SmartCulTour Platform Use Cases

Smart

CulTour

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

Deliverable

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01 Introduction

1.1. D5.5 Rationale

The SmartCulTour Platform has been conceived, designed, and implemented to serve the purpose of a Decision Support System (DSS), helping users make sense of the large plethora of data collected as a result of several SmartCulTour activities. This objective has been achieved through a structured set of sophisticated, highly interactive data visualization tools, which – during the project's lifespan – have progressively evolved in order to host newly acquired data sources and corresponding requirements.

Throughout this process, a user-centred approach has been adopted, thereby prioritizing users' engagement with the Platform on the basis of the two following preestablished macro groups:

- SmartCulTour's partners and Living Lab (LL) participants (e.g., LL managers, LL stakeholders);
- General public (e.g., DMOs, tourism stakeholders, researchers, policymakers);

The analytical necessities of these groups of users were extensively described in D5.2., D5.3., and D5.4., alongside with both the general and the specific characteristic of the DSS as such.

Thus, it is not the aim of the present document to delve into details of each tool featured in the SmartCulTour Platform. Rather, this deliverable will focus on providing readers with a series of case studies, which are intended as an operative illustration of the modalities of particular segments of the SmartCulTour Platform. The present document will also serve as the textual counterpart to a set of hands-on videos (to be found at http://www.smartcultour.eu/smartcultour-platform/) created by the WP5 team in order to intuitively communicate and disseminate the aforementioned tools to a larger public.

The objective is to start from a needs-based perspective and list a series of information objectives that users could practically achieve through the adoption of selected data visualization tools featured in the DSS. Since the SmartCulTour Platform is rich in data types (both visualization approaches, variable groups, and regional scopes), use cases will be limited to four examples that are considered of particular interest and relevance:

1) The regionalized Tourism Travel and Competitiveness Index
2) The Living Lab Basic Dashboards
3) The Living Lab Intertopic Clustering and Data Clustering
4) The Telco Tourism Trends visualizer

Table 1 provides a complete overview of the SmartCulTour Platform tools, indicates both regional scope, potential user groups and primary potential applications for these four use cases, as well as integrating them within the wider Platform structure.

1.2. D.5.5 Structure

As anticipated above, what follows will focus on the SmartCulTour Platform's tools from the viewpoint of their applicability within several tourism-related, analytical contexts. The underpinning idea is double-faceted. On the one hand, these use cases – and the corresponding videos hosted on the SmartCulTour website and YouTube channel – can be seen as tutorials guiding less analytical-savvy users through discovering trends and correlations in their respective areas or destinations. On the other hand, they are hands-on demonstrations of some of the practical purposes these tools can serve, highlighting their specificity as well as the real potential of the analyses they enable.

Thus, D.5.5 will pivot around two main objectives:
- Specific Use Cases for a selected number of tools, extensively describing each use case in details as well as providing stepwise indications on how to operate the tool itself;
- A brief description of the production of the videos related to the aforementioned use cases.

In the following table, a summary of all SmartCulTour Platform's data visualization tools is provided, which quickly lists their respective ideal user group, geographical level, user personas, and potential applications. It is worth to mention that both the potential applications mentioned in the following table and the use cases reported in the present document represent only a fraction of the numerous potentialities offered by the DSS tools.

Table 1. Summary of SmartCulTour Platform data visualization tools

Section of Platform	DSS Tool	Geographic scope	Potential users	Potential Applications
Regional/ National	Dashboard	Regional (NUTS2); National	DMOs; Policymakers; Researchers; Tourism Stakeholders	Monitoring of destination development
Regional/ National	TTCI	Regional (NUTS2); National	DMOs; Policymakers; Researchers; Tourism Stakeholders	National plans for tourism competitiveness; Strategic investment decisions; Marketing plans; Transnational cooperation plans
Regional/ National	Tourism FLOWS	Regional (NUTS2)	DMOs; Policymakers; Researchers; Tourism Stakeholders	Strategic development plans; Marketing plans; Mobility and transportation planning; Forecasting and scenario analysis of domestic tourism
Living Labs - Basic	LL Basic Dashboards	Municipalities (LAUs) of the 6 LLs	Local policymakers; LL stakeholders	Monitoring of destination development; Local Tourism Development Plan; Comparative analysis of destination competitiveness

Living Labs - Advanced	LL Advanced Dashboards	Municipalities (LAUs) of the 6 LLs	Local policymakers; LL data analysts; LL managers	Monitoring of destination development; Local Tourism Development Plan; Comparative analysis of destination competitiveness
Living Labs – Premium	Intertopic Clustering	Regional (NUTS2), for the 6 LLs	Local policymakers; LL data analysts; LL mangers; LL Tourism Stakeholders	Market/visitor analysis; Marketing plans
Living Labs – Premium	Data Clustering	Regional (NUTS2), for the 6 LLs	Local policymakers; LL data analysts; LL mangers; LL Tourism Stakeholders	Market/visitor analysis; Marketing plans
Living Labs - Premium	Telco Tourist Trends Visualizer	Regional (NUTS2), only available for Veneto (Italy)	Local policymakers; LL data analysts; LL mangers; LL Tourism Stakeholders	Destination management planning; Market/visitor analysis; Marketing plans; Mobility and transportation planning

02 DSS Use Cases

2.1. TTCI – Regionalized Tourist Competitiveness

The TCCI Regionalized Tourist Competitiveness Index Tool is featured in the Regional/National section of the SmartCulTour Platform and was designed to provide a useful support for monitoring the tourism competitiveness of the European regions as well as their positioning against a backdrop of current global tourism megatrends. Significantly, the tool allows for an immediate comparison of the state of tourism competitiveness of a given region with respect to the European average, that of each European country and, most importantly, that of all the European regions identified with the NUTS2 level of the European nomenclature of territorial units for statistics (NUTS).

To delve into a practical example, we can consider one of the most competitive tourist regions in Europe: Italy's Veneto region.

The Regionalized Tourist Competitiveness Index tool allows users to analyse the Veneto Region by distinguishing the various factors underlying its tourist competitiveness, by sharpening the focus on aspects that are increasingly important for the success of tourist destinations such as their business environment and their level of development and use of ICT as well as their international openness and the provision of cultural infrastructures and resources.

Using the tool is pretty intuitive: user can select their preferred region (the Veneto Region, in our case) by using the dropdown menu on the left-hand side. On the other hand, by interacting with the dropdown menu on the right-end side, users can select a different area they wish to use for comparison.
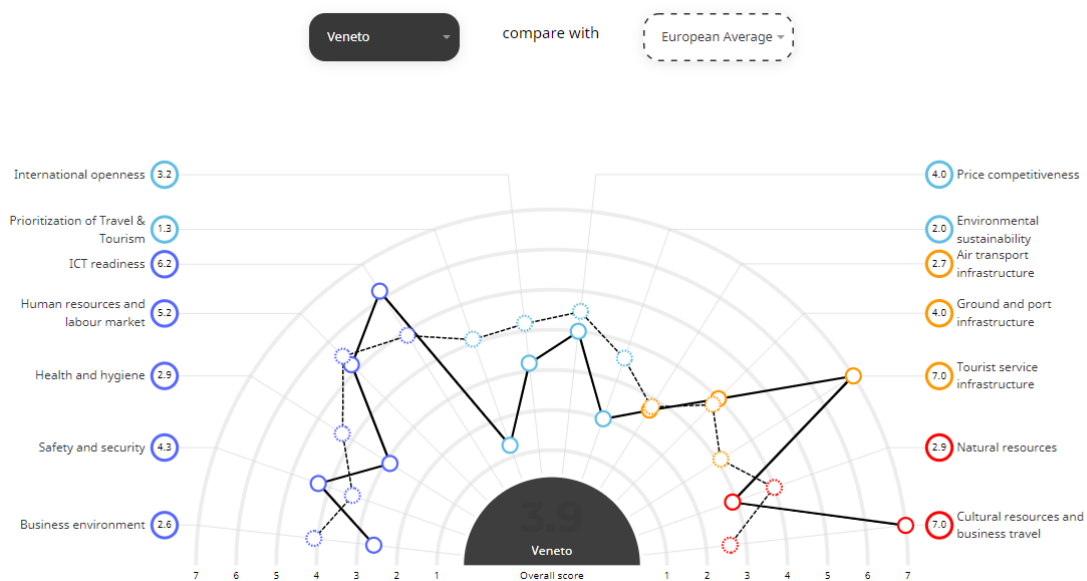

Fig 1. View of the TTCI tool in the SmartCulTour Platform

The plot (i.e., a highly customized radar chart), immediately shows the performance of the Veneto Region with respect to 14 sub-indicators of the tourism competitiveness calculated in accordance with the methodology of the World Economic Forum[1]. For instance, in the example above, it is possible to infer that the Veneto Region prevails over the European average for the use of and development of ICT in the tourism field, as well as for the provision of tourist service infrastructures, cultural resources, and business travel. It is, instead, relatively underperforming in terms of environmental sustainability and price competitiveness.

As mentioned above, the process can be quickly repeated for all EU countries (NUTS0) and EU regions (NUTS2). As a result, the possibility for comparison across different geographical levels makes a good case for the application of the tool in a large number of tourism-related contexts and operations.

Let's imagine, for instance, the application of the tool within the design process of a national plan for regional competitiveness. In such context, not only does the tool help users better understand the positioning of their country as compared to other EU countries, but can also provide immediate insights on the region for which investments and interventions may be particularly beneficial.

Moreover, another use case for the TTCI tool could be that of researchers working on a transnational cooperation plan (such as an INTERREG project). Presuming that – in this scenario – users might be interested in understanding specific gaps and weaknesses of a given region, the tool could prove a swift support to facilitating the identification of themes and priorities the transitional program should address.

In conclusion, the regionalized TTCI tool is therefore a useful support for those regional organizations that are willing to understand and analyse the strengths and deficiencies of the tourism competitiveness of their territory and destinations, as compared to their main competitors. This regionalised information is deemed fundamental in the field of destination management since it allows to:
- Set a decision-making criterion for the allocation of financial resources to support strategic components underlying the competitiveness of the tourism industry;
- Supervise destination marketing strategies, using strengths and weaknesses as the starting point;
- Develop public investment plans and growth strategies, specifically in light of the strategies implemented by the Recovery and Resilience Facility initiatives and the NextGenerationEU plans.

2.2. Living Lab Basic Dashboards

The SmartCulTour Platform is organized in two main groups of data visualization tools:
- Self-contained, interactive visualizations (i.e., TTCI, Tourism FLOWS, LL Intertopic Clustering, Data Clustering, Telco Tourist Trend Visualizer);
- In-depth, tourism dashboards collecting a large plethora of plots and indicators that can be concurrently explored and analysed as a whole (i.e., Regional/National Dashboard, LL Basic Dashboards, LL Advanced Dashboards).

Arguably, it could be said that the latter group is more in line with the functionalities of a traditional decision support system (DSS), in that it requires users themselves to explore visualizations by selecting the indicators which are most fit to their own purpose. However, for some inexperienced users (be that either in terms of data analytics or a tourism-related knowledge) this very variety of resources and possibilities

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[1] See https://www3.weforum.org/docs/WEF_TTCR_2019.pdf

may actually prove cumbersome or disorienting to approach.

Precisely for this reason, the WP5 team decided to produce a series of fixed and pre-filled versions of the Living Lab Dashboards – the LL Basic Dashboards – which present users with a set of destination-specific visualizations and indicators for them to analyse, while allowing more experienced users the full modular and flexible functionality via the LL Advanced Dashboards.

Let's, for instance, put ourselves in the shoes of a Dutch citizen, living in the Rotterdam area (i.e., one of the six SmartCulTour Living Lab areas). This persona is not particularly tech-savvy, nor very used to the tourism-related lexicon and indicators. However, they would be interested in learning more about the tourism-related trends of their area. They might be planning to start a microenterprise (e.g. an international bookshop) and wonder which city could be optimal for their business – considering that tourists visiting the Netherlands are their ideal customer segment. Accordingly, they can find such necessary information via the Basic LL Netherlands-Dashboard.

As they first enter the webpage, they are presented with a set of nine plots, visualising nine corresponding indicators.

Fig 2. View of the Basic LL Netherlands Dashboard in the SmartCulTour Platform

The first plot is a choropleth map, namely a geographical representation where the largest municipalities of the area are coloured in proportion to the number of tourists visiting them (i.e., tourist arrivals). As expected, Rotterdam has the biggest share of tourist arrivals (1,237,000), but this figure alone is not enough for our persona to make a robust decision. As a matter of fact, the remaining visualizations provide them with a comprehensive set of insights.

For instance, they might want to look at the "ratio of tourist to locals" bar chart - where Rotterdam is by far the best scoring destination in the area too. Additionally, thanks to another bar chart, our persona might infer that Rotterdam is also the city with the highest "daily number of tourists per km²", although, in this instance, also Delft looks much more densely visited – and thus having a higher spatial concentration – than other neighbouring municipalities. Another useful indicator might be the number of "cultural (and creative) enterprises", signalling that Rotterdam – which has 5,870 of such enterprises in 2019 – might be considered

a hub for cultural tourists as well as for local dwellers interested in culture, two ideal customer segments for our persona's bookshop.
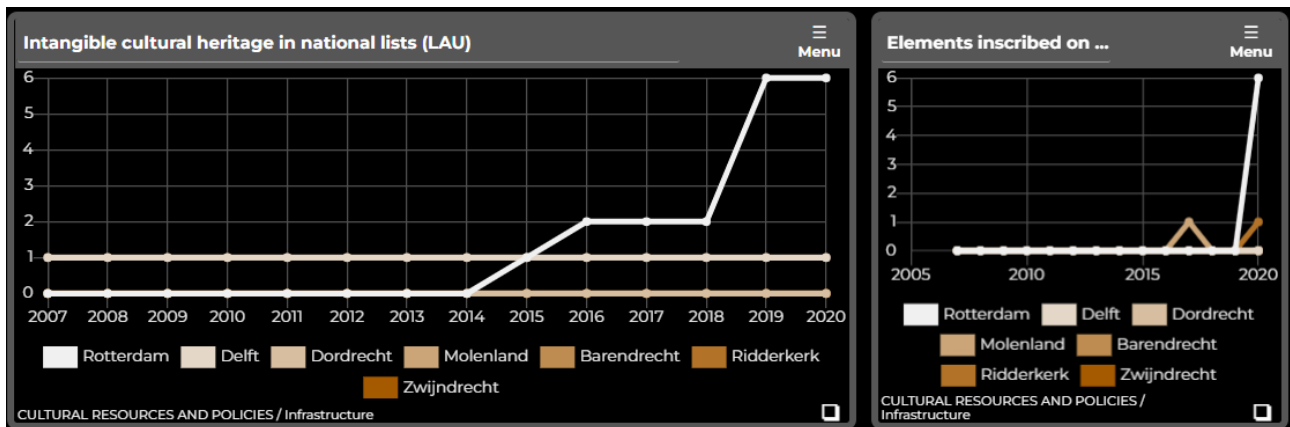

Fig 3. View of the Basic LL Netherlands Dashboard in the SmartCulTour Platform

Finally, this hypothesis is corroborated by two line charts visualizing the number of "intangible cultural heritage in national lists" and "element inscribed on the UNESCO intangible cultural heritage lists". Both visualizations display significantly growing trends for the city of Rotterdam, with the former chart counting six "intangible cultural heritage in national lists" (as opposed to zero in 2014) and the latter indicating that six "elements inscribed on the UNESCO intangible cultural heritage lists" were added in 2020 alone.

In conclusion, it is not – of course – the ambition of the tool to be the only source upon which our persona's investment should be made. And yet this easy-to-grasp set of information could prove to be an impactful support that, if integrated with other exogenous factor, could informed an effective, data-oriented decision-making process.

2.3. Living Lab Intertopic Clustering and Data Clustering

The Smartcultour Platform offers two innovative tools that exploit the so-called "user generated content": Intertopic Clustering and Data Clustering. These tools are both based on online reviews of visitors as an alternative source of information on the preferences, behaviour and opinion of tourists during their visits and are available on NUTS2 level for the relevant NUTS2 regions linked to the SmartCulTour Living Lab areas.

The Intertopic Clustering Tool aims to create groups of topics and keywords that identify a tourism destination. This tool is based on online reviews, using TripAdvisor as a source, and analyses the text of comments posted by visitors. The underlying algorithm aims to detect relationships between the most frequently used keywords in reviews by providing groupings of topics representative of the analysed destination. Each grouping of topics is therefore made up of sets of words that the algorithm recognizes as combinable. Groups of different topics can be very different from each other or contain elements of similarity. Such similarities or differences between topics mark the distance between them. The Intertopic Distance Map provides users with an immediate Cartesian representation of these distances.

Taking the example of Living Lab Scheldeland, which covers the NUTS2 regions of Antwerp and East Flanders, and focusing on the province of Antwerp specifically, this tool identifies 10 groupings of topics

covered by visitors for this destination. In particular, the tool allows to obtain a scale of importance of these topics (indicated by the size of the circles in the left side of Figure 4), showing how at least 2 specific topics prevail between two quadrants. While the right side of the visualization initially shows the top 30 most salient topics for the region as a whole, clicking any particular circle in the left field limits the analysis to topics relevant for that particular cluster only. For instance, clicking the orange circle in the bottom left side will generate topics that are predominantly related to Antwerp Cathedral and baroque architecture.
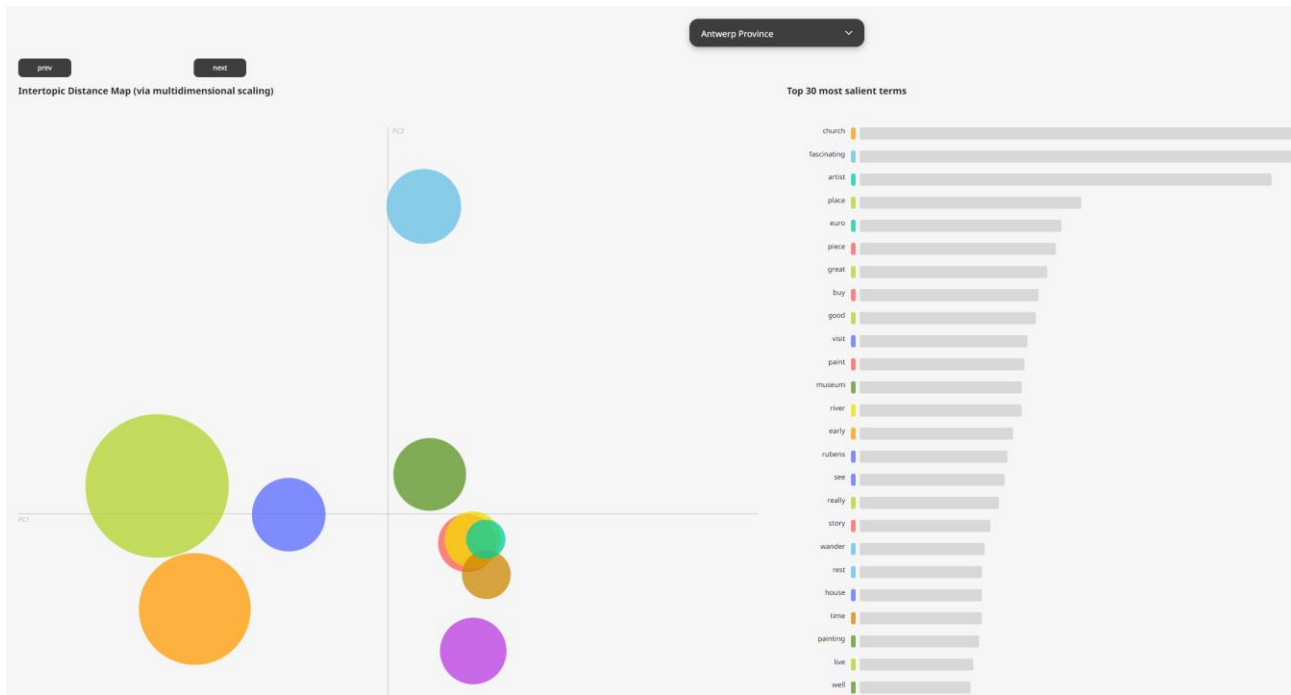

Fig 4. View of Intertopic Clustering in the SmartCulTour Platform

Therefore, Intertopic Clustering allows for themes to originate from online review scraping, the composition of each cluster being displayed in the list of keywords on the right, and, finally, the distances between each of them distributed on four quadrants. The tool can be used to investigate how a tourist destination is perceived and to highlight any specific issues, which can be strengths but also weaknesses, between branding/marketing and actual visitor experiences. This tool represents a valid approach for verifying the marketing policies of a destination and building its brand.

The Data Cluster Tool can further support such analysis by creating user groups and visitor profiles. Again using online visitor reviews, such as those provided by TripAdvisor, cluster analysis allows the analysis of visitor behaviour in destinations by focusing on the various sites a user has visited (and reviewed) and sequencing their trips into cultural subcategories such as: museum, cultural interest, nature, attractions and tourist facilities. The underlying algorithm identifies clusters of people with similar behaviours and interests. In this way a DMO can create a clear picture of the different groupings of visitor types that distinguish a destination and see in detail the tourist offer predominantly preferred and visited by tourists.

Let's take the example of the region of Dalmatia in Croatia: we select this Region from the dropdown menu and notice 10 different clusters of visitors, characterized by seven main macro-sections: tour and activities, bar and clubs, entertainment and events, transport and services, natural sites, shopping, relax and wellness. We can notice that Cluster 6 is the largest cluster (encompassing 8,152 reviews) and is most

influenced by visits to natural sites (dark green circle), although these visitors also to a large extent enjoy tours and activities (light green circle), shopping (purple circle) and transports and services (dark blue circle). By comparison, Cluster 3 is less dominant in total visitor numbers but has a much more uniquely defined profile, with visitors mainly visiting natural sites and not really being involved in any of the other macro-activities. Similarly, Cluster 5 is smaller in its totality but is more singularly defined by the motive of visiting bars and clubs.
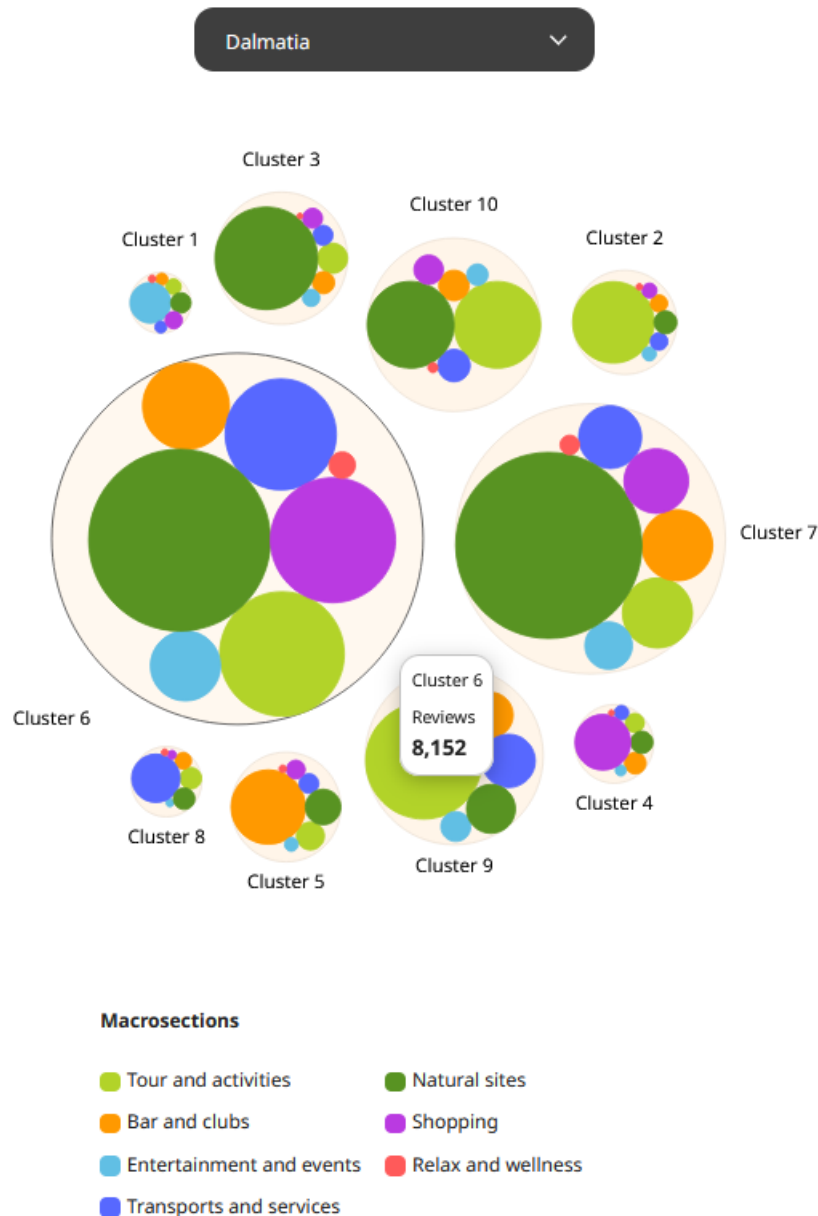

Fig 5. View of Data Clustering in the SmartCulTour Platform

These results can be used to drive new communication strategies or to focus on the development of new tourism services based on personalization of the offer towards one or more identified clusters.

2.4. Telco Tourist Trends Visualizer

In cultural destinations it is crucial to consider tourist flows analysis solutions such as density calculation, impacts on the cultural sites, behaviour of visitors and mobility patters. A new way of measuring these aspects is the use of big data from telco. Thanks to this new type of data, it is possible to provide insights into the spatial pattern of the tourist and their behaviour in a destination without surveys or questionnaires but rather by using big data. Collecting and analysing these kinds of big data offers new opportunities in tourism research by providing spatial and temporal data that is able to describe the behaviour and mobility of tourists and visitors. This information might prove useful to different tourism issues and research scopes, particularly related to destination management strategies of spreading tourists through time and space to combat overcrowding in certain hotspot areas.

In the SmartCulTour Tourist Trends Visualizer the possibilities of telco data are explored for the Veneto region in Italy, specifically with an aim to understand visitor profiles (see Table 2), since it is a well-known issue in tourism to account for number of day visitors at a destination, as well as to understand behavioural patterns (see Table 3). Big data generated by telco companies provides new insights into the tourism sector which allows not only accurate monitoring at a smaller scale (e.g. individual attractions, neighbourhoods within a city) when compared to official statistics (usually overnights at municipal or regional level), but offers a quantification of the total number of travellers, rather than those staying in official accommodation. Using big data and telco data further provides an opportunity to better monitor tourist activity in cities and cultural attractions, by revealing the total number of users, the total time spent in a destination, as well as understanding tourists' behaviour and mobility patterns. In addition, by using this detailed information, it is possible to cluster users into categories such as day-trippers or holiday-makers, as well as other categories, such as nationality.

Data from one of the major Italian operators, Vodafone Italia, has been used. This data source is created passively, by automatically storing information which is kept by mobile operators. This log track is composed of the unique ID of a user (without personal and sensitive information, in accordance with the directives of the European General Data Protection Regulation (GDPR)), a timestamp, and the location of the position of the antenna (tower station) of the cell network. The localisation of the antenna is referring to a coverage area (from a minimum of hundreds of meters to a maximum of several kilometres) and not to specific coordinates. This dataset is composed by 2G, 3G and 4G passive signals created by the mobile device while connecting to the phone network and is thus not limited to active behaviour such as making calls, receiving and sending messages or internet use. In addition, this dataset is characterized by the nationality of the user's sim card, so it is possible to estimate the origin of the users. Via a proprietary calibration algorithm, the number of people are re-proportionated to the entire network of users and not only Vodafone or foreigner sim card users who are connecting to the Italian national network.

The data recorded by the activity of a smartphone is produced automatically, continuously providing records of each sim card every minute. To make sense of this huge source of data, and to extract value from them, data are aggregated for each user into tables and divided according to minutes and hours. Through these first aggregations it is possible to provide almost all the analysis necessary to illustrate the behaviour of people in the territories under discussion, and to provide valuable insights for the study of cultural tourism.

In the Telco Tourist Trends Visualizer different users and dynamics are showed as covered in Tables 2 and 3.

Table 2. Summary of visitor profiles in the Telco data

Visitor profiles	New values from Telco data
Resident	All the users with most frequent nights' cell counts in a municipality even without an official registration to the municipality statistical system. That includes all the people who decided to live in a territory with a different scopes (e.g. workers and students that spend more than 6 months a year in a municipality).
Workers/ students	All the users that are not included in the cluster of the residents but have a high rate of repetition of visit (e.g. more than 12 times in a month for more than 4 hours a day). Those are usually residents in municipalities in the neighbourhoods. It is possible to better understand their mobility patters during the time slots of a day (e.g. reaching the destination in the morning and leaving in the afternoon or an increase number of this users during high/summer season show seasonal workers).
Day-visitor	Telco users who visited a tourism destination (e.g. a municipality/province or an area) for few hours in a single day but they did not spend the night in the visited territory (so without an overnight). It is possible to understand where they passed the night to identify their holiday/visit behaviour (e.g. a single day visit= home location -> destination -> home location or a traveller with a "star" holiday mobility patters e.g. tourism destination -> visit of another city -> tourism destination for few days during their trip).
Tourist	A tourist is a user not classified as resident or worker/student that visited the destination for at least a few hours and stays during the night in the municipal area. This behaviour could represent an overnight in the destination. These users usually stay in the destination two days or longer. All the people that elude registration on official statistics, such as tourists in second homes, guests visiting friends or people staying in short-term rentals (represented lately by the sharing economy such as Airbnb) are monitored and quantified through big data from cell phones. This information makes it possible to develop estimations on the hidden part of tourism, such as tourism that does not pass through the compulsory registrations at police headquarters and communication to municipal and/or regional statistics.
Domestic tourist	Tourists for which residency is calculated inside the national boarder of the visited destination.
International tourist	Tourist with a sim code different from the national one connected to the visited tourism destination.

While Table 2 gives an overview on insights into the typology of tourists, in Table 3 information is included on the possible extraction of visitor-specific behaviour at the destination.

Table 3. Summary of SmartCulTour Platform data visualization tools

Type of analysis	Valuable information
Presence	Count how many people are in a destination per single day and time. It represents the visitor density.
Origin of the user	Identify proximity tourism or long distance holidays.
Nationality	Create clusters of users based on their nationality (e.g. European, international or per single country). It is important to better understand tourism seasonality per country and where to promote/market the cultural destination.
Dwell time per day	Useful to understand the behaviour of the visitors during the different times of the years (e.g. short visit in summer, longer visit in autumn).
Dwell time per holiday	It gives the real average of stay in the destination at monthly level with different possible sub-levels (e.g. per nationality, per age range).
Destination of the	Shows where the day visitors originate from and where they mostly congregate (the

day-visitors	destination hotspots).
Co-visitation	Displays the visitor behaviour of the users in the region (e.g. a cultural city hopper will visit more than 2 cultural destinations).
Mobility behaviour (aviation)	Counts how many visitors reach the destination by plane or use a flight to departure.
Age and gender	Shows age range and gender of domestic users.