# SmartCulTour Platform final guidelines

Smart**CulTour**

**Smart Cultural Tourism as a Driver of Sustainable Development of European Regions**

Deliverable
D5.4

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This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No.870708

# Deliverable D5.4
# Title: SmartCulTour Platform final guidelines

**Due date:** June, 2021

**Submission date:** June, 2021

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**Dissemination Level**

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|---|---|---|
| ☒ | **PU:** | Public |
| ☐ | **CO:** | Confidential, only for members of the consortium (including the Commission Services) |

# Abstract

The main purpose of the SmartCulTour Decision Support System (DSS) is to define an engaging model for a more systematic representation of analysed data and for visualizing statistics to increase understanding about the impacts of cultural tourism.

WP5 aims at developing a web application to display traditional and non-traditional data sources, to help entrepreneurs, policy makers and academics make decisions. Data can arise from (inter)governmental agencies, academic sources, private companies, social media extractions, open data retrieved from the web and they can concern indicators on environment, economy, social interactions and culture. Where necessary, data will be anonymized and harmonized in order to be treated as standardized open data.

WP5 receives inputs from WP4 (assessment of cultural tourism impacts) and WP2 (theoretical development) and provides output to WP3 (state-of-the-art of cultural tourism policies) and, particularly, WP6 (Sustainable Cultural Tourism Living Laboratories).

The DSS is served via a web interface, making it accessible through a web browser from a proper device connected to the Internet, without the need to install any software.  Data are visualized on a map in the form of areas or points; to obtain more information the user can further explore the data by displaying charts or tables on demand. It is possible to make comparison between items on the same map. The responsive approach allows the DSS to be also explored on mobile devices.

# Contents

# 01 The DSS in action

The SmartCulTour DSS, developed within WP5, aims at visualizing indicators and bridging the gap between indicator collection and destination management. The final users will be entrepreneurs, policy makers and academics, which will work on both traditional and novel data sources.

The SmarCulTour DSS is devised to be thoroughly open and highly adaptable. Its content is primarily grounded in a user-friendly set of data visualizations, which is encapsuled within an aesthetically pleasing, intuitive layout. In order to provide maximum usability, the DSS layouts is structured making use of web widget technology as its core component.

## 1.1. Web Widgets

Web widgets are reusable, stand-alone Web applications that do not require site-specific compiling. In other words, they are a specific set of Web applications that can be embedded within a website without changing its code framework in its entirety. Thus, widgets are increasingly widely adopted because of their flexibility, which allow users to easily interact with content in a fast and playful manner. They are also visually versatile in that they can integrate multiple functionalities within the individual layout of a single web page. Accordingly, they can serve purposes as diverse as visitors counters and daily weather reports.

Within the context of the SmartCulTour DSS, widgets allow to promptly connect to the plethora of data sources made available via data visualization. In this way, users are able to control the flow of information and to actively mould it according to their individual needs. Additionally, thanks to their integration within the DSS highly interactive layout, users are able to add, zoom in, and delete widgets at will, thereby creating their own preferred interface.

Lastly, the implementation of the DSS within the SmartCulTour official website is itself achieved by using a specific typology of widget, called iFrame. This grants easy-to-use integration of all DSS functionalities within the same platform, thereby simplifying and optimising the operations of dissemination and content outreach.

## 1.2. Layout Adaptability

The DSS website is specifically designed to be as flexible as possible. Its layout is swiftly adaptable to both data formats and data sources feeding the platform. It has a versatile structure, which can be easily adjusted to support both pairwise and multivariate comparisons, on the basis of both the selected visualization tools and the provided indicators. In the first DSS online implementation, a pilot set of six data visualization tools will be available, which will be later integrated with a larger list of more elaborate typologies.

Due its very nature, the DSS layout already fully supports swift interchangeability across multiple geographic locations – be they within the city, regional, or living lab contexts.

Thanks to its widget technology core, users can select up to thirty simultaneous views to be included in a single layout, thereby making use of data and data visualizations tools to create their own storytelling experience. Thus, it is not the webmaster to be ultimately in charge of the UX / UI aspect of the platform, inasmuch as the users have virtually full control over the content they need to visualize, consistently with a thoroughly non-hierarchical, bottom-up approach.
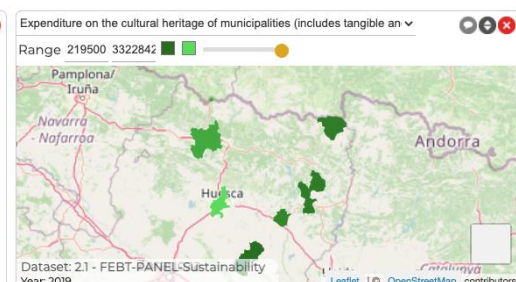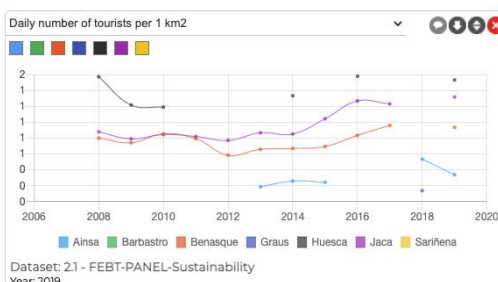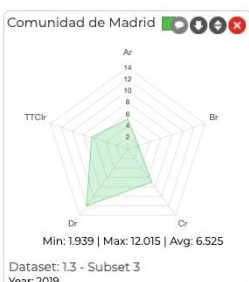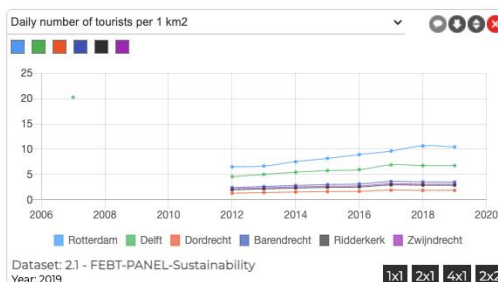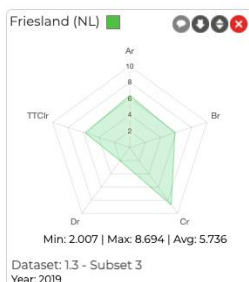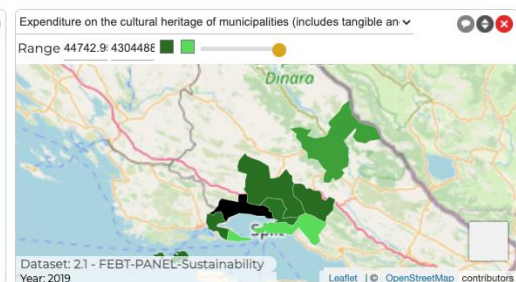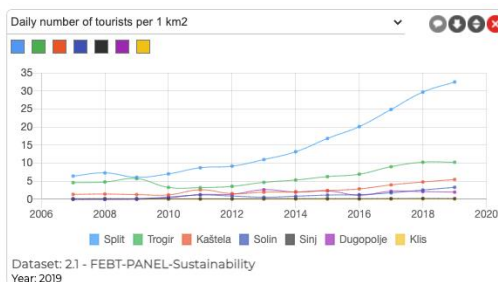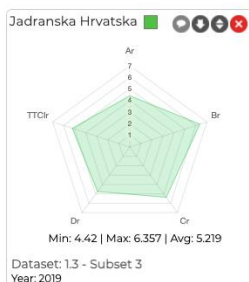


## 1.3. A DSS Walk-through

Upon accessing the SmartCulTour Platform section on the smartcultour.eu official website, users are presented with a scrollable landing page, which – footer aside – comprises four main components:

– A six-seconds-long opening video / header featuring a moving map of Europe, on top of which a set of regionalised indicators of cultural resources are graphically superimposed.
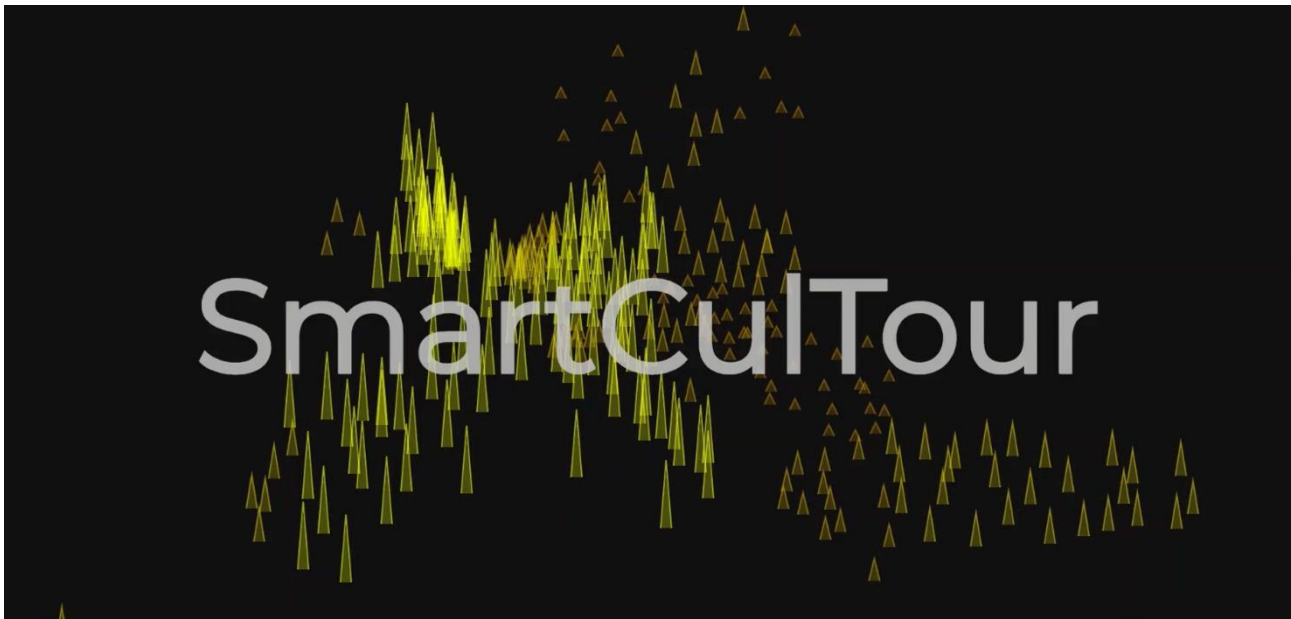


– A short summary describing SmartCulTour's main features and intents.



Welcome to SmartCulTour

SmartCulTour (Smart Cultural Tourism as a Driver of Sustainable Development of European Regions) is a four-year project, funded by the European Union in the frame of Horizon 2020, grant agreement number 870708. The goal of SmartCulTour is to support regional development in all European regions with important tangible and intangible cultural assets, including those located in rural peripheries and the urban fringe, through sustainable cultural tourism.

– A dashboard selection horizontal navigation menu.
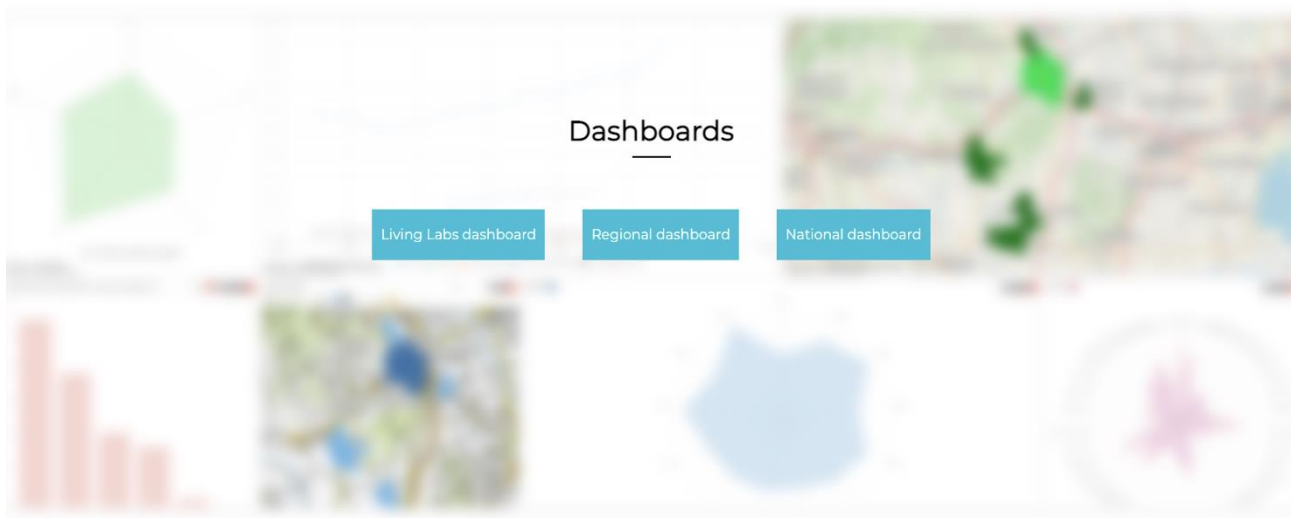
– A closing section crediting all the partners involved in the project by integrating their respective institutional logos.



In the upcoming second online implementation of the DSS platform, new features will be implemented to support the functionalities of the landing page. Specifically, a novel set of data visualizations will be included as a new page placed in between the dashboards page and the landing page itself. The purpose of these new data visualizations will be that of presenting a series of both high level and composite data sources. As compared to those presented in the Dashboards pages, in these visualizations the interactive components will be reduced, in favour of a series of more visually sophisticated views, which will be less granular and yet more elaborate from an analytical standpoint.

Within the landing page, users' attention is naturally drawn to the Dashboard selection menu, via which users can directly filter the typologies of dashboards they have access to, on the basis of a few intuitive geographic categories.

Once the category is selected, the corresponding dashboard opens up in a new webpage, where a series of preset data visualizations is presented as widgets. Users can then edit and control most of the elements presented within this environment. They can, for instance:

    – Change the provided indicator by making use of each widget's dropdown menu.
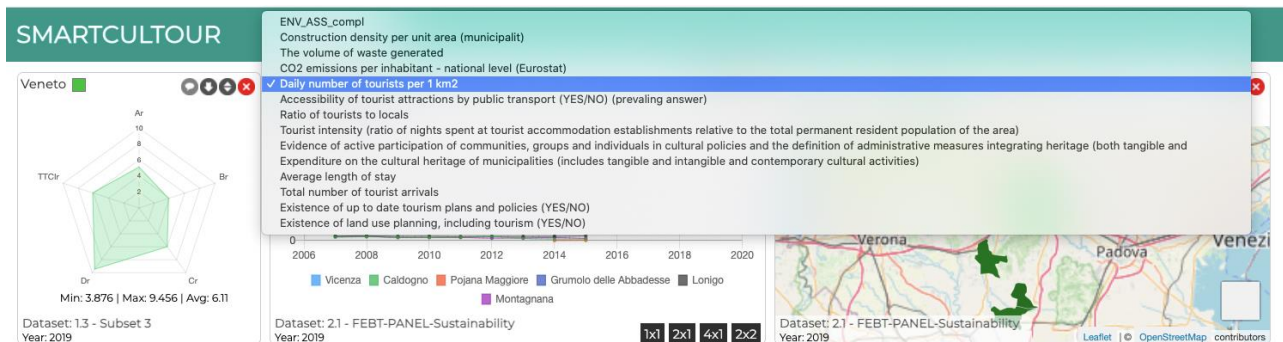


    – Filter out some of the entries in order to display data regarding their own city / municipality.
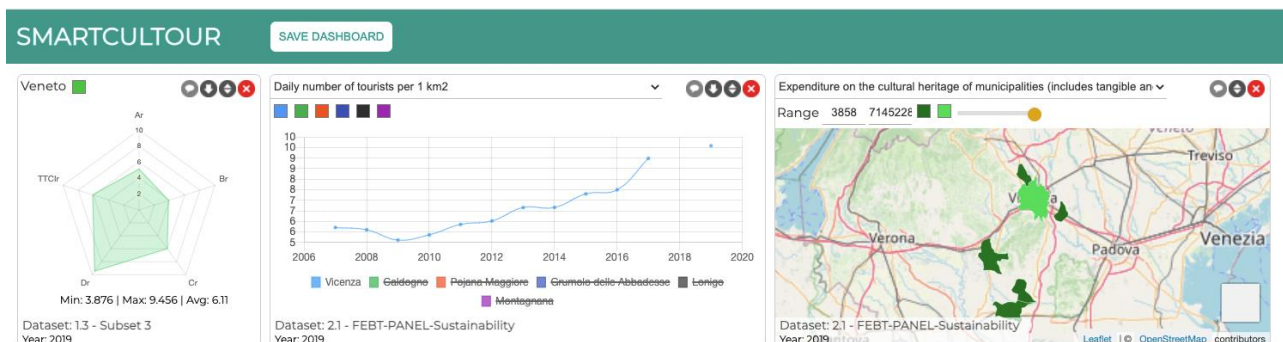
– Drag and drop the selected widgets, thereby creating their own personalised layouts of data visualizations.
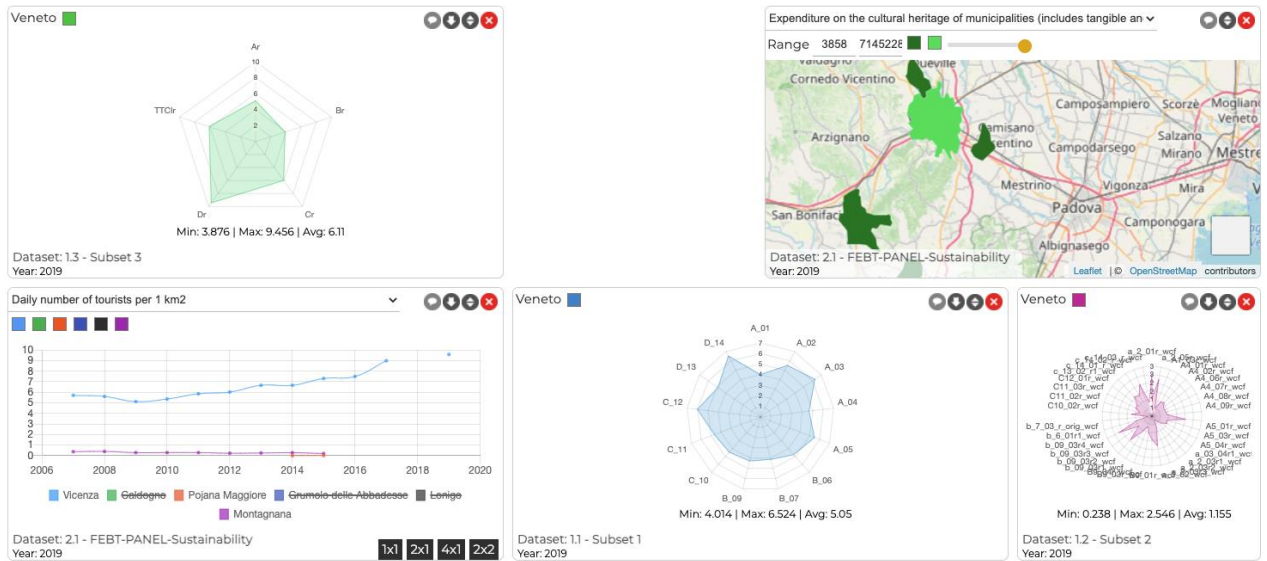


– Resize widgets according to user-specific needs, by selecting one of the four available aspect ratios (1x1, 2x1, 4x1, 2x2).



– Easily add new widgets to the layout and delete unwanted ones.
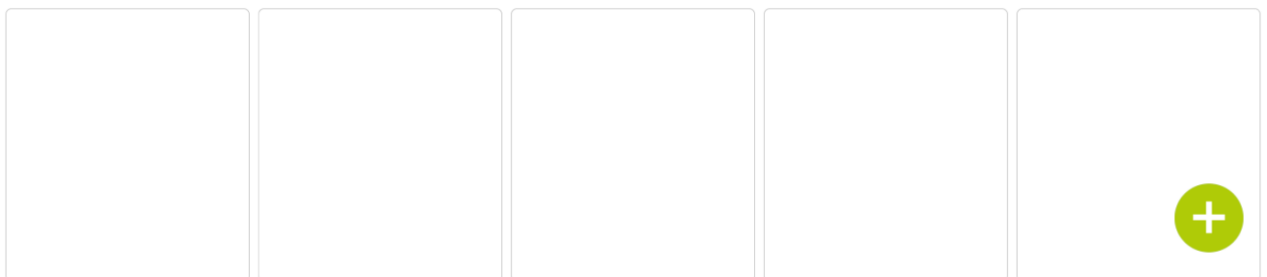


Finally, all the resulting dashboards (comprising all the selected widgets) can be saved and exported by users, in order to allow for later use as either reference or presentation in a diverse array of contexts and applications.

## 1.4. Data Visualization Toolkit

The main objective of the SmartCulTour Platform is to provide accessible insights on the selected geographical areas and, accordingly, to visualize data which are available at the National, Regional, and LAU level, respectively. This is obtained by providing a set of nine data visualization tools, which are tailored on supporting a large array of data sources.

Aside from the ones already displayed in the preset dashboards, users can select the type of data visualizations they want to add from a drop-down menu, which presents them with figurative icons quickly summarizing each visualization type.



The aforementioned data visualization tools, which are often considered to be cornerstones of the data analytics field, are also widely adopted outside both the academic and the Business Intelligence (BI) domains, being regularly featured in the general media. They were thereby selected in order to present users with tools that look both familiar and immediately readable.

The data visualization tools available within the SmartCulTour Platform are listed and briefly described in the pages that follow.

## 1.4.1. Correlation (Scatter plot)

A scatter plot is a type of data visualization showing the relationship between different variables. Data are shown by placing various data points between an x- and y-axis. Essentially, each of these data points looks "scattered" around the graph, giving this type of data visualization its name. Scatter plots are also known as scatter diagrams or x-y graphs, and the main reason leading to choose this tool is to identify patterns or correlations between the two selected variables.
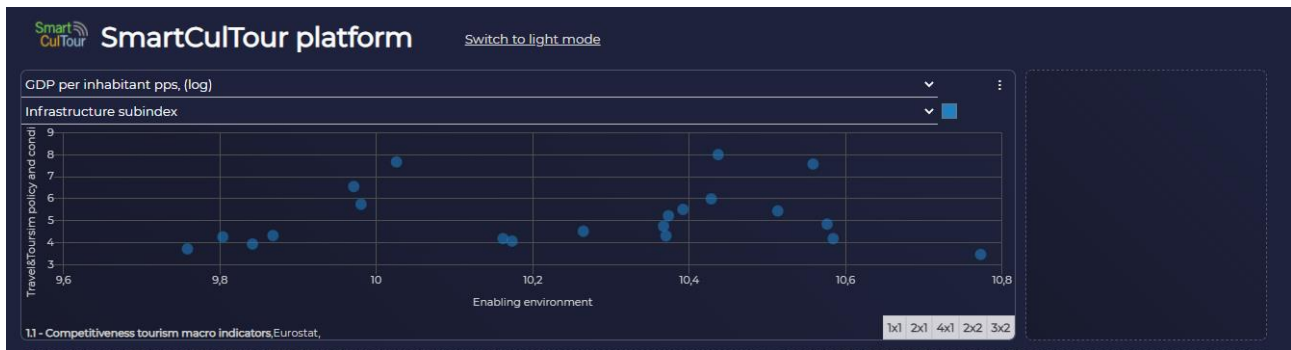


The patterns or correlations found within a scatter plot can be classified according to three different features.

- Linear or Nonlinear: A linear correlation forms a straight line in its data points while a nonlinear correlation might display a curve or a different, unidentified shape connecting the data points.
- Strong or Weak: A strong correlation will have data points close together, while a weak correlation will have data points that are further apart.
- Positive or Negative: A positive correlation will point up (i.e., the x- and y-values are both increasing), while a negative correlation will point down (i.e., the x-values are increasing while the corresponding y-values are decreasing).

In summary, if none of these features are clearly displayed within the visualized graph, that implies that no correlation between the selected variables can be found.

The Scatter Plot (Correlation) model implemented in the DSS allows the end-user to assign data to each axis of the graph via a drop-down selection menu, as well as customising the graph in terms of size and aspect ratio.

## 1.4.2. Bar chart (distribution)

A bar chart generally plots the numeric values for levels of a categorical variable. Levels are plotted on one chart axis, and values are plotted on the other axis. Each categorical value is represented by one bar, and the length of each bar corresponds to each level's value. Bars are plotted on a common baseline to allow for visually immediate value comparisons.
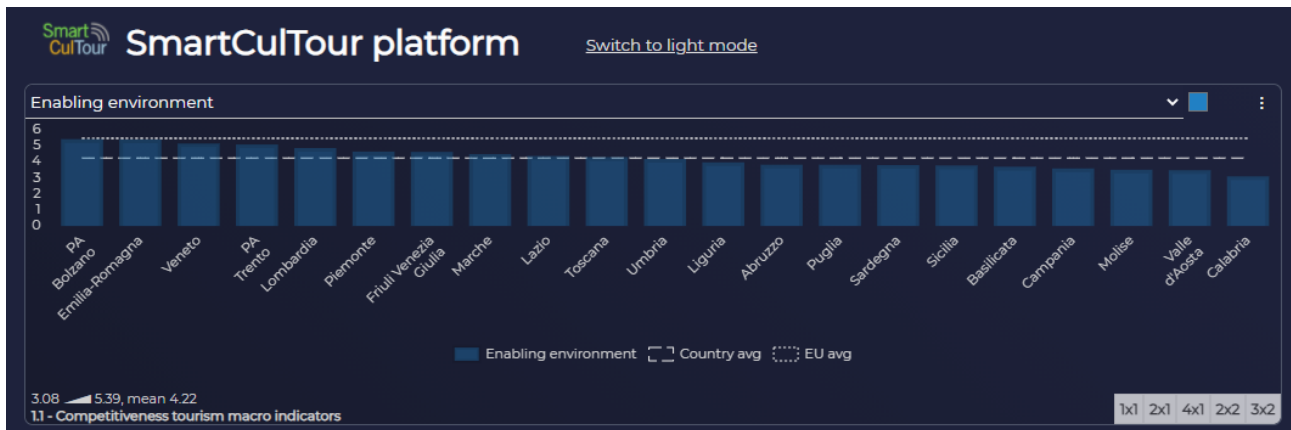


A bar chart is used when users are willing to show the distribution of data points or to perform a multivariate comparison of metric values across different subgroups of data. From a bar chart, it can be easily identified which groups score the highest or are the most common, and how other groups compare against the others. Since this is a fairly common task, bar charts are a rather ubiquitous chart type.

The primary variable of a bar chart is its categorical variable. A categorical variable takes discrete values, which can be thought of as labels. Some categorical variables have ordered values, which can divide the displayed object according to size (e.g. small, medium, large), or other types of subdivisions. In addition, some non-categorical variables can be converted into groups, in order to, for instance, aggregate temporal data on the basis of their respective date (e.g. dividing years into quarters and so forth). The important point for this primary variable is that the groups are clearly distinct.

In contrast, the secondary variable is numeric in nature. The secondary variable's values determine the length of each bar. These values may come from a great variety of sources. In its simplest form, the values may be a simple frequency count or proportion describing how much of the available data is included into each category.

Specifically, the bar chart model that is integrated within the SmartCulTour Platform has some useful interaction elements to further customise visualisation itself. In fact, it is possible to choose the indicator to be displayed on the ordinate axis, to set the size of the chart and to either show or hide some useful graphic elements, such as national and European averages.

## 1.4.3. Graph (Chord Diagram)

A chord diagram represents flows or connections between several entities (called nodes). Each entity is represented by a fragment on the outer part of the circular layout. Then, arcs are drawn between each entity. The size of the arc is proportional to the importance of the flow.

Chord diagrams are eye catching and quite popular in data visualization. They allow to visualize weighted relationships between several entities. They are often adaptable to several specific situations that slightly modify output and data readability.
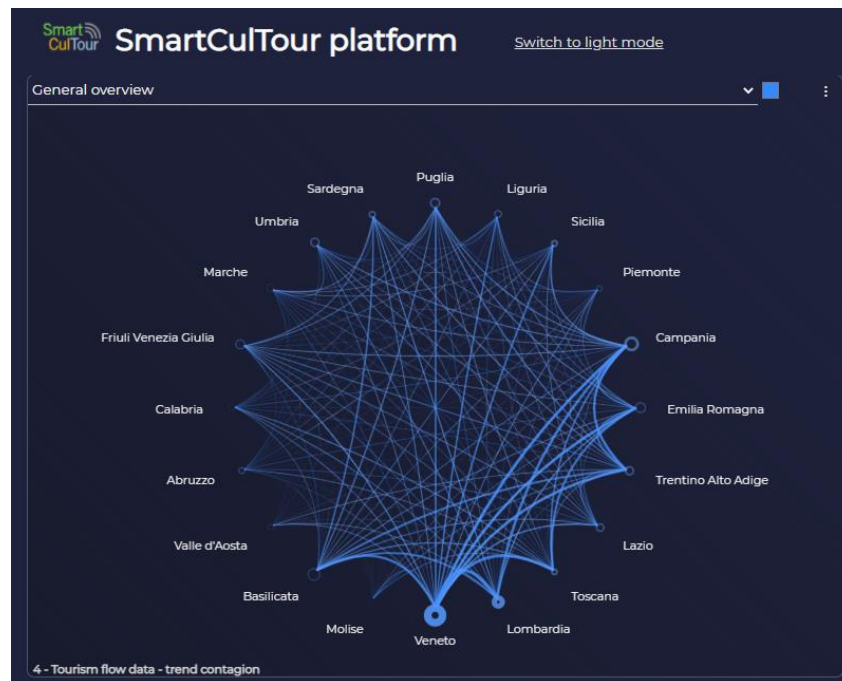


While a small amount of data could be represented within a circular diagram using straight lines to show the interconnections, a diagram featuring numerous lines would quickly become illegible. That's why interactivity is a real plus to make the chord diagram understandable.

The DSS' Chord Diagram is a customised version of the classic and common chord, which makes use of the size of each arch as the dimensional element of the nodes. In this variant, the size of each node is represented by the diameter of the circle of the node itself. The thickness of the lines determines the intensity of the exchange between the nodes.

The user is supported in reading the graph by a variety of interaction elements. The hover effect on the nodes highlights the connection to and from the node, additionally displaying data in text format within a tooltip popup. A drop-down menu at the top of the widget allows the user to filter the dataset.

## 1.4.4. Maps (Choropleth Map)

A choropleth map is a type of thematic map in which a set of pre-defined areas is coloured or patterned in proportion to a statistical variable that represents an aggregate summary of a geographic characteristic within each area, such as population density or per-capita income.
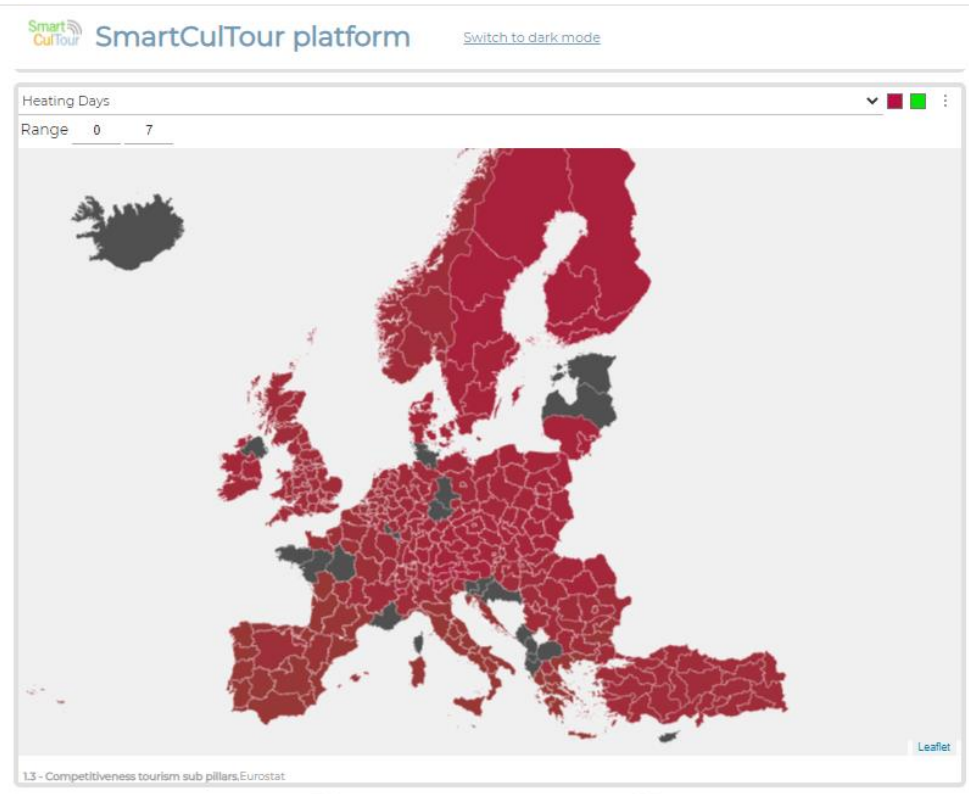


Choropleth maps provide an easy way to visualize how a variable varies across a geographic area or show the level of variability within a region. The Choropleth is likely the most common type of thematic map because published statistical data (from government or other sources) is generally aggregated into well-known geographic units, such as countries, states, provinces, and counties. A portion of the data included within the DSS is no exception.

A Choropleth map, necessarily, brings together two datasets: spatial data representing a partition of geographic space into distinct districts, and statistical data representing a variable aggregated within each district.

SmartCulTour's Choropleth Map, similarly to all widgets included within the platform, is customisable by the user, who can decide the width and range of the extremes defining the gradient associated with the scale of values. The zoom in and zoom out effects, as well as the drag effect, allow users to explore the map more efficiently. A tooltip element on hover effect completes the exploration of the dataset.

## 1.4.5. Line chart

A line chart or line graph is a type of chart which displays information as a series of data points called 'markers', which are connected by straight line segments.

It is similar to a scatter plot, except that the measurement points are ordered (typically by their x-axis value) and joined with straight line segments. Line Charts show how data change across equal, predefined intervals. Accordingly, they are often used to visualize a trend in data across a predetermined timespan – often called time series – by drawing the lines chronologically.
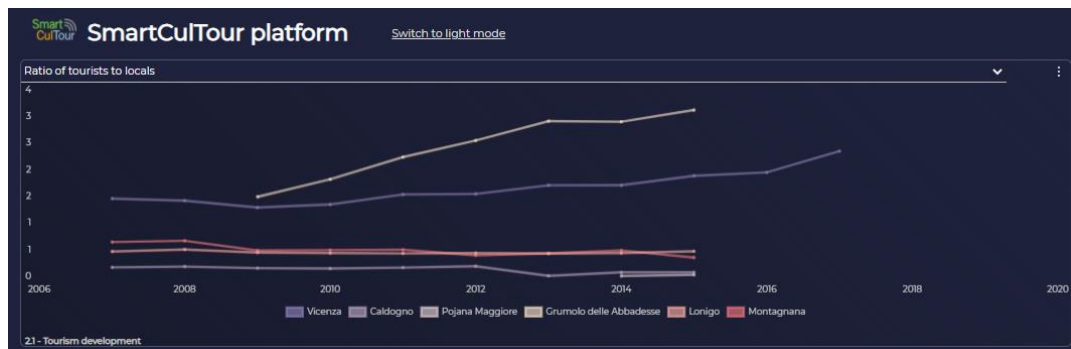


The line charts included in the DSS, as shown in the picture above, displays several lines on the screen corresponding to several time series, each representing the trend in the specified municipality (LAU). This allows for swift comparisons across at both the chronological and geographical level.

Additionally, by making use of the drop-down menu, it is possible to choose the indicator to be displayed, and by interacting with the legend at the bottom of the widget, users can decide to show or hide some historical series from the chart. By doing so, the dynamic graph will resize its axes on the basis of the data to be shown.

## 1.4.6. Synthesis
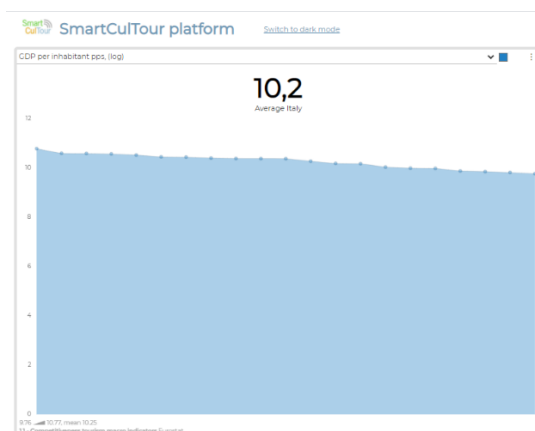


This widget consists mainly of a line chart in which data are arranged in descending order – highest to lowest – along the horizontal axis. In the upper part, the average of the values in the chart below is displayed in text format. Users can choose the indicator to be displayed, customise the chart in terms of size, and make use of the tooltip hover effect to display specific data relating to each data point.

## 1.4.7. Radar Chart

Radar Charts are tools for comparing multiple quantitative variables. Similar values are quickly identified, while potential outliers are easy to spot. Radar Charts are also useful for determining which variables are scoring high or low within a dataset, making them ideal for displaying performance.
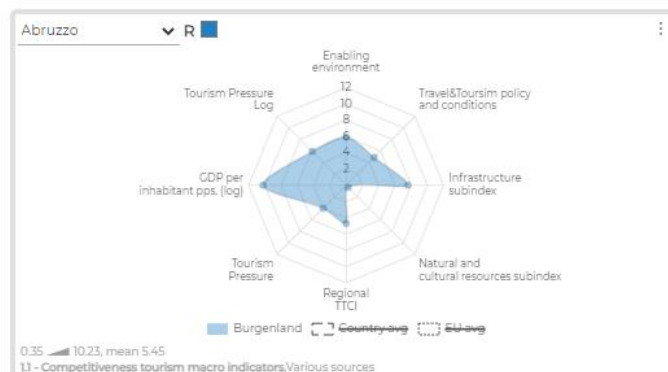


Each variable is provided with an axis that starts from the centre. All axes are arranged radially, with equal distances between each other, while maintaining the same scale between all axes. Grid lines that connect from axis-to-axis are often used as a guide. Each variable value is then plotted along its individual axis and all the variables in a dataset are connected together to form a polygon.

The radar charts included within the DSS not only show the classic polygon relating to the dataset under consideration, but it also displays two additional elements that enrich the presentation of the data. A dashed line indicates the national average, while a dotted line represents the European average. Users can interact with the widget elements to hide or show each of the two lines.

### 1.4.8. Polar Chart

A polar chart is a variation of the radar chart. It is simply a cartesian chart where the X axis is wrapped around the perimeter. It can render common cartesian series types like line, column, area or area range. It is often used to compare multivariate data sets. In the DSS polar charts, variables can be explored using the tooltip hover effect and are indexed via different hues of the same colour.

### 1.4.9. Table

A table is a box displaying data and information that can be read both vertically and horizontally. Organised into rows (tuples or records) and columns (pivots), the first row often constitutes the header of the table with its various fields (attributes), while the remaining rows constitute the body of the table into which the useful data flows. Each record displays one or more properties or attributes in its row. The elements of a table can be grouped, segmented or arranged in many different ways and even nested recursively. In addition, a table may include metadata, annotations, a header, footer or other auxiliary features.
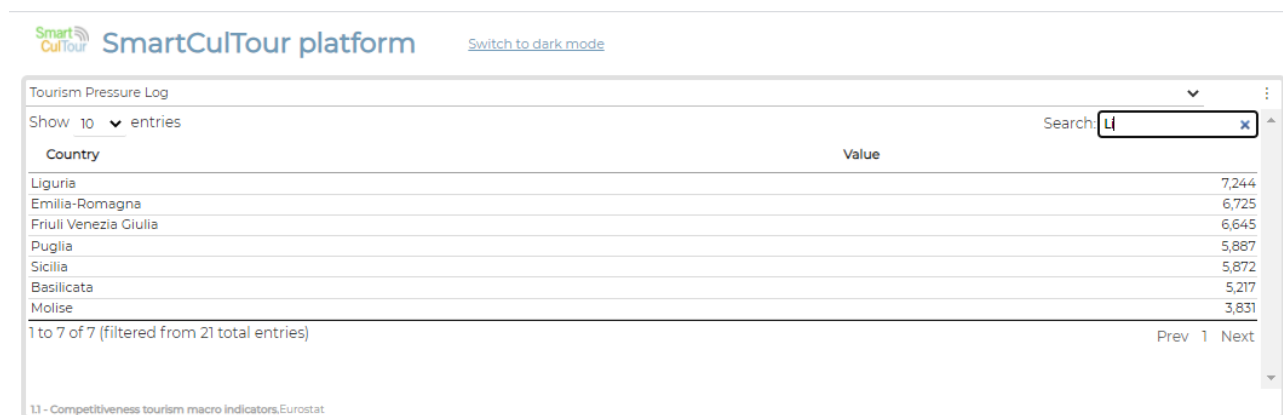


The SmartCulTour table can be customised by the users who, once the dataset has been selected, can set which indicator to display by using the drop-down menu. Users can also decide on the number of records for each page of the table and sort the records in ascending or descending order. The table can be navigated through the vertical scroll bar and the pagination at the bottom of the widget. The search field at the top of the block completes the widget.

# 1.5. Data and Indicators

## 1.5.1. Indicator Selection

In accordance with the research and data collection activities carried out by Ca' Foscari University of Venice (Italy) and the University of Split (Croatia), a comprehensive set of indicators – and the data associated to them – has been defined, selected, and organized as follows.

**1 Competitiveness and Sustainability**
Identified and collected by Ca' Foscari University of Venice, drawing from the World Economic Forum Report "The Travel & Tourism Competitiveness Report 2019", and updated at the regional level.

**1.1 Competitiveness tourism macro indicators:**
GDP per inhabitant in purchase power standard (and its logarithm); Tourism Pressure; Tourism Pressure (and its logarithm); Regional Travel & Tourism Competitiveness Index; Enabling environment; Travel & Toursim policy and conditions; Infrastructure subindex; Natural and cultural resources subindex.

**1.2 Competitiveness tourism macro pillars:**
Business environment; Safety and security; Health and hygiene; Human resources and labour market; ICT readiness; Prioritization of Travel & Tourism; International Openness; Environmental sustainability; Air transport infrastructure; Ground and port infrastructure; Tourist service infrastructure; Natural resources Cultural resources and business travel.

**1.3 Competitiveness tourism sub pillars:**
Corruption & Quality; Crimes NUTS3; Crimes NUTS2; Sanitation Access; Hospital Beds; Care Beds and Facilities; Primary Education Enrolment; Secondary Education Enrolment; Education Rate; Net Migration; Labour Productivity; Employment; Tech Employment; Internet Usage; Broadband Access;
Waste Rate; Tour Arrivals/1000People; Tour Arrivals/km2; Nights spent/1000People; Nights spent/km2; Heating Days; Air Passengers; High-Speed Trains; Ports; Tour Accommodations; Monuments & Sights; Sport Facilities.

**2 Living Labs Indicators**
Collected under direction of University of Split by the consortium partners at the LAU level, and mainly focused on feeding the Living Lab section of the Platform.

**2.1 Tourism development:**
Daily number of tourists per 1 km$^2$; Ratio of tourists to locals; Average length of stay; Total number of tourist arrivals.

**2.2 Cultural Resources:**
Number of monuments in national lists; Number of intangible cultural heritage in national lists; Number of World Heritage Sites; Number of elements inscribed on the UNESCO Intangible Cultural Heritage Lists; Number of museums per 1,000 inhabitants; Number of theatres per 1,000 inhabitants.

**2.3 Cultural Policy:**
Expenditure on the cultural heritage; Evidence of a culture based regulatory framework (YES/NO) (at least the Law on cultural heritage/culture); Examples of initiatives designed through inter-ministerial cooperation to enhance culture's impacts in other areas (tourism, education, communication, ICT, trade,

international affairs, employment), such as regulatory frameworks, sector specific laws, etc. (YES/NO);

Evidence of cultural management plan or alike strategic document (YES/NO); General government expenditure on culture per capita (in €).

### 2.4 Environmental indicators:
The volume of waste generated; $CO_2$ emissions per inhabitant (national level).

### 2.5 Demographics & Social Indicators:
Number of cultural (and creative) enterprises; Number of cultural jobs per 1,000 population; Total employment level; Revenues of local government in € (per capita); Expenditures of local government in € (per capita); GDP - Purchasing power standard (PPS) per inhabitant in € (NUTS2, Eurostat).

## 3 TripAdvisor Data
Collected by Ca' Foscari University of Venice and available at both the regional and LAU level. The database represent 611 tourist territories (and 109,243 different cities) in the European Union where are listed 591,654 tourism attractions divided into 230 different categories which have been merged in macro-categories like cultural, natural attraction, open-air activities, tours, museums, UNESCO sites, etc. The data collected are able to represent both the tourist infrastructure in term of things to do in a destination and the perception of visitors that left a qualitative information (a score from 1 to 5) regarding their tourist experience producing in total 954,062 reviews.

### 3.1 Hotels
We collected data from TripAdvisor website for all the accommodation facilities of European countries during March 2021 (representing the situation of that particular period). The dataset is composed of: name of the food facility, total number of reviews, score rate, type of accommodation (e.g. hotel, B&B, apartment, etc.), geographical information (city, region, nation).

### 3.2 Restaurants
We collected data from TripAdvisor website for all the restaurants facilities of European countries during March 2021 (representing the situation of that particular period). The dataset is composed of: name of the food facility, total number of reviews, score rate, type of kitchen, geographical information (city, region, nation).

### 3.3 Attraction
We collected data from TripAdvisor website for all the attractions and things to do of European countries during March 2021 (representing the situation of that particular period). The dataset in composed by: name of the food facility, total number of reviews, score rate, type of attraction (categories like: museum, natural sites, tour, etc.), geographical information (city, region, nation). In addition this dataset has been collected also for time series (3-5 years depending on numerosity) of the reviews for all the cultural attractions of the Living Labs destinations and LAUs.

## 4 Trend Contagion Data
Collected by Ca' Foscari University of Venice and available at the regional level. The goal of the analysis is to understand how the regions of the European countries influence each other, in terms of number of tourists, assessing how the increment of tourists in one country could influence the demand of other countries through a machine learning methodology. In order to better understand whether this increment in tourism a good opportunity for the region or whether it just increases the seasonality of touristic flows, a decomposition of the series in the seasonal and trend component has been developed. Following this methodology it is possible to obtain six different results regarding two macro tourist dimensions connected to time series:

**4.1 Trend Contagion**
**4.2 Seasonality Contagion**
**4.3 Trend Positive Contagion**
**4.4 Trend Negative Contagion**
**4.5 Seasonality Positive Contagion**
**4.6 Seasonality Negative Contagion**

## 1.5.2. Indicators Categorization

Ahead of the SmartCulTour platform release within the context of the Living Lab testing phase, it has been decided that, in order to better accommodate usability and readability criteria, a reorganization of the indicators shown above was in order. Accordingly, a thematic categorization, including the entirety of the indicators within a single categorized framework, has been selected as the optimal choice.

On May 21st 2021 an online working group – composed by Dario Bertocchi (UNIVE) and Bart Neuts (KU Leuven), and facilitated by Jacopo Trabona (QUANTITAS SRL) – was held, in order to produce the aforementioned categorisation. By making use of the online whiteboarding tool Miro, participants identified a set of three macro categories (Tourism Indicators, Cultural Resources and Policies, and General Characteristics) and a subset of twelve subcategories within each of the aforementioned macro categories. Indicators were then allocated to both macro categories and subcategories, by making use of digital sticky notes, colour classification, and a three-columns data table.

1 COMPETITIVENESS AND SUTAINABILITY

1.1 Competitiveness tourism macro indicators (Regional)

1.2 Competitiveness tourism macro pillars (National)

1.3 Competitiveness tourism sub pillars (Regional)

2 LIVING LABS

2.1 Tourism Development

2.2. Cultural Resources

2.3 Cultural Policy

2.4 Environmental Indicators

2.5 Demographic & Social Indicators
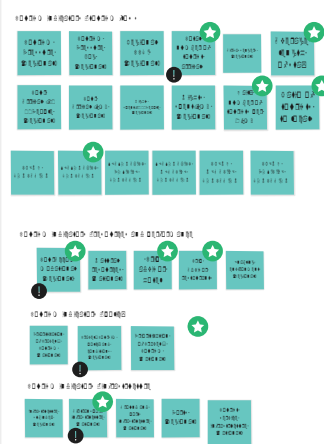
2.6 Economic & employment data
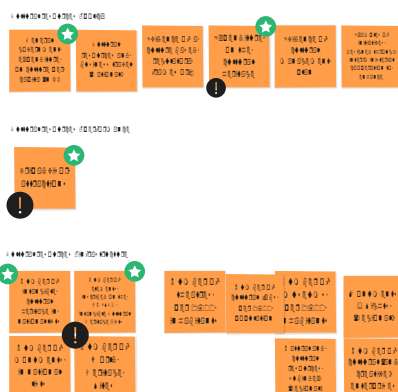
3 TRIP ADVISOR DATA
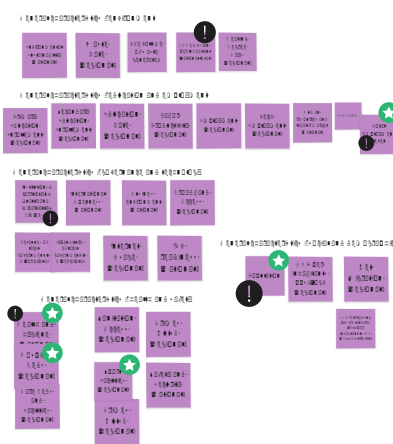
4 TREND FLOW ANALYSIS

TOURISM INDICATORS

CULTURAL RESOURCES AND POLICIES

GENERAL CHARACTERISTICS

The final result of this categorisation process is schematically summarized below:

# 1 Tourism Indicators

Indicators that measure the main tourism-related aspects of each country, region and municipality (LAU), and which are, in turn, further repartitioned in four subcategories: tourism flows, resources and performance, policy, and infrastructure.

## 1.1 Tourism flows

Tourism Pressure (Regional); Tourism Pressure Log (Regional); Regional TTCI (Regional); Total number of tourist arrivals; Air Passengers (Regional); Average length of stay; Arrivals/1000 People (Regional); Arrivals/km$^2$ (Regional); Nights spent/1000 People (Regional); Nights spent/km$^2$ (Regional); Daily number of tourists per km$^2$; Ratio of tourists to locals;

## 1.2 Resources and performance

Tourist Accommodation (Regional); Natural resources (National); TripAdvisor hotel; TripAdvisor restaurants; Enabling environment (Regional).

## 1.3 Policy

Prioritization of Travel & Tourism (National); Travel & Toursim policy and conditions (Regional); Prioritization of Travel & Tourism (National).

## 1.4 Infrastructure

Infrastructure subindex (Regional); Air transport infrastructure (National); Ground and port infrastructure (National); Ports (Regional); Tourist service infrastructure (National).

# 2 Cultural Resources and Policies

Indicators that measure the degree of development of cultural resources and policies in each country, region and municipality (LAU). Related subcategories are policy, performances and infrastructures.

## 2.1 Policy

General government expenditure on culture per capita (in €); Cultural resources and business travel (National); Evidence of a culture based regulatory framework; Expenditure on the cultural heritage; Evidence of a cultural management plan; Examples of initiatives designed through inter-ministerial cooperation to enhance cultural tourism.

## 2.2 Performance

TripAdvisor attractions.

## 2.3 Infrastructure

Number of intangible cultural heritage in national lists; Number of elements inscribed on the UNESCO Intangible Cultural Heritage Lists; Number of monuments in national lists; Number of World Heritage Sites; Number of theatres per 1,000 inhabitants; Number of cultural jobs per 1,000 inhabitants; Number of museums per 1,000 inhabitants; Monuments & Sights (Regional); Natural and cultural resources subindex (Regional); Number of cultural (and creative) enterprises.

**3 General Characteristics**

Indicators that provide a miscellaneous, general overview of each country, region, and municipality (LAU). They are aimed at putting each geographical entity in a wider context, and are organized in five subcategories: education and employment, governance and technology, health and safety, social and demographic.

**3.1 Environment**

Environmental sustainability (National); Waste rate (Regional); The volume of waste generated; $CO_2$ emissions per inhabitant (national level); Heating Degree Days  (Regional).

**3.2 Education and employment**

Primary Education Enrolment (Regional); Secondary Education Enrolment (Regional); Education Rate (Regional); Labour Productivity (Regional); Employment (Regional); Tech Employment (Regional); Human resources and labour market (National); Education; Total employment level.

**3.3 Governance and technology**

Institutions, corruption, quality and impartiality, 1-7 (best); International Openness (National); Business environment (National); Broadband Access (Regional); Revenues of local government in € (per capita); Expenditures of local government in € (per capita); Internet Usage (Regional); ICT readiness (National).

**3.4 Health and safety**

Health and hygiene (National); Hospital Beds (Regional); Care Beds and Facilities (Regional); Sanitation Access (Regional); Sport Facilities (Regional); Crimes NUTS3 (Regional); Crimes NUTS2 (Regional); Safety and security (National).

**3.5 Social and demographic**

Population; GDP per inhabitants in purchase power standard (and its logarithm) (Regional); Net Migration (Regional); GDP - Purchasing power standard (PPS) per inhabitant in € (NUTS2, Eurostat).

## 1.5.3. Indicators – Colours

Following the aforementioned categorisation process, a methodological system for displaying each category within the DSS needed to be established. Accordingly, testing and researching activities were conducted, taking into consideration a series of both the technical (informatic) possibilities and user experience (UX) must-have. In other words, it was necessary to produce a solution that would be technically elegant, and which would not compromise the usability of the DSS interface.

Three main systematic options were thereby identified, alongside with their corresponding implementation requirements:

- Producing three separate JavaScript environments, one for each macro-category.
- Implement categorisation only at the layout level by using graphic-design and typographical elements.
- Using graph's colours to display each indicator's association to one of the three macro-categories.

Moreover, for each of the aforementioned three options, the corresponding UX strengths and weaknesses were singled out. As a result of this analysis, a colour-categorization approached was identified to be the optimal one, since it would allow for an immediate visualization of each indicator's category within the interface, while maintaining the layout flexibility that characterises the core components of the DSS.