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Assessing the tourism sustainability of EU regions at the NUTS-2 level with a composite and regionalised indicator

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Abstract: Sustainability in the tourism sector has become a principal goal for destination management and for the strengthening of the competitiveness and attractiveness of destinations (Bell & Morse, 2012). There is, however, no absolute scale of spatial analysis for sustainability. In this paper, we propose regions as a unit of analysis. Our empirical approach aims to assign regional variability to an already existing and commonly used national indicator, making it possible to achieve a good compromise between data availability and the need to have access to universally comparable data while embracing the value of scaling down the monitoring process to consider detail at a more local level. The advantage of such an approach is that it combines the rich set of information from existing indicators with the wide availability of quantitative regional indicators freely obtainable from official statistical sources, such as Eurostat or ESPON (European Spatial Planning European Network). Our paper develops an application using the Tourism & Travel Competitiveness Index framework as a starting point, creating regional sustainability indicators for the 281 NUTS-2 regions (territorial units for statistics) in Europe. The first contribution of this approach is the regionalisation of a national indicator that allows monitoring of not only the individual level of sustainability of a destination, but also its standing among every other European region. The second is the creation of a practical tool that is able to continuously monitor and benchmark the sustainable development of EU regions, thereby supporting stakeholders in their decisionmaking processes

Keywords: Tourism Sustainability Indicators, Regional Sustainability, Environmental Indicators, Regionalisation, NUTS-2

JEL Codes: L83, Q01, Q56, R11, R58, Z32

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Introduction

Following Brunddland's (1987) original intuition, sustainable tourism development should strive to align the paths of tourism consumption, production and management that pursue a dynamic balance between human development and environmental protection, and at the same time, succeed in guaranteeing intra- and inter-generational equity (WCED, 1987; Wu, 2013). Sustainable tourism development refers to the necessity of taking the current and future impacts of tourism into account, while also paying attention to the needs of visitors, the tourism industry, the environment and host communities (UNEP & UNWTO, 2005).

Therefore, sustainable tourism development calls for greater responsibility and awareness concerning the impact that tourism can have on the fragile environmental, economic and social balances that characterise every tourist destination (Bramwell & Lane, 1993; Butler, 1999; Dodds, 2007; Dubois, 2005; Gunn, 1994; Klein-Vielhauer, 2009; Tanguay et al., 2013).

However, pursuing these objectives is only possible when the previously mentioned stakeholders are equipped with adequate support tools (Butler 1999). In fact, one of the main challenges posed by the concept of sustainable tourism is seeking operational methods through which tourism sustainability can be tangibly assessed and sustainability objectives transformed into concrete actions (WTO, 2004; Parris & Kates, 2003; Tanguay, 2013; Bramwell et al., 1998; Castellani & Sala, 2010; Choi & Sirakaya, 2006; Clarke, 1997; Dodds, 2007; Ko, 2005).

The efforts undertaken in recent decades by prestigious international organisations, as well as through numerous studies, in the development of sustainable tourism assessment indicators have certainly sought to respond to these needs (WTO, 1996; European Commission, 2009; UNWTO, 2004; UNWTO, 2019; Miller, 2001; Fernandez and Rivero, 2009; Singh et al. 2009; Torres-Delgado & Saarinen, 2013; Lee and Hsieh, 2016).

Although they are still in an early stage of development, indicators are important tools for the assessment of tourism sustainability (Mikulić, 2015; CIT; Ko, 2005 Sirakaya et al., 2001; Ko, 2005; Agyeiwaah et al., 2017; Asmelash & Kumar, 2019; Rasoolimanesh et al., 2020). They have been widely used to compare sustainability between different destinations (Cernat & Gourdon, 2012; Blancas et al., 2015; Lozano-Oyola et al., 2019), as well as to plan and create policies to support more sustainable tourism development Stoeckl et al., 2004; Morrey, 1997;UNWTO, 2004; Karnauskaitė et al., 2018; Lozano-Oyola, Macarena, et al., 2012; Nesticò & Maselli, 2020).

In developing and applying these indicators of tourism sustainability, attention has been focused on either the supranational, national scale (Hall, 2011; Church, 2004; Ateljevic et al., 2017) or a strictly local scale (Choi and Sirakaya, 2006; Logar, 2010; Nok, Suntikul, Agyeiwaah, & Tolkach, 2017; Önder et al., 2017)

However, little attention has been given to the regional scale and to the development of regionalised indicators of tourism sustainability.

This is surprising given the important role this scale of analysis can play in achieving the aforementioned objectives of a more tangible and relevant assessment of the sustainability of

tourism, as well as the growing importance that regional governments are assuming in tourism policies.

The well-known Agenda 21, for example, is a global strategy that recognises the active role of regional and sub-regional governments in sustainability issues. To this end, the Sustainable Development Commission (CSD), established in 1992, was explicitly charged with monitoring progress in the implementation of Agenda 21 recommendations at international, national and regional levels.

Focusing on more recent events, the importance of the regional dimension has also been made clear in the United Nations' Sustainable Development Goals (SDGs) 2015–2030. In particular, "Partnerships for the Goals" emphasises that a successful sustainable development agenda requires partnerships at the global, national, regional and local levels". Furthermore, the recent Paris Agreement (2015) that deals with climate issues underlines that adaptation is a problem concerning the regional and subnational dimensions and thus is a fundamental point of reference for the achievement of its objectives.

The reasons for paying greater attention to the regional scale in the case of tourism are numerous. Among these, the need for a more thorough examination of the problems and effects associated with sustainable tourism is undoubtedly highlighted. By looking at tourism sustainability through a regional lens, as opposed to a national or local lens, a much clearer assessment of limitations can be provided. This is because the national or local scale is too fragmented, or simply cannot encompass a wide range of effects (Wu, 2013).

However, an interest in the regional scale may also arise from the advantages that can be obtained through the involvement of regional stakeholders in the implementation and use of methods for assessing the sustainability of tourism (Briassoulis, 2002; Mowforth & Munt, 2009; Simpson, 2001; Budeanu et al., 2016). Local governments have a detailed understanding of how tourism interacts with the local environment and, consequently, can more accurately identify necessary intervention strategies (Elliott, 1997). They can then design and implement regulations in the sphere of tourism, manage tourism development plans and take charge of environmental assessments and monitoring (Dredge & Jenkins, 2007; Dredge & Moore, 1992; Hunter, 1995; Jackson & Morpeth, 1999) by driving a sustainable development agenda in tourism destination contexts (Ruhanen, 2013; Nunko & Smith, 2013; Brokaj, 2014; Denman, 2003).

The advantages of involving governments and local stakeholders in addressing sustainability issues can also extend to the specific design and use of monitoring indicators (Manning, 1999; Dimoska & Petrevska, 2012; UNEP, 2009; Asmelash & Kumar, 2019; Bell & Morse, 2012; Mayer, 2008). As argued in Ramos (2009), the development of indicators is not simply a technical and scientific issue, but should also aim for public participation, particularly when operating at levels (e.g., regional or local) where a nuanced knowledge of a territory is primarily held by local stakeholders. This involvement should also concern the construction and implementation of sustainability assessment tools (Manning, 1999; McCool et al., 2001; Ramos, 2009) that take advantage of the insights that tend to characterise local stakeholders, such as extensive knowledge

(Timothy, 1998) and the ability to evaluate local phenomena, identify priorities and set new scenarios (Fraser et al., 2006; Ko, 2005; Jones et al., 2019).

Research focused on the development of tourism sustainability indicators should therefore continue to explore methodologies and technical solutions in order to achieve the broadest system for evaluating tourism sustainability. This should be able to support stakeholders operating on subnational, regional and local scales, as well as facilitate their effective and active involvement in the implementation of sustainability policies (Blaschke, 2006; Giampietro, 1994; Munda & Saisana, 2011; Budeanu, 2016; Hall, 2001; Botequilha Leitao & Ahern, 2002).

Following these introductory considerations, this paper seeks to demonstrate how important it is to adopt a regional perspective and how such a perspective can be supported by a set of regionalised indicators of tourism sustainability. However, in order to develop indicators of regional sustainability, a number of known complications need to be addressed, including the availability of data, the credibility of information and the ability to be understood by users, as well as the ability to convince the broadest pool of stakeholders to use the proposed indicators, thus avoiding repeating previous misuse.

Consequently, this paper also provides a practical methodology for creating sustainability indicators on a regional scale that utilises those on a national scale, with advantages in terms of data collection. This will also help realise a system of national, regional and local indicators for assessing tourism sustainability that work harmoniously together. To that end, we focused on the regionalisation of the Tourism and Travel Competitiveness Index (TTCI), developed by the World Economic Forum to measure the set of factors and policies that allow the sustainable development of the travel and tourism sector, which in turn contributes to the development and competitiveness of a country (WEF, 2019). This index allows different variables to be taken into consideration, grouped (Lopes, Muñoz, & Alarcón-Urbistondo, 2018) and recomposed. Since it is being adopted by different countries globally, it allows for the standardisation of the evaluations of the performance of destinations (Andrades & Dimanches, 2017; Pérez León, Victor Ernesto, et al.; Croes & Kubickova, 2013). The creation of a regionalisation of the TTCI will enable the exploitation of the useful properties of this index (Lopes, Muñoz, & Alarcón-Urbistondo, 2018; Fernández et al., 2020; Dias, 2017), use already available data or, if necessary, the creation of proxies that can be easily traced back to the original structure of the index, while promoting a more coherent framework between national and sub-national indicators.

The paper is organised as follows. First, we focus on the reasons behind the use of a regionalisation process in the field of tourism sustainability, together with the main barriers to creating sustainable indicators, as well as describing the advantages of adopting NUT-2 regions as a unit of analysis. Secondly, we describe the method of creating indicators at the scale of regionalisation, not only from a theoretical perspective, but also through the concrete application of sustainable tourism development models to case studies in member countries in the European Union (EU). Furthermore, we analyse a specific online tool that facilitates the co-creation and integrated use of these indicators among stakeholders. The paper concludes with some possible applications of the presented regionalised indicator systems for tourism development policies.

1 Theorical Background

The objectives of inter-generational equity and attaining balance between society and the environment, which comprise the concept of sustainability, have a spatial dimension. This is especially evident in tourism, given that the exploitation and consumption of tourism resources necessarily takes place in specific areas, environments or sites. The identification of the spatial dimension, however, is not a simple task. In fact, the field of action and the boundaries of the effects of individual sustainability systems may not coincide spatially and may change over time. Furthermore, a system, such as a social system, can be influenced by certain local factors as well as by others of a global nature.

Similarly, the ecological system of a site may seem delineable if we only consider the elements that constitute that site. However, the site could also be influenced by other more distant exogenous factors that, if considered, will lead us to broaden the field of investigation, resulting in much wider ecosystem boundaries. We are therefore faced with real complex spatial systems characterised by geographical spaces with specific boundaries whose spatial scales can vary considerably (from local to global), thus giving rise to hierarchies of spatial systems (Niu et al., 1993). As Wu (2012) has noted, sustainability is effectively "multiscaled and hierarchically linked in space and time".

Sustainability is a place-based phenomenon. People's skills, knowledge and preferences can influence approaches to sustainability (Barca, 2009; Grenni et al., 2020). Measuring the sustainability of a territory is crucial not only for policy-makers who need to drive the sustainable development of an administrative area, but also for investment or business activities in different sectors, including tourism. In particular, policy makers often demand indicators and aggregate indices that support their decisions and strategic views, and measurement systems that can be easily understood and shared with a non-expert audience (Böhringer and Jochem, 2007). Moreover, politicians, managers and the general public need some form of comparative assessment of the single units involved in the context of sustainability, often requested in the form of a ranking of territories (countries, regions, cities) for territory planning (Carrillo & Jorge, 2017). In order to measure sustainability and to gain insight into the assessment of sustainability in diverse territories, the use of indicators has been widely applied both by international organisations and by the academic community. Indicators and systems of indicators are recognised as appropriate tools for assessing achievements on the path towards sustainable development (Mayer, 2008) and represent valuable quantitative tools for decision-making (Bell and Morse, 2012).

Nevertheless, developing a system of indicators and indices to monitor tourism sustainability is a complex and ambitious effort for both researchers and policy makers

(Blancas, González, Lozano-Oyola & Perez, 2010; Blancas, Lozano-Oyola, González & Caballero, 2016; Buckley, 2012; Castellani & Sala, 2010; Hezri & Dovers, 2006; Kožić & Mikulić, 2014; Lozano-Oyola, Blancas, González & Caballero, 2012; Marzo-Navarro, Pedraja-Iglesias &

Vinzón, 2015; Miller, 2001; Perez et al., 2013; Roberts & Tribe, 2008; Tanguay, Rajaonson, Lefebvre & Lanoie, 2010; Torres-Delgado & Saarinen, 2014).

Many proposals have been made in the last few decades by national and international bodies and in the scientific literature regarding the criteria for creating indicators used to measure territorial performance, sustainability and competitiveness (Lopes, Muñoz, & Alarcón-Urbistondo, 2018).

Critical issues concerning sustainable tourism indicators

The primary purpose of indicators is the creation of information that is methodologically and scientifically valid, easy to put into practice and shareable. Measurability is an essential condition for the creation of indicators and indices. The creation of value from data needs to be verified in accordance with the conditions of the indicator (Torres-Delgado & Saarinen, 2014) when determining data availability. In addition to measurability, usability is another primary condition for the creation of a) a simple indicator able to detect tourism impacts and apply solutions and b) complex indicators (created by the combination of simple indicators) that are useful for reflecting a more comprehensive situation (Rivero & Fernández, 2008). Measurability and usability are related to critical issues, such as data selection (e.g., the type of data and any spatial or temporal issues), the imputation of missing data, methodological choices made when collecting and analysing data, weighting and normalising measures, transparency and, finally, visualisation of the results (Organisation for Economic Co-operation and Development, 2008). One of the methods to ensure those preconditions is utilising theoretical frameworks developed by international organisations, such as the World Tourism Organization or the European Commission, to replicate or develop a "certificated" indicator system that aids in the selection and combination of variables (Tanguay, Rajaonson & Therrien, 2013). Such organisational schemes represent frameworks for indicator systems that allow different ways (and measures) to approach a given phenomenon and many simple indicators based on what needs to be studied (Castro, 2004). Despite these universal frameworks, however, both scientific committees and destination managers still have not determined how many indicators an indicator system should have to best evaluate and monitor tourism impacts.

Indicator conditions

There is no universally accepted method for measuring tourism sustainability, but there are some primary conditions (Bell & Morse, 2003; Ivars, 2001; White et al., 2006) and two approaches (Rametsteiner, Pülzl, Alkan-Olsson, & Frederiksen, 2011): the scientific approach, which includes a large amount of information, and the policy maker approach, which is designed for a specific territorial area through a participatory model.

The goal of a sustainable system of indices and indicators is achieved by keeping in mind the criteria of transparency, adaptability, comparability, temporality, spatial representation, frequency, cost efficiency, usability, availability and shareability (Torres-Delgado & Saarinen, 2014; Blancas et al., 2016). As the experience of Tudorache et al. (2017) has shown, after a participatory process

exploring the relevance and adoptability of the indicators in the tourist destination of Braşov County, the committee that collaborated to develop the European tourism indicator system (ETIS) discovered that data were not available for all the selected indicators.

Data availability and interpretation

As mentioned previously, one of the main preconditions in creating indicators is measurability, which is strongly interrelated with data availability, data collection methods and the types of data sources (such as official datasets following a particular data-sharing standard, or unofficial sources, such as an unstructured dataset). Since sustainability is a vast concept encompassing many aspects, data typically need to be collected from various public and private bodies to include additional data sources and more varied information from different perspectives on the same phenomena. Typical data sources include national, regional and local institutes of statistics, tourist offices, tourism observatories, water/energy/air quality agencies and others.

Data that are discontinuous in terms of temporal features (e.g., information not updated) and spatial features (e.g., gaps in territory coverage), or where different methods for data collection were used, or that have different protocols for sharing (e.g., open data and creative commons standards, raw datasets, or fuzzy information), and the fragmentation or incompleteness of the required information, can present issues for the operability and interconnectivity of data, causing a data bottleneck in the creation of comparable indicators. This data bottleneck can also be due to using datasets that are generated by different departments (with different potential biases) that are non-uniform or out of date (as in the example shown by Torres-Delgado & Palomeque, 2014). As affirmed by Tudorache et al. (2017, page 8), the availability and accessibility of statistical data are not only crucial for the development of concrete, measurable and precise indicators but are also part of creating an "essential condition for the development of forecasts and strategies for sustainable development of tourist destinations".

Another critical issue regarding data and indicators is related to the interpretation of the information and the results themselves. It is still unclear whether an index should be evaluated with another indicator representing a limit or a threshold, monitored over a period of time (months, tourism seasons, or years), or compared with other data from similar or neighboring destinations. Periodic calculation of the indicators enables monitoring of situations, identifying trends and tracking the evolution of sustainable conditions (Torres-Delgado & Palomeque, 2014); however, this is also influenced by data availability and the frequency of data updating.

Bell and Morse (2003) proposed a comparative approach to the interpretation of the results, focusing on determining comparative levels of sustainability based on current qualitative data (concerning greater or lesser degrees of sustainability) rather than adopting absolute numbers and indicators. Although various indicator systems have been proposed, Tanguay, Rajaonson and

Therrien (2013) have noted some significant limitations for practical application, since they only allow a partial comparison between case studies.

Destination context and typology

Tourism sustainability indicators and indices are often seen as serving different purposes that are related not only to monitoring the social, economic and environmental dimensions of sustainable development, but also the destinations' uniqueness and specific tourism externalities, such as overcrowding and deterioration of the flora and fauna in a natural ecosystem. Destinations have differential characteristics based on geography that allow the classification of tourist environments into categories such as urban, coastal, mountain and rural. It is reasonable to conclude that each destination should have its own indicator system that is characterised by the peculiarities of its territory, history, culture and type of tourism (e.g., leisure or business). Consequently, the selection of the relevant indicators has to be a flexible process that is appropriate for the peculiarities of each destination (Tudorache et al., 2017). In addition to the peculiarities of a destination, internal and external contexts can also influence destination sustainability, as emphasised by Peeters et al. (2018) in their study on overtourism.

However, limiting monitoring to a local level could be in opposition to the principle of a large sustainable development plan that considers sustainability to be a widespread purpose (as formulated in Agenda 21 for the travel and tourism industry regarding the priority "to fix realistic indicators), that is applied at the local and national levels for assessing and monitoring progress in sustainable tourism development" (WTO, 1996, page 15). Despite the ultimate goal of global and holistic sustainability, a focus on the local scale can be justified in terms of governance (Choi & Sirakaya, 2006; Valentin & Spangenberg, 2000).

The assessment of sustainability through indicators must strike a balance between different destinations' contexts and scales through the usability of various indicator systems presented to policy makers and administrations. Some negative impacts of tourism or best practices of sustainable tourism actions could have local effects but fall under national or regional legislation, as some tourism infrastructures and facilities managed by national or subnational territorial entities can have serious impacts and effects locally.

Global, national or local scale

There is therefore no absolute scale for the spatial analysis of sustainability. Rather, there is a need to identify units of analysis capable of representing relatively isolated levels, each operating at distinct temporal and spatial scales (O'Neill et al. 1989).

Trying to delineate geographical boundaries to measure sustainability in a destination is not a simple task. Production and consumption related to tourism often take place at the local level (Palomeque, 2004), so it seems reasonable to quantify tourism impacts and sustainability at this level. This level can allow a more precise evaluation of territorial diversity, but it is still difficult

to define the geographical limits of a "tourism spatial area" (identified as the smallest level where tourism is significant) that "might be applicable in its entirety to a certain regional and/or sub-regional administrative entity, but more often it is likely that it might not cover a single municipality, nor an entire region" (INRoute, 2017, Durán, 2008).

A limited level of analysis allows monitoring of the destination through both a quantitative approach and qualitative measures, such as distributing surveys to visitors, residents and tourism businesses. These qualitative analyses are recommended by one of the most important indicator systems, the European Tourism Indicators System for Sustainable Management (ETIS), at the destination level. According to Tudorache et al. (2017, page 5), "ETIS is a flexible system, offering a high degree of freedom to the destinations that aim to implement it at the municipality level, which are later transferred to the county and national statistics", but this freedom has both pros and cons. Its positive aspects are linked

to the personalisation of the indicator system's destination characteristics and data, as well as the number of surveys and studies available for addressing different temporal levels. The negatives include the flexibility of data collection and the inconsistencies in adopting transparency and comparability conditions, especially regarding qualitative analysis through surveys or questionnaires.

Furthermore, monitoring a tourism destination at a local scale could present challenges related to collecting, reporting and publishing statistical data (which are often available only at a national scale or are inaccessible to stakeholders, researchers and the public) and the frequency of survey updates. Customisation of indicators and measures in the analysis stage is definitely more convenient to more effectively monitor a destination's performance and sustainability but has limitations when there is a need for comparison and benchmarking between destinations (which, as we have seen, is an essential condition of indices and indicator systems).

On the other hand, assessing sustainability at a larger level (e.g., regions or countries) could be imprecise due to the individual social and spatial characteristics of these territories that could be too diverse and complex for comparison (Lee, 2001); however, doing so is easier in terms of data availability. Nevertheless, the concept of sustainability involves a holistic perspective, including large-scale impacts such as climate change, pollution and soil consumption issues. Some authors thus argue that assessments of sustainability should consider a large territory, even at a national or international scale, to enable a global approach to tourism sustainable development, management and monitoring (INRoute, 2017).

Finally, Schianetz et al. (2007) have argued that the most appropriate scale for a comprehensive assessment of tourism sustainability is a single destination under the control of a local authority or a municipality, because this is the level at which regional planning, management and regulation take place (Torres-Delgado & Saarinen, 2014).

2. Regionalisation of tourism sustainability indicators

Drawing on the reconstruction proposed by Tosun and Jenkins (1996), a region is a large expanse of land with relatively homogeneous characteristics and defined boundaries. However, it is also defined as a spatial unit characterised by its own original environment (e.g. geological or climatic) that is redefined by human intervention. A region is also a distinct part of a country or continent occupied by people united by certain common affinities, such as religion or history. It can also be the result of a process called regionalisation, which can be based on scientific approaches or result from a political decision. It can therefore represent an administrative area or a regional or cultural unit.

Regions are also decision-making centres. The regional levels are represented by institutional bodies with regulatory and political power. They are regions whose borders are decided on a political basis, allowing the incorporation of sustainability into political decisions, including at the local community level (Devuyst, 2001). They are thus entities that have the tools to transform the aforementioned potential of the local community into something more concrete. Areas smaller than the regional unit, although they may be representative of the community, do not have such implementing power. In many countries, regions are in charge of tourism planning, management and industrial development.

In addition, regions represent areas capable of explaining the tourist phenomena as a whole (Lohmann & Beer, 2013). The regional scale can help overcome the limitations of an analysis on a national or local scale, which is often too fragmented or unable to consider wide spatial range effects. Furthermore, it makes it possible to take into account compensatory and multiplicative effects. A particular landscape or site can cause negative effects (externalities) in neighbouring areas that a local scale analysis would most likely fail to detect. At the same time, some phenomena could be incorrectly categorised as inconsequential and below certain tolerance thresholds if calculated on a site-by-site basis, but could result in a categorisation of "unsustainable" if the region is considered as a whole. Regions are tourist destinations. Increasingly, the development strategies of tourism companies are based on the expansion of the business ecosystem, which leads to a spatial expansion of tourism offerings. The spatial diversification strategies used to compensate for any excess pressures that tourists exert on local communities are well known (Butler, 1999).

Regionalisation is therefore a process that aims to identify one or more areas as separate entities and depends on the criteria used (Tosun & Jenkins, 1996). If the criteria are relevant to aspects of tourism development, the region can be called a tourist region. The term regionalisation can also refer to the process of acknowledging the role that specific areas of a country can play in pursuing certain political and administrative activities and functions. A region in this case is the result of a political project shifting decision-making to the regional level by promoting collaboration and cooperation (Prokkola, 2007). In our paper, we propose regions as a unit of analysis. The reasons for choosing this unit of analysis differ, since they are based on the limits and appropriate precautions that should be taken into consideration in order to analyse the issue of tourism sustainability indicators outlined above. In particular, besides overcoming the different limitations of an analysis on a national or local scale while describing tourism sustainability, finding a good balance between too fragmented or wide-ranging variables and adopting a regional point of analysis allows for the creation of more relevant indicators, adding new and more detailed information that is useful to policy makers and stakeholders in addressing the sustainable development of a region (Figure 1). The critical issues concerning tourism indicators can take advantage of the ability of the regionalisation process to smooth difficulties, especially regarding:

- data availability. While national information is easier to collect using open statistical datasets, local data are sometimes difficult to find, and the collection phase is very time-consuming, involving face-to-face or email contact with private employees or the public.
- data representativeness. Using different data sources to build the same indicator for different destinations sometimes makes comparability challenging, and indicators are customised based on the characteristics of a specific territory.
- qualitative analyses, which are difficult to run in a national context (especially regarding visitors' or residents' perceptions), can sometimes include significant biases. It may be easier for regions to develop qualitative analyses, especially when seeking to involve tourism stakeholders and public authorities who will use the results to make strategic decisions.
- usability of indicators. Obtaining relevant information and new values from indicators that can enable evaluation of the performance of territories is typically difficult to achieve due to the multidimensional nature of the (destination) system, which usually provides conflicting data across different dimensions (Rowley et al., 2012). In this case, a regional approach can provide more insight for policy-makers compared to a national approach, and can amplify measures at the local scale, improving the effectiveness and efficiency of these policies and governance of the destination.



Figure 1 Indicators regionalisation process and benefits taken from other geographical level

Many widely adopted indicator systems have limitations or critical issues, as explained above. In fact, only a few of these have a regional focus of analysis, and this is a significant omission because regions often play key roles as tourist destinations, and many are exemplars in the area of tourism management (Garín-Muñoz & Moral, 2016). Taking up the argument of Nijkamp et al. (1991), regions (in our case identifiable with NUTS-2 administrative borders) can be considered suitable units for the assessment of sustainability due to their relatively open and specific circumstances (i.e., availability and use of natural resources and socio-economic capital, environmental vulnerability and resilience) and their authority in managing common environmental assets and resources.

In terms of data sources and data usage (in this case, the focus is specifically on European countries), there is a high availability of data at the regional (NUTS-2) level, which offers a reference and connection point for data collection. Other territorial and landscape units suffer from data shortages and are based on valuation methods determined through a top-down approach (Riley, 2001). The use of data at this spatial unit helps overcome this shortcoming and facilitates the construction of sustainability indicators. In addition, the regionalisation method is based on the principle of data availability using open statistical data from all the countries in the EU, collected in an open dataset on the Eurostat website. Comparability is another key factor of this regionalisation; it develops single and complex indicators for 281 regions in Europe and offers a monitoring system on an international (European) scale.

European Regions

Within the European Union, regionalisation has led to the identification of specific territorial units within its borders to which funds and financial responsibility can be allocated. As Prokkola (2011) argues, regions in Europe are now strategic actors in national and transnational political arenas and can pursue their own specific interests. Nevertheless, on closer inspection, we are faced with the identification of spatial units that unite different objects on the basis of a criterion, which in turn will depend on the objectives of the analysis or the aims of an economic policy.

In our paper, we refer to NUTS-2 regions as the unit of analysis. The NUTS-2 regions are identified in accordance with the regionalisation process established by the European Union, which leads to the NUTS classification (nomenclature of territorial units for statistics) of the European economic territory of the EU and the UK for the purpose of the collection, development and harmonisation of European regional statistics. The NUTS classification is therefore hierarchical and divides each member state into territorial units with a NUTS level of 1, 2, or 3. The administrative units existing in the member states are the first criterion used for the definition of territorial units. For this purpose, "administrative unit" means a geographical area with administrative authority that has the power to make administrative or political decisions for that area within the legal and institutional framework of the member state. The average size of the class of administrative units in terms of population is considered to determine the NUTS level classification for a given class of administrative units of a member state. In this work, we consider the NUTS-2 level, which identifies the basic regions for the application of regional policies.

3. Materials and Methods

One of the most acclaimed and internationally recognised measures is the Tourism and Travel Competitiveness Index (TTCI), developed by the World Economic Forum (WEF), which measures different factors and policies that evaluate both the travel and the tourism sectors in different countries worldwide (Crotti & Misrahi, 2015). In general, it is widely praised for its comprehensive nature, in terms of both the range of variables covered and its grouping or dimensionality (Marti & Puertas, 2016; Webster & Ivanov, 2014; Wu, Lan, & Lee, 2012). Many authors currently consider the TTCI, published since 2007, as one of the most complete measures (Ivanov & Webster, 2013; Marti & Puertas, 2016; Webster & Ivanov, 2014; Wu et al., 2012) to better understand tourism dynamics due to its multifaceted and holistic nature (Blanke, Chiesa, 2013; Croes & Kubickova, 2013; Crotti & Misrahi, 2015). Nevertheless, the current literature focuses on the methodological improvement of these indicators (Pulido-Fernández & Rodríguez-Díaz, 2016; Wu et al., 2012), and this paper focuses on a possible improvement regarding the regionalisation method of this index for the analysis of sustainability at a regional level.

The aim of this research is to present a regionalisation process for the TTCI indicator system that contributes to an approach that is able to mitigate the critical technical issues previously presented by focusing on an intermediate level of territory analysis (regional areas). A ranking of EU territories at the NUTS-2 level will be obtained based on their relative level of tourism sustainability, which has been visualised using an online and open tool that can serve as a starting point to define improvement strategies at the regional level. The indices are presented through a geographical visualisation of the regional indicator values embedded in a user-friendly dashboard that allows the user to compare similar, neighbouring, cross-border or non-heterogenous destinations.

We decided to regionalise the TTCI index, rather than merely adopting a regional framework, for three main reasons. First, we believe that measuring sustainability is complex and that it should account for several dimensions. However, it is unlikely that all the necessary indicators will be available from regional data sources, such as ESPON or Eurostat. In our view, it is better to build an index that includes all the necessary dimensions, even though some of them will have only national variability, rather than having a fully regional index that fails to account for some relevant aspects. Unfortunately, there is a trade-off between information availability at the regional level and the quantity and quality of the available information. Second, different dimensions of the sustainability index are likely to have different intrinsic variability. In other words, it is not possible to measure everything at the regional level, and some indicators used will necessarily have just a national level variability, such as the ratification of environmental treaties (B9_05). Third, we chose to build our index based on the TCCI structure, improving it by adding regional variability, rather than defining our own index because the TTCI represents a benchmark to measure competitiveness in the tourism and travel industry, and is constructed taking into account all the relevant dimensions.

Finally, regionalising the TTCI means maintaining multilevel methodological continuity in the construction of the structure of sustainability indicators. This makes it possible to avoid the creation of subnational indicators that are too different from one another and from national indicators. This translates into a more systematic and standardised construction of the indicators and the associated data and dimensions, facilitating their understanding and application by users.

Data

We collected data from several sources. First, we obtained data from the national Tourism & Travel Competitiveness Index (TTCI) (—Crotti & Misrahi, 2017) from the World Economic Forum (WEF) for the year 2017. Then, we collected information at the NUTS-2 level from Eurostat and the ESPON (European Spatial Planning European Network) databases for the same year. The WEF collects information directly from key stakeholders and professionals in travel and tourism to understand competitiveness in that sector. The TTCI is published every two years and is used to compare 140 countries and understand the factors and policies that can promote sustainable development within the travel and tourism sector. Eurostat provides statistics about

various aspects of European countries' socio-economic conditions. Data are collected for various years and allow in-depth investigations at different territorial levels. Our analysis is focused at the NUTS-2 level in order to provide a good balance between information availability and the territorial level of analysis. Finally, the ESPON database stores different types of data and data-related functionalities from various sources relevant to territorial analysis and monitoring. Data and indicators collected from ESPON during previous programming periods have been harmonised according to international statistical standards and are available at the NUTS-2 level. Our final database contains information regarding 281 European regions in the year 2017.

Methods

Our empirical approach aims to assign regional variability to an existing indicator. The advantage of such an approach is that it combines the rich set of information gained from existing indicators with widely accessible quantitative regional indicators that are in turn freely available from official statistical sources such as Eurostat and ESPON.

We propose to use one or more regional variables to assign a weight to each component of a national indicator. Our approach can be summarised by the following steps: (i) identification of the national-level indicators that should be regionalised—in some cases, regional variability may not exist (e.g., indicators related to the enactment of national legislation); (ii) identification of the most relevant regional proxies for national-level indicators; (iii) regional weight calculations; and (iv) use of regional weights to assign regional variability to the national indicator.

The weights are constructed as follows:

$$w_{rt} = \frac{X_{rt}}{\overline{X_t}}$$

 X_{rt} represents an indicator of interest for region r at time t, and

$$X_t = 1/R \sum_{r=1}^{n} X_{rt}$$

is the average across regional values during time t. These weights will be equal to 1 for a region at the average of the distribution of X, and will be above 1 for regions located above the average of X. Similarly, the weights will be below 1 for regions located below the average of X. After obtaining the regional weights, we used them to construct a regionalised indicator as follows:

$$I_{rt} = w_{rt}I_t$$
(2)

 I_t represents the national indicator and I_{rt} its regionalised version.

We propose an empirical application using the TTCI, one of the most important indicators of the competitiveness of tourist destinations at the national level. The TTCI can be divided into 14

pillars, one of which is related to environmental sustainability; we decided to apply our method to this pillar. However, it must be stressed that our approach is completely generalisable to other TTCI pillars and to other indices.

In order to select the most appropriate proxies to construct regional weights we proceeded by consulting the most relevant data sources containing information about socio-economic and demographic characteristics at the NUTS2 level (Eurostat and ESPON). Then we selected the variables that, among the available ones, were more similar to the national dimensions used to construct the sustainability index from the TTCI indicator. Our sustainability indicator is composed of 10 dimensions, as described in Table 1: i) stringency of environmental regulations; (ii) enforcement of environmental regulations; (iii) sustainability of travel and tourism industry development; (iv) particulate matter concentration; (v) environmental treaty ratification; (vi) baseline water stress; (vii) threatened species; (viii) forest cover change; (ix) wastewater treatment; and (x) coastal shelf fishing pressure. The regional variables used to build weights, as described in the previous equations, are listed in column 3. From the above-mentioned data sources, we were able to find valid proxies for four dimensions of the TTCI. The remaining dimensions (from 5 to 10) are unweighted but are also used for constructing the composite index. When more weighted variables are available, the final weight used is obtained by averaging the available information. The final sustainability index, called Sust_r, is obtained as the average of the 10 dimensions described in Table 1.

TTCI (WEF)	DESCRIP TION	TTCI (REGIO NAL)	REGIONAL WEIGHTS	YEA R	SOURCE	VARIA BILITY
B9_01	Stringency of environmen tal regulations	B9_01r	Coverage rate of municipal waste collection	2017	Eurostat	NUTS-2
B9_02	Enforcemen t of environmen tal regulations	B9_02r	Patents in green technologies per capita	2017	ESPON Database	NUTS-2
			Average patents in green technologies per capita	2017		NUTS-2
			Energy indicators	2017		NUTS-2
			Wind energy potential	2017		NUTS-2

Table 1. Regionalised environmental sustainability indicators and data sources

B9_03	Sustainabilit y of travel and tourism industry developmen t	B9_03r	Arrivals of tourists/km ²	2017	Eurostat	NUTS-2
			Nights spent/km ²	2017		NUTS-2
			Arrivals of tourists/1000 people	2017		NUTS-2
			Nights spent/1000 people	2017		NUTS-2
B9_04	Particulate matter (2.5) concentratio n	B9_04r	Number of heating degree-days	2017	Eurostat	NUTS-2
B9_05			Environmental treaty ratification	2017	WEF	NUTS-0
B9_06			Baseline water stress	2017	WEF	NUTS-0
B9_07			Threatened species	2017	WEF	NUTS-0
B9_08			Forest cover change	2017	WEF	NUTS-0
B9_09			Wastewater treatment	2017	WEF	NUTS-0
B9_10			Coastal shelf fishing pressure	2017	WEF	NUTS-0
		Sust	Regional environmental sustainability index, 1–7	2017	Own calculations on the basis of Eurostat, ESPON, WEF and other sources listed below	NUTS-2

The method of regionalisation proposed in this paper, and in particular the validation of the proxies of regionalisation used to characterize the national-level indicator of every single EU region, were validated by applying a matrix of correlations between subindexes. The two sets of subindexes were composed of the TTCI dimension related to environmental sustainability at the national level, and our regionalized indicators which were also aggregated at the national level. The results show

that the correlation between national and regionalized indicators is very high (higher than 85%) demonstrating the appropriateness of the proxies used for regionalization. On the other hand, the correlation between different dimensions is low (lower than 35%), meaning that the indicators used capture different dimensions of environmental sustainability.

4. Results and Discussions

The 2017 TTCI report "Paving the Way for a More Sustainable & Inclusive Future", focused on the goal of attaining a more sustainable and inclusive travel and tourism industry through the calculation of 90 indicators to analyse environmental sustainability (including a dedicated session inside the report). This included social and economic pillars that represent some aspects of destination sustainability. Moreover, WEF's concept of sustainable competitiveness in its report focuses on "the notion that, although competitiveness can be equated with productivity, sustainable competitiveness can be linked to a broader concept that focuses on aspects that go beyond mere economic outcomes to include other important elements that render societies sustainably prosperous by ensuring high-quality growth". It also states that "the concepts of competitiveness and environmental sustainability are linked at both the country and the firm level" (Schwab & Sala-i-Martin, 2014). In this framework, what we have presented is only the indicator system of environmental sustainability, but the entire regionalised system can also be calculated following the same methodology to obtain social and economic insights in order to monitor tourism sustainability in Europe at the regional level. In addition to the environmental aspects of the TTCI, it is also possible to regionalise the other three tourism subindices of the national indicator system, taking into consideration the tourism and travel policy and enabling conditions, the infrastructure and natural and cultural resources. These four subindices are divided into 14 pillars with a total of 90 individual indicators that could be regionalised following the presented methodology.

As previously highlighted, regions often play a key role as tourist destinations, and many have competencies in the area of tourism management. The regionalised method presented above can offer valuable insights on sustainability levels at a regional scale and develop a specific focus of analysis that is able to assist policy makers and stakeholders. In particular, starting from a globally recognised system of indicators at a national scale, it is possible to move down one level for the same variables without using new pillars or indicators that take new aspects into consideration. Including a regional perspective in the sustainable indicators makes it possible to transfer the positive aspects of a larger scale of analysis, especially regarding data availability, possibility for benchmarking and comparability. Regionalization, being on a lower administrative level than the national scale, does mean a more detailed comparison is feasible, and the strategic information to transfer to stakeholders is more impactful and able to address sustainable development actions. The process of regionalising indicators is conducive to the practical purpose of monitoring and acting; it is potentially more connected to the local scale of the analysis and is closer to the destination's characteristics and the visitors' and residents' needs. In this context, we focused on trying to solve some frequently encountered problems related to missing data at the local level,

which is too often solved by weighting and correlation among the variables or customisation of the indicators based on accessible data, which in turn leads to overestimation and unsound results (Mendola & Volo, 2017). The introduction of a level between the national and local scale thorough the regionalisation of indicators could develop possible solutions to the critical issues described above pertaining to the representation of the destination context and the destination typology, as well as data and information interpretation. These methods of addressing critical issues when creating indicators are also significant as they can be used for benchmarking, as well as for understanding the applications and implications for policy and strategic actions.

Monitoring and benchmarking

The development of a regionalised indicator system for the 281 European regions following the methodology described earlier, allows for the inclusion of the social and economic variables represented in the TTCI, as well as the environmental dimension shown in our research. This is done at the European, national and regional scales making it possible to monitor the overall, as well as the specific, situation of different territories (with single indicators). The monitoring process could be developed year by year, offering a temporality of observations thanks to the open datasets utilised that are updated every year or more frequently. This monitoring at a large-scale level (by including all the regions), can be useful for controlling European sustainability standards or, by grouping together some regions, can be used to analyse specific territories (e.g., North, South, East, West and Central Europe) to guide European funding to certain areas. In addition, one major potential benefit of this system is the high level of comparability due to the large geographical coverage of the datasets. Various comparative analyses can be conducted to benchmark territories, such as the following:

- a comparative analysis between similar destinations in terms of types of offerings (e.g., urban destinations, rural territories, coastal regions);
- a comparative analysis between cross-border regions for international benchmarking;
- a comparative analysis between regions belonging to the same overall tourism destination (e.g., the Alps, the Mediterranean coast, the Balkans) for inter-regional benchmarking; or
- a comparative analysis between competing regions (working in the same tourism market and offering similar products and services).

One of the major challenges for this research is the representation and sharing of the results of this massive matrix of 281 regions with approximately 90 indicators in total. As emphasised, communication and usability are key conditions in the design of indicators, and the ultimate purpose of these indicator systems is the participation of stakeholders, who will use the indices for new policy and development plans. Geographical visualisation, the creation of an online platform for data visualisation and the downloading of data and results are good-practice approaches to

solving this problem. The creation of an interactive dashboard allows regions and pillars to be monitored over the course of years, producing rankings to detect the best and worst European regions and benchmarks between regions and territories, thus enabling the transmission of simpler and more practical indicators to stakeholders (Figure 2). The regionalised indicators system was tested on the entire European territory and on selected tourism regions in the Mediterranean area of the EU (MED) to evaluate its effectiveness.



Figure 2 Map and interactive platform of the regionalised indicator of the travel and tourism industry development $(B9_03r)$ in 281 European regions, year 2017.

Applications

The presented regionalised sustainable indicator system and the regionalised competitiveness and attractiveness indices (following the same weighting rules) have been tested in several circumstances where the comparability of regions and the necessity to create a widespread monitoring process based on common data and data availability were essential. These experiences have been informed by some preconditions drafted by the European Union in the context of the Interreg Programme, in which transferability is a key asset for cooperation between states and territories and outputs must be reusable, following the criteria of a) comparability of data and information, and b) reliability of data and information. The regionalised indicator system was

applied in two different European projects ("Shapetourism¹" by Interreg Mediterranean and "Blutoursystem²" by Interreg Italy-Croatia) for different purposes. *Shapetourism* aimed to improve the tourism knowledge framework by providing analytical and operational tools to drive and monitor sustainable growth in tourism throughout the design of a decision support system, including regionalised indicator systems. *Blutoursystem*, on the other hand, focused more on the education of tourism stakeholders (with the aim of developing new offers of creative and sustainable tourism) using regionalised indicators during some learning activities, such as living labs and roundtables (Figures 3 and 4).



Figure 3. The regionalised indicator of stringency of environmental regulations for the MED regions in the Shapetourism platform, year 2017



¹ https://shapetourism.interreg-med.eu/

² https://www.blutoursystem.eu/

Figure 4. Benchmarking between Italy-Croatia territories (in red) and the Andalucía region (in yellow) in terms of regional sustainability in the Blutoursystem project, year 2017.

Another application of the regionalised indicator system at the NUTS-2 level involves the number one Italian region in terms of tourist arrivals, Veneto, which through a participation process developed a new tourist strategy and development plan in 2018 called -in Italian - Piano Strategico di Sviluppo del Turismo (PSST)³ (Figure 5). Sustainable development of tourism in the Veneto region constitutes the fundamental and regulatory objective of PSST (Regione Veneto, 2019, page 7) and was explored through focus groups and public meetings where the overall situation and specific indices of the region's sustainability were compared with those of other European regions. Finally, one other Italian region, Puglia, developed a regional tourism observatory including regionalised indicators of sustainability with a focus on temporality (changes year by year) and spatiality (comparing Puglia with other regions) (Figure 6). It did this using a monitoring system developed through quantitative and qualitative research, reports, a focus on tourism flows, destination performance and new trends, including the regionalised indicator system.



Figure 5. Regionalised sustainable indicator comparing the performance of Veneto with other regions. Tourism strategic plan (PST) Veneto Region with indicators for the year 2017.

³ <u>https://pstveneto.questlab.it/</u>



Figure 6. Benchmarking between the Catalunya, Alentejo, Puglia and European and Mediterranean averages. Puglia Region Observatory. Indicators for the year 2017.

Purposes and policy implications

The regionalised indicator system offers a different method of analysing EU tourism dimensions with valuable information for managing and addressing the tourism development of the entire European Union as well as individual territories and regions. One of the first suggestions based on the overview of the levels of sustainability and competitiveness for all the regions is that the European Union should start planning investments and development projects to raise standards of sustainability in regions that value it least. This is already encouraged by European collaboration projects that, with the presented tool, could receive more direction regarding how and where to spend money on developing regional sustainability besides focusing on less developed areas. A second practical aspect that was detected is that in some European countries, tourism is a regional domain managed by both municipal and regional administrators. Some tourism macro-subjects are under the authority of the regions, such as mobility, health, cultural and natural heritage preservation and education. This system can help regions to develop assets themselves or ask private stakeholders for collaboration and inclusion.

Finally, since sustainable tourism development is driven by indicators that are able to monitor the negative impacts of tourism on a destination (Dubois, 2005; Dymond, 1997; Hughey et al., 2004; Manning, 1999; Twining-Ward & Butler, 2002; WTO, 2004), a regionalised indicator system for the entire European territory helps to emphasise the stability or the weaknesses of a region and indicates a lack of resilience or an inability to adapt to change, resulting in vulnerability to unexpected events, crises or disasters (De Sausmarez, 2007), such as the recent COVID-19 pandemic (Galvani, Lew & Perez, 2020; Jones & Comfort, 2020; Higgins-Desbiolles, 2020).

5. Conclusion, Limitations and Future Research

The sustainability of tourism is a challenge that involves all levels of government, and consequently has to be equipped with ad-hoc assessment tools calibrated on different spatial scales. The use of different spatial hierarchies of analysis allows for the detection of effects and phenomena related to tourism sustainability that would otherwise not be possible to identify using a single scale of analysis.

Monitoring the sustainability process of tourism on a regional scale can help overcome the limits of analysis that such monitoring faces on a national scale, which is sometimes too broad to evaluate local phenomena, identify priorities and set new scenarios. At the same time, it also contributes to overcoming the limits of monitoring at a local scale ,which is often too fragmented or simply unable to take its wider context into consideration.

However, the construction of indicators at a regional level in the field of tourism sustainability requires knowing how to work with practical and methodological complications that have not yet been resolved. In particular, this concerns the availability of data, the representativeness of the indicators obtained, as well as the need to contribute to the development of a harmonious multilevel system of indicators. This facilitates the understanding and application of the multilevel system of indicators by the broadest pool of stakeholders, regardless of the territorial level of belonging.

This paper proposes a methodology to overcome all these difficulties. It is premised on the idea of reaching a regionalization of national indicators and thus allowing multi-level methodological continuity in the development of the structure of tourism sustainability indicators between different levels of government. To this end, we have focused on the regionalization of the Tourism and Travel Competitiveness Index (TTCI), developed by the World Economic Forum to measure the set of factors and policies that enable the sustainable development of the travel and tourism sector, which in turn contributes to the development and competitiveness of a country. This index was found to be valid for our purposes as it considers various variables and dimensions useful for the representation of tourist sustainability that can be easily grouped and reassembled. As it is adopted by several countries globally, it allows for the standardization of destination performance assessments. Furthermore, limitations in finding missing data at the regional level of the various dimensions are overcome by the indicator. This is because quantitative regional indicators are widely and freely obtainable from official statistical sources, such as Eurostat or the ESPON

Programme. Where it is not possible to find data on a regional level, proxies can be used which allow the original structure of the index to be maintained.

The regionalised method presented above can offer valuable insight into sustainability levels on a regional scale and develop a specific focus of analysis that can assist policy makers and stakeholders. In particular, starting from a system of indicators that are focused on a national scale but are recognized worldwide, it is possible to go from the level of the national to the regional using the same variables without being obliged to use new pillars or indicators. All of this with the possibility of benchmarking and comparability between a large group of regions on a global level. Our approach allowed us to obtain a ranking of territories across the EU at NUTS-2 level based on their relative level of tourism sustainability, which was visualized using an online and open tool that can serve as a starting point for defining improvement strategies at regional level. The indices are presented through a geographic view of regional indicator values embedded in a user-friendly dashboard that allows the user to compare similar, neighbouring, cross-border or non-heterogeneous destinations.

The usefulness of this system of regionalized indicators was recognized by the EU which supported its dissemination and application in two European Territorial Cooperations during the years 2019-2020. The dashboard is now used by over 80 European regions.

In the development of regionalised indicators and their operational application just mentioned, the need for knowledge and transferability of insights has also emerged through the design and implementation of sustainability assessment tools that are able to engage tourism actors. Territories, regions and communities require research, multi-scale analysis and information that can guide decision making, policy development and participation through user-friendly platforms (similar to the platform we have presented) to facilitate multilevel operational interaction among stakeholders.

Nevertheless, the use of this regionalisation method has its limitations. One such potential limitation of our analysis is related to the inclusion of average values to calculate weights. The average is sensitive to the size of the sample, and this could lead to imprecise estimates for our weights. However, we must say that the magnitude of this bias is unlikely to be very large given that many of the indicators used rely on aggregated data at the regional level that are indeed obtained using very large samples. Another concern may be related to the presence of outliers (i.e., exceptionally large or small values) to which the mean is sensitive. In order to account for this, and following the same strategy used for the national TTCI index, we excluded values above and below the 95th and the 5th percentiles of the distribution when calculating average values. A final limitation is that the final sustainability index is obtained as the average of the 10 dimensions described in Table 1. Adopting this method, we implicitly assign the same relevance to each dimension. Indeed, some dimensions may be more important than others for tourism sustainability, but we believe that assigning equal weights represents the most conservative approach when additional information is missing. We may further investigate this issue in future developments

arising from this paper. However, in our view, the most reliable method to address these concerns would be to conduct an ad hoc survey among experts in the tourism sector. In addition, a next step would be to examine the choice of other types of indicators that are crucial for monitoring at the regional level, but are not as important at the national level. Finally, the utilised TTCI indicators were initially designed to facilitate comparisons between countries, and their application to regions requires an in-depth analysis of which variables are crucial at the country level and which are unnecessary at a regional level.

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