) Complex index depending on the existence of historical monuments of national interest, museums and public collections, folk art and tradition, entertainment institutions, serial cultural events; (ii) Ministry of Public Works, Development and Administration; (iii) unit.	ANTH-TOUR-RES	If ↑ NAT-TOUR-RES, then STI ↑	+
3. Relative number of accommodations	(i) Number of tourist accommodations per 100 inhabitants; (ii) NIS, TEMPOne time series; (iii) no./100 inh.	ACCOMM-NO	If ↑ ACCOMM-NO, then STI ↑	+
4. Tourism intensity	(i) Number of tourists per km <sup>2</sup> (ii) NIS, TEMPOne time series; (iii) tourists/km <sup>2</sup>	TOUR-INT	If ↑ TOUR-INT, then STI ↑	+
5. Tourism employment	(i) share of population employed in tourism out of the economically active population; (ii) NIS, Census; (iii) %	TOUR-EMPL	If ↑ TOUR-EMPL, then STI ↑	+
6. Yearly accommodation occupancy	(i) Average yearly occupancy rate of the accommodation units; (ii) NIS, TEMPOne time series; (iii) %.	ACCOMM-OCCUP	If ↑ ACCOMM-OCCUP, then STI ↑	+
7. Drinking water	(i) Total length of drinking water supply network; (ii) NIS, TEMPOne time series; (iii) km/100 inh.	WATER	If ↑ WATER, then STI ↑	+
8. Natural gas	(i) Total length of natural gas network (ii) NIS, TEMPOne time series; (iii) km/100 inh.	NAT_GAS	If ↑ NAT-GAS, then STI ↑	+
9. Population density	(i) Number of inhabitants per administrative area (ii) NIS, TEMPOne time series; (iii) inh/km <sup>2</sup> .	POP-DENS	If ↑ POP-DENS, then STI ↑	+
10. Population Aging Index	(i) Number of elderly persons (aged 65 and over) per young persons (under 15 years old); (ii) NIS, TEMPOne time series; (iii) unit.	POP-AGING	If ↑ POP-AGING, then STI ↓	-
11. Road accessibility	(i) The accessibility to the TEN-T core and comprehensiveness (gradient), combined with the accessibility to different non-TEN-T roads (motorway, European, National, County) (ii) Ministry of Public Works, Development and Administration; (iii) unit.	ACCESS	If ↑ ACCESS, then VULN ↑	+
12. Protected areas	(i) share of protected areas in relation to administrative areas (ii) NIS, TEMPOne time series, Ministry of Environment; (iii) %	PROT-AREA	If ↑ PROT-AREA, then STI ↑	+

#### 4. Results

The geographical position and three defining natural landmarks—the Carpathians, the Danube, and the Black Sea—as well as the cultural–historical background in terms of archeological vestiges, historical monuments, architecture and art, and a rich ethnofolkloric heritage, lend Romania a touristic potential of a complex and special value [101].

In 2017, the direct contribution to the GDP of the tourism sector was 2.8%, and the tourism sector employed 373,074 people [102]. In 2018, at the level of the EU-27, 64.1% of the population aged 15 or over practiced a form of tourism for personal scope, with a steep difference between 27.0% in Romania to 91.0% in Finland [103].

In 2019, Romania registered 13.37 million tourist arrivals, an increase of 10.14% over 2017, the international tourists reaching 2.68 million in 2019. The number of total overnight

stays increased by 11.04%; the number of international visitors remained constant in 2019 compared to 2017, reaching 5.29 million nights. While domestic overnight stays in accommodation units recorded an increase of 13.73% for the same period, it reached 24.79 million nights in 2019.

The values of the STI range from 54,500 in Bucharest City, the capital of Romania, and 49,284 in Gogoşu, a small commune in Dolj County. The 3181 Romanian LAUs was grouped according to STI in five classes, as follows: high class (11 LAUs representing 0.3% of total LAUs), medium-high class (93 LAUs, 2.9%), medium class (754 LAUs, 23.6%), low-medium class (2031 LAUs, 63.7%), low class (301 LAUs, 9.5%) (Figure 2, Table 2).

**The high STI degree** is characteristic for 11 LAUs, the majority being urban centers and only two large cities—Bucharest and Constanţa. Both of them register high values of anthropic touristic resources, population density and road accessibility indicators. Bucharest Municipium is the most important political, economic, financial-banking, commercial, cultural-scientific, educational, transport, informational, sports, and tourist center in the country. Constanţa, one of the most important cities in Romania, is a mix of old and new, history, tradition, and modernity, but also of summer tourism, multiculturalism, and an ethnic mosaic. In addition to the Mamaia resort, which offers countless entertainment possibilities related to its well-known beaches, there are also archaeological remains and heritage buildings. Constanţa is the only city in Romania benefiting from all modern means of transport—road, rail, sea, river, and air—and is the most important port city on the Romanian Black Sea coast. Although they have no important natural touristic resources, these two cities benefit from the extended protected areas surrounding them (e.g., Comana, Snagov, Căldăruşani, Cernica near Bucharest, in Ilfov County, and the marine protected area 2 Mai-Vama Veche and many others in Constanţa County) which attract touristic flows.

The other LAUs included in this STI category are small or very small towns (e.g., Băile Tuşand, Băile Herculane, Eforie, Călimăneşti) or large rural settlements (e.g., Buneşti, Bran and Moeciu in Braşov County). The small towns listed have a high STI degree due to the important hydro-mineral and bioclimatic resources, on the basis of which spa tourism has developed. This type of tourism is combined, in some cases, with types of active tourism (e.g., sports, leisure) or with new types (i.e., niche forms) such as tourism for cosmetic treatments or spa (e.g., Eforie). The above-mentioned rural settlements are favorable for rural tourism and agro-tourism, combined with ecotourism, as a result of the picturesque natural environment, but also combined with cultural tourism, which capitalizes on the ethnographic potential. For this last case, the example of Viscri village (in Buneşti) is highly relevant: a World Heritage Site declared by UNESCO in 1993, and since 2006, under The Prince of Wales Foundation Romania, Saxon houses from the 18th century have been restored and converted into guesthouses for tourists.

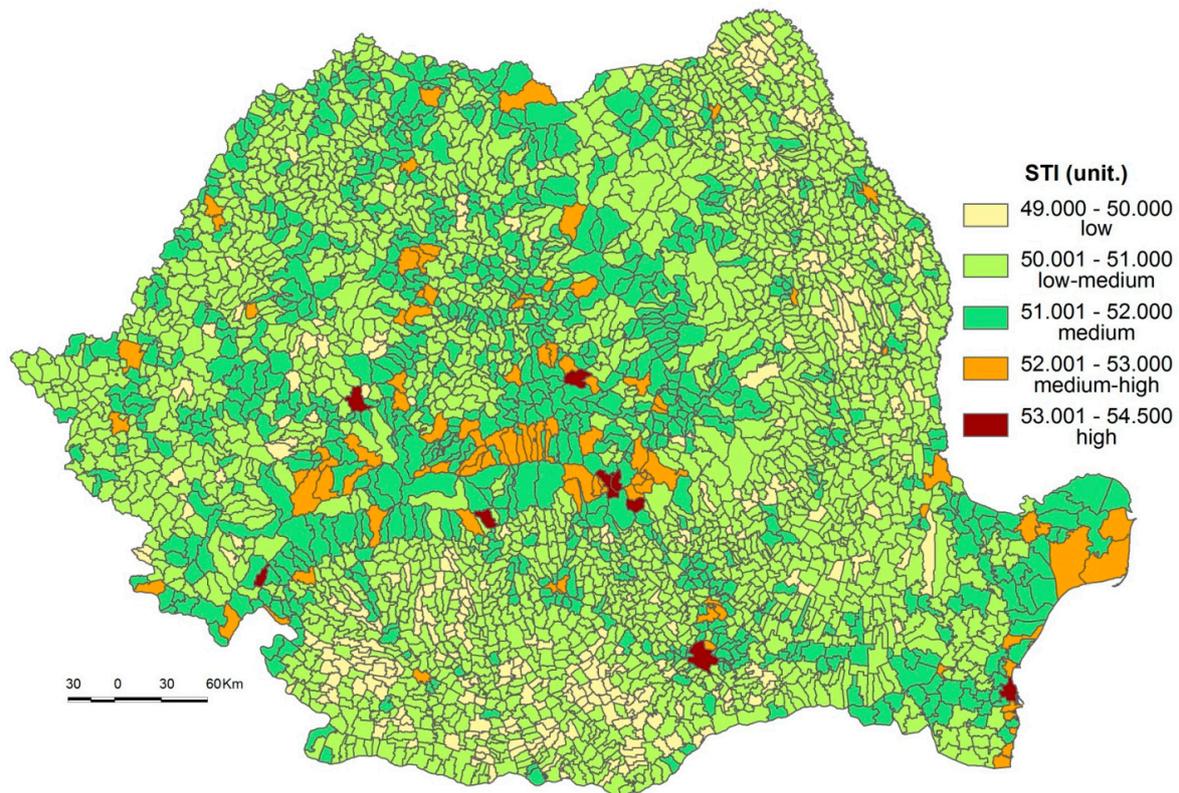


Figure 2. Sustainability Tourism Index, 2019.

Table 2. The degrees of the STI and its synthetic territorial distribution.

STI (Units)	STI Degrees	No. of Urban LAU	No. of Rural LAU	Corresponding to the Types of LAUs (HAC Method)
53,001–54,500	High	8	3	1 LAU in each of classes 11 and 12, and 9 LAUs in class 5
52,001–53,000	Medium-high	42	51	Almost half of these LAUs are assigned to class 4, followed by classes 5, 1, 9 and 11
51,001–52,000	Medium	151	594	The majority of these LAUs are included in classes 4 and 8, followed by classes 7, 14 and 10
50,001–51,000	Low-medium	119	1,912	In the north-eastern part of the country, these LAUs are included in class 1; in the south-western and western parts, those from class 10 are predominant; other LAUs are included in classes 6 and 7
49,000–50,000	Low	-	301	The majority are lying in the south-western, south and north-eastern parts, where they correlate with class 1 in Dolj County and with class 10 in other counties of this part of the country; in the north-east, the LAUs are included in class 1

The localities registering a high degree of STI are associated with the maximum values of the number of arrivals/m<sup>2</sup> and with high and average values recorded by the indicators reflecting the facilities and endowment in terms of drinking water, natural gas and sewerage networks (Figures 3 and 4). Almost all the statistical indicators selected for computing the STI registered values higher than the national average.

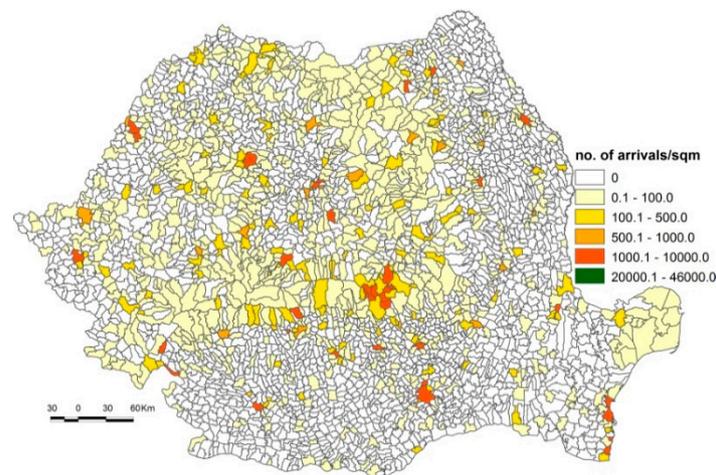


Figure 3. Tourism intensity.

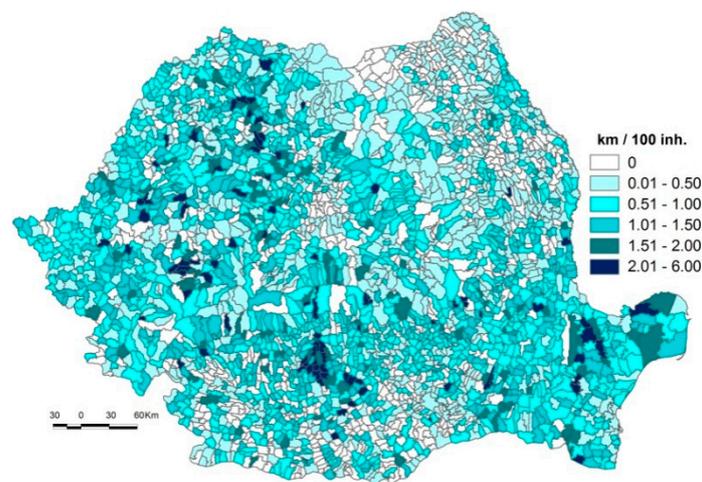


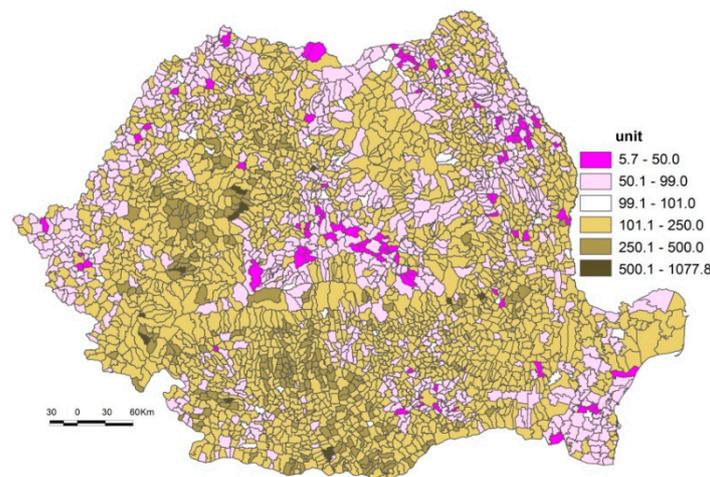
Figure 4. Total length of the drinking water supply network.

The **medium-high STI degree** constitutes a relatively balanced category in terms of rural and urban settlements, including 42 urban LAUs and 51 rural LAUs (Table 2). Almost half of these LAUs have important tourist natural resources and are mainly located in three areas: (i) the Southern and Western Carpathians and Transylvania Plateau; (ii) the seaside along the Black Sea and the Danube Delta; and (iii) a small area located in the Northern part of Bucharest (i.e., Snagov, with a protected area and important tourist endowment). Aside from these three areas, a medium-high STI degree was recorded by some country-level main cities such as Iași, Cluj-Napoca, Timișoara, Galați, Brașov, Craiova. They have important anthropic touristic resources, the values ranging from over 50 in Orăștioara commune (Hunedoara County) and Baraolt town (Covasna County), to 0 in the case of six LAUs. This indicator is linked to the high number of arrivals/ $m^2$  as shown in Figure 3, the values ranging from 5637.9 arrivals/ $m^2$  in Mangalia town, a seaside resort with a large, fine-sand beach developed for aeroheliotherapy and wave therapy, as well as with specific microclimate based on saline aerosols with therapeutic effects. The high values (over 3000 arrivals/ $m^2$ ) are also registered in some resorts in mountain (Predeal) or seaside areas (Costinești), in thermal spa resorts (Sânmartin rural LAU with its famous Băile Felix baths), or county-seat towns (Târgu-Mureș, Sibiu, Iași). The highest values of employment in the tourism industry (over 10%) are registered in Moneasa, Azuga, Predeal, Băile Olănești, Bușteni, Sovata and Sânmartin/Băile Felix resorts. Also, the road accessibility is good and the settlements along the European highways/roads are the most accessible and have the highest potential to be developed towards sustainable tourism. However, because of the

high values of population density, the indicators related to public endowment (Figure 4) (i.e., the water supply network, the natural gas network) have medium and even low values. For example, 27 LAUs do not have a natural gas supply network, and 67 LAUs have less than 1 m/inh. of water supply network length.

**The medium degree STI** is registered especially by the rural settlements (594), located in the Carpathian and Subcarpathian regions, as well as on extensive areas in the Dobrogea and Transylvania Plateaus. In this class, 151 urban LAUs are also included, out of which 20 are county-seats, which is half of the town category at the national level. The majority of the LAUs have good road accessibility and/or important natural tourist resources.

In the internal mountain depressions located in the Curvature Carpathians and in the Maramureş and Apuseni Mountains, the localities display high values of anthropic tourist resources and of accommodation occupancy rate. The anthropic touristic resources vary from the value of 66 in the town of Târgu Lăpuş, the second highest one registered at the national level and 1 in the case of 16 LAUs. The accommodation occupancy rate registered values of over the 50% in 20 LAUs, of which over 80% are recorded in Vânători, Vrancea County; Poieni-Solca, Suceava County; and Balc, Bihor County. However, 250 LAUs are characterized by a null value. In the South Dobrogea Plateau and in several localities in the Banat Mountains, there is a better situation than the national average for the drinking water network indicator (due to the fact that this indicator is in relation to the total population number, which is low, so the final values are above the national average (Figure 4), but they have several demographic imbalances, reflected by a high population aging index (Figure 5) and a low population density. The aging phenomenon, the most important change in age structure that Romania's population has faced over the past four to five decades [104], is observed in 429 LAUs from this class, representing 72.2% of the total LAUs. The population density is higher than the national average, 93.1 inh./km<sup>2</sup> [54] in the case of 217 LAUs, the highest ones being registered in populated, average-sized towns. The other indicators recorded values close to the national average.



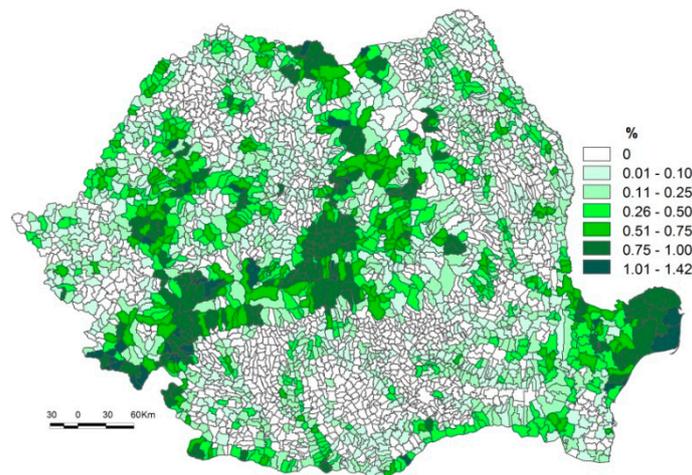
**Figure 5.** Population Aging Index.

**The low-medium STI degree** assumes that the values of the indicators are near the national average. Territorially, more than 2000 LAUs (Table 2) are scattered in-between those representing the low STI degree. This category includes the most important part of the total national LAUs (63.7%) with values under the national average. For example, 1594 LAUs have no natural gas network and 357 LAUs have no water supply network. The road accessibility, which might contribute to a sustainable tourism development, has a low or low-to-medium level in 1681 LAUs. The indicators related to tourism activity also have low-to-medium values; for example, the share of population employed in tourism is less than 1% in 64.5% of LAUs, and the highest value from this class belongs to the Brebu Nou commune (21.05%) in Caraş-Severin County; the null value of the yearly

accommodation occupancy is specific for 1623 LAUs, the rest of the LAUs ranging from 0.5% to 63.5% in Tetoiu commune and 74.4% in Măciuca commune, both located in Vâlcea County. Also, over half of the LAUs have no anthropic potential and no visitors.

**The low STI degree** includes 301 rural LAUs located mainly in the south-western, South and North-Eastern parts of Romania. The lowest values are registered by the Gogoşu commune (49.284) located in Dolj County, reaching null values of anthropic touristic resources, tourism intensity, length of drinking water supply network, length of natural gas network, share of the economically active population employed in tourism, and average yearly accommodation occupancy rate.

These low values are driven by the following indicators: the length of natural gas network and average yearly accommodation occupancy rate, which register null values in all LAUs; road accessibility, which has a value of 1, with the exception of 16 communes located mainly in the southern part of Romania; tourism intensity presents non-null values in eight LAUs only, with Poiana Ilvei commune (Bistriţa-Năsăud County) having the highest value due to the high number of tourists accommodated in tourist units; the length of the drinking water supply network also registers low values, even null in 196 LAUs; the aging index has values over the 100% in 264 LAUs; the share of protected areas varies between 0 in 205 LAUs and 0.53 in the Întregalde commune (Alba County) (Figure 6); the null value of the yearly accommodation occupancy was registered in 296 LAUs, the remaining six having values ranging from 1.2 and 7.1%; the share of population employed in tourism varies between 0 in 98 LAUs, and 2.5% in Şiştarovăţ commune (Arad County).



**Figure 6.** Protected areas.

## 5. Discussions

The typology of the LAUs associated with the sustainable development of tourism analyses the role of each selected statistical indicator in determining the final level. By using the HAC method, the Romanian LAUs are grouped into twelve classes, offering information about their influence in drawing each sustainable development level (Figure 7).

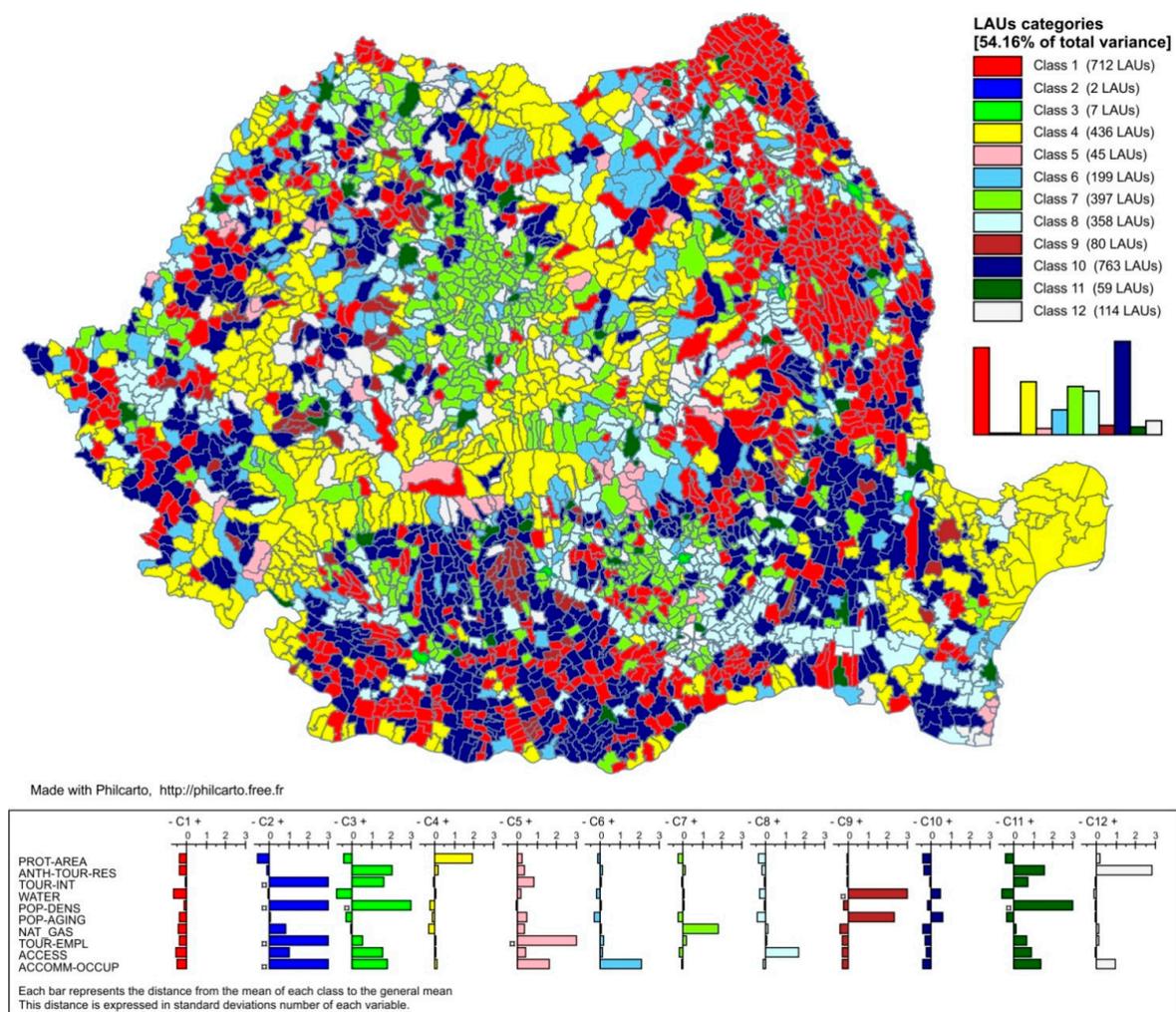


Figure 7. Types of LAUs (HAC Method).

*Class 1* includes 712 LAUs located mainly in the Moldova Region, the western and north-eastern part of the Romanian Plain, also spread to the Western Plain and Hills. The values of all indicators are below the average, the only indicator having a value near the average being tourism intensity;

*Class 2* accounts for two LAUs (Băile Tușnad and Eforie resorts) with a low touristic potential (protected areas and anthropic touristic resources), with a medium-developed water supply network and the value of the aging index close to the national average. The other indicators have values above average;

*Class 3* includes seven LAUs, county-seats (Ploiești, Pitești, Bârlad, Bacău, Brăila, Craiova, Iași cities) with anthropic tourist resources but with a low share of protected areas, with a poorly developed water supply network and with the value of the aging index close to the national average; the gas distribution network is also developed on a medium level. The other indicators have values above the average;

*Class 4* groups 436 LAUs located in the Eastern and Southern Carpathian area, the Apuseni Mountains, and the Danube Delta, along the Danube River. These localities have an important natural tourist potential, the values of the other indicators being close to the national average, except the population density and natural gas network length which are slightly below the average;

*Class 5* includes 45 LAUs, mainly resorts located in the mountain areas, such as Desna, Moneasa, Pilu (Arad County), Azuga, Bușteni, Comarnic, Sinaia, Secăria, Talea (Prahova County), Vatra Dornei, Sucevița (Suceava County), Băile Govora, Băile Olănești,

Călimănești, Berislăvești, Sălătrucel, Voineasa (Vâlcea). They have high values of employment in the tourism sector and high values of yearly accommodation occupancy. The values of the other indicators are close to the national average;

In *class 6* 199 LAUs are included, having high values of yearly accommodation occupancy. The values of the other indicators are close to the national average, except for the aging population which has values below the average. The areas where these LAUs are found are Bucovina and the south-eastern part of the Maramureș region, the Apuseni Mountains, the northern part of the Black Sea coast;

*Class 7* (397 LAUs) is characterized by a well-developed natural gas distribution network, and the LAUs are found mainly in the areas with this type of resource (e.g., the western border of Curvature Subcarpathians, the eastern border of Getic Subcarpathians, the Transylvanian Plateau, the Western Hills). The values of the other indicators are close to the national average;

*Class 8* is characterized by a good accessibility on roads, while the values of the other indicators have a very low negative impact on the degree of tourism development. The localities in this class are located mainly along the main road axes, i.e., highways A1 (functional or planned) and A2, E85;

*Class 9* includes 90 LAUs with a very well-developed water supply network and a high aging index. The population density is below the national average, the gas distribution network is less developed, and the accessibility on roads is reduced. The employment rate of the population in tourism and the yearly accommodation occupancy rate are both low. The tourist potential (natural and anthropic) is close to the national average, and the tourist intensity is around the average;

*Class 10* is the most populated with 763 LAUs which occur especially in the south-western and south-eastern parts of Romania, as well as in the western part. What sets this class apart is a well-developed water supply network and a slightly high aging index. The population density is below the national average and the tourist intensity is around the average. The values of the other indicators are below the national average.

*Class 11* groups 59 urban LAUs which are county-seat towns (29), or small towns located surrounding Bucharest City. What individualises this class is a low share of protected areas, an under-developed water supply network, a low aging index and a developed, average natural gas distribution network. The values of the other indicators are above the national average;

*Class 12* (114 LAUs) is characterized by important anthropogenic tourist resources and high values of the accommodation occupancy rate. The values of the other indicators are close to the national average.

By applying a sustainable tourism index, the authors were able to assess the tourism development level at a national scale in Romania, delineating the most advantaged/disadvantaged areas. The analysis of sustainable tourism in Romania shows that tourism performance is more consolidated in the big cities, on the Black Sea coast, in the Danube Delta and the Carpathian Mountains. Areas with STI values less than the national average, seen as sustainable tourism disadvantaged areas, are located mainly in the eastern and southern parts of Romania, the western part being characterized by a low-to-medium development level. The main factors behind the high sustainable tourism development are explained by the indicators related to the high level of anthropic and natural potential, tourism activity indicators, as well as by technical–urban infrastructure (Table 3).

**Table 3.** Average values of indicators: differences to national average.

INDICATORS	National Average	LAUs Below the Average, No. (%)
ANTH-TOUR-RES	5.05	1881 (59.1%)
TOUR-INT	55.4 tourists/km <sup>2</sup>	2904 (91.3%)
TOUR-EMPL	1.92%	2635 (82.8%)
ACCOMM-OCCUP	38.98%	3072 (96.6%)
WATER	0.38 km/100 inh.	1241 (39.0%)
NAT_GAS	0.02 km/100 inh.	2311 (72.5%)
POP-DENS	93.1 inh./km <sup>2</sup>	2486 (78.1%)
POP-AGING	112.2%	1320 (41.5%)
ACCESS	1.9	1386 (43.6%)
PROT-AREA	0.16%	1390 (43.7%)

The reverse situation is valid for the indicator which reduces the level of social development (e.g., population aging index). According to the average SDI value, 23.5% of the total rural LAUs fall into the category above the average value, while 76.5% fall into the category below the average value.

## 6. Conclusions

Under the increased demand for more diverse and attractive tourist facilities and services, the development of tourism in a sustainable manner has gained increasingly more attention in the recent years. However, the difficult-to-appreciate effects of the COVID-19 pandemic have significantly affected tourism, thus providing new challenges for sustainable tourism development in the future [1,2,4]. In this context, studies such as the present one are meant to provide a methodological framework that will be useful for the quantitative assessment of the sustainable level of tourism development with the economic, social and environmental performance.

As revealed by the present study, anthropic potential, protected areas, as well as tourism intensity, accommodation occupancy and population employed in tourism are the foremost factors that influence tourism sustainability. The dwellings quality (e.g., the length of the drinking water supply network, the length of the natural gas network) is also an impacting factor on the level of tourism sustainability. Road accessibility is also strongly interrelated to this issue, as is the lack of accessibility to the main tourist attractions and the quality of transport infrastructure which both have a major impact on territorial synapses (development corridors) that link growth poles at different territorial levels.

The STI has the potential to draw out meaning from large amounts of data in order to evaluate and project the sustainable performance of a destination in a comprehensive manner so as to be useful for planning and management. The STIs would be able to identify key areas that have the prospective for sustainable development and areas less suitable for tourism development.

Despite the fact that tourism has substantial economic benefits for the receiving regions, it may also affect the social and cultural values of the resident population. Calculating and visually displaying the STI for each of the NUTS5/LAU levels, the paper results could foster the dissemination of this information in the management of tourism destinations in Romania. As the sustainability of local destinations becomes increasingly important, the integration of national and local policies is seen as indispensable to maximize the contribution of tourism to the objectives of Agenda 2030. This study provides useful spatial data for further in-depth studies to be carried out at different spatial scales.

**Author Contributions:** Conceptualization, B.M. and P.-R.Ş.; Data creation, I.M. and N.D.; Formal analysis, I.M., N.D., I.G. and M.D.; Investigation, P.-R.Ş., N.D., I.G., M.D. and C.D.; Methodology, B.M., P.-R.Ş. and I.M.; Software, B.M., M.D. and C.D.; Supervision, B.M.; Visualization, I.M., N.D. and I.G.; Writing—original draft, B.M. and P.-R.Ş.; Writing—review & editing, B.M. and I.G. All authors contributed equally to this paper. All authors have read and agreed to the published version of the manuscript.

**Funding:** This paper comprises the results of the HORIZON 2020 Project Social and Innovative Platform on Cultural Tourism and its potential towards deepening Europeanisation (<https://cordis.europa.eu/project/id/870644> (accessed on 11 November 2020)): ID 870644, funding scheme Research and Innovation action, call H2020-SC6-TRANSFORMATIONS-2019.

**Institutional Review Board Statement:** Not applicable.

**Informed Consent Statement:** Not applicable.

**Data Availability Statement:** Data sharing not applicable.

**Acknowledgments:** Research-work for this paper is also part of the Institute of Geography research plan “Regional geographical studies in view of sustainable development and trans-sectorial cooperation”.

**Conflicts of Interest:** The authors declare no conflict of interest.

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