

The use of SMGI in supporting tourism planning practices: an innovative approach for the municipality of Cagliari

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Introduction

Tourism is commonly recognized as a spatial (Peroni 2007) and soil consumption (Boccagna 2010) phenomenon, which comprises the travel to and around a destination, with the purpose of exploiting particular natural or non-natural attractions, accommodations, general and specialized services (Smith 1991). It may generate positive and negative impacts within the social, cultural and environmental domains (Buhalis 1999). These impacts may become more evident when tourist activities are not adequately developed and planned (Briassoulis 2002). In Sardinia, the tourism sector is one of the major driving forces of regional economy and mostly affects coastal areas, which have usually been considered as locations to be planned in a special way, due to their fragility, for the number of activities and possible land uses (Hospers 2003). As a result, various interests, such as those of residents, developers and environmentalists, may meet in coastal areas and come into conflict. Thus, the Regional Executive Committee decided to prepare the Regional Landscape Plan (RLP) together with the Regional Plan for Sustainable Development based on Tourism (RPSDT), in order to preserve cultural and natural landscape and to promote sustainable development based on tourism. The RPSDT focuses on the relationship between economic benefits and environmental impacts of tourism services supply; however it lacks of a global strategy of sustainable development, as well as of an

effective stakeholders' involvement and of a deep analysis of tourists' behaviours.

Understanding tourists' behaviour and psychology may help in assessing some of the problems that planners and decision-makers need to solve for the tourism planning implementation (Briassoulis *ibidem*). Indeed, good planning process needs to engage local communities and recipients directly in its implementation (Zoppi 2012).

In the Digital Information age, tourist preferences data, available on online forums and reviews, are generated by users and may provide relevant knowledge for planning practices (Campagna et al. 2015). Moreover, the integration of this information, namely Social media geographic information (SMGI), with official data, or Authoritative geographic information (A-GI), may represent an opportunity to enrich tourism strategies with a broader, deeper and more multifaceted knowledge of the places.

In the light of these premises, the paper aims to demonstrate the potential of SMGI for supporting tourism planning practices, and the benefits derived from informing local initiatives with a pluralist user-oriented view on strategic development issues. An innovative approach, applied to a case study concerning the municipality of Cagliari, is presented, by which tourists' preferences are discovered by processing and analyzing publicly available social media data.

Methodology

The methodological approach builds on a preliminary analysis regarding the tourists' social networks' contents for the Sardinia region, in order to identify the spatial distribution of tourists' preferences and the relationships between the quality of tourist lodging services (TLSs) and their geographic locations. Effectively, the study is carried out through the following four steps:

- Data collection from Booking and TripAdvisor and geocoding;
- Preferences' dynamics analysis;
- Geographically weighted regression (GWR) model (Fotheringham et al. 2002) estimation;
- Complementary SMGI extraction from Instagram and Foursquare.

The first step consists of the construction of a database based on rankings, which are drawn from tourists' ratings extracted for the period May 2012-May 2013 from Booking.com and TripAdvisor. The dataset includes both quantitative information concerning the TLSs scores and qualitative information related to TLSs' inherent characteristics and tourists' textual reviews. The main issue is to manage this huge amount of information. Thus, the study requires the adoption of a mixed methodological approach. The second step includes the implementation of a spatial analysis of users' opinions and attitudes, relying upon spatial statistics methods and spatial, temporal and textual analysis, in order to identify clusters of TLSs showing high concentration of users' preference at the regional level. Afterwards, at the local level in the destination of Cagliari, analyses are developed in order to discover through the investigation of textual contents why tourists prefer some destinations rather than others (qualitative analysis), meanwhile, a quantitative assessment, regarding the location of tourists' preferences and the factors that contribute to this phenomenon, is implemented integrating SMGI and available A-GI.

In the third step a spatial regression is used for modelling the preferences phenomenon and testing the reliability of the hypothesis derived from textual analysis, in order to identify leading success factors of destinations and make appropriate decisions in terms of policy. Finally, in the last step we evaluate in more detail the study area, identifying the points of interest (POI) as perceived by tourists and local community through social network contributions. This step is carried out by extracting a complementary SMGI dataset from Instagram, related to the period May 2012-May 2013, processing data by means of a spatial clustering analysis and extracting Foursquare SMGI in order to identify the most attractive venues within the detected clusters.

Results and discussion

Geocoding is run on the extracted addresses of each tourism lodging service (TLS) collected from Booking.com and TripAdvisor within the Sardinian region. A unified database of 992 records is finally defined. The analysis' results reveal that the spatial distribution of the tourists' reviews on the TLSs is divided into five types of accommodation: bed and breakfast (15.7%), agritourism (6.0%), hotels (42.0%), residences and resorts (7.3%) and tourist houses (29.0%). The analysis of the tourists' preferences related to the coastal and inner areas of Sardinia revealed that a 92.0% of tourists' reviews concerns TLSs located in the coastal areas, while less than an 8.0% are related to the inner areas. Possibly, this may indicate that thus far only a few tourists are attracted by inner areas, which allow discovering a less popular side of the island, characterized by its significant natural and cultural heritage and tradition-related resources. For each TLS, the database includes a score record that is the average of six attributes, namely geographic position, services' proximity, price/quality ratio, staff quality, room cleanliness and TLS's perceived comfort. Data are normalized and ranked by the same scale in order to identify the locations

most affected by Tourists' positive preferences incidence (TPPI) in Sardinia. Results confirm that the municipalities located along the coastal area attract tourists, while the inner areas are less attractive.

Afterwards, integrating SMGI and A-GI and carrying out spatial analysis, textual analysis and statistical techniques, the study investigates the potential reasons behind the tourists' preferences toward certain locations (qualitative analysis). The SMGI-based analysis assesses the success factors, namely the determinants (explanatory variables) of the high TPPI rates (dependent variable), concerning the Cagliari municipality, which is considered among the best-selling destinations by different tourists' typologies. The spatial clusters of preferences are detected by hot-spot analysis (Getis and Ord 1992). The location of each TLS allows detecting sites where the preferences of tourists who visited Cagliari are focused on. Firstly, a threshold distance of 1,700 meters is identified and the spots by census tract summarized. The darker areas, located in the inner areas of the municipality, show high concentration of the TPPI phenomenon (hot spot), while the lighter areas, located in Pirri, that is a peripheral residential area, represent locations where the phenomenon is less intense (cold spot) as shown in Figure 1.

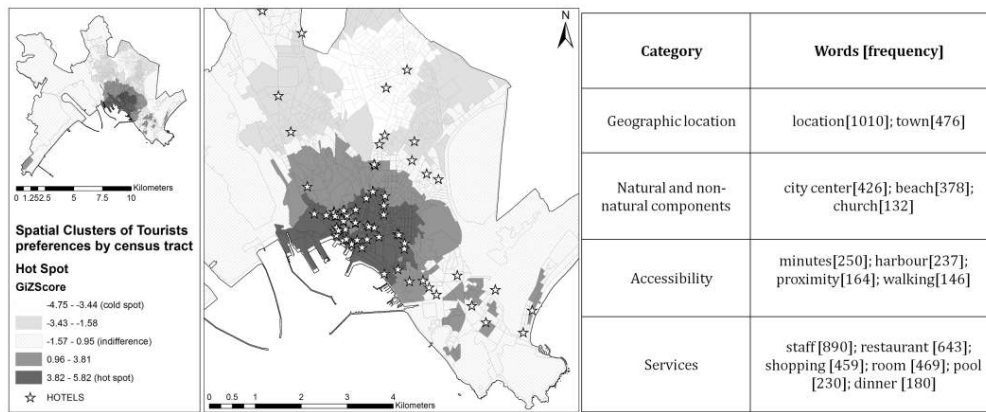


Fig. 1. Cluster of tourists' preferences (left) and top 15 words related to Cagliari as depicted in reviews and divided by category (right).

The next step focuses on each review's content in order to understand what tourists think about Cagliari. Hundreds of textual reviews on TLS are processed by means of simple text analytics, identifying the most used words and consequently the spatial or physical aspects more attracting users. While most of the words refer to municipalities physical factors, such as 'city centre', 'beach', and 'church', other words are related both to leisure sites, that is 'restaurants' and 'shopping', and to TLS' supplied services, such as 'staff' and 'room'. Moreover, a number of keywords concerning accessibility, such as 'proximity' and 'walking', are frequent too, potentially indicating a correlation with TLSs spatial location. This is not the kind of information we usually find in land use-related planning documents, but it may be powerful in supporting design and decision-making.

The spatial relationships and the explanatory factors behind observed spatial patterns are modelled using the GWR. The aim of the regression is to discover what factors contribute to the TPPI rate. The model is applied to a sample of 150 TLSs spatially distributed over 100 of the 1359 Cagliari's census tracts. The dependent variable is the score of the TPPI, normalized as fraction of the comments that are positive for a location belonging to a census tract. For each census tract, a measure of the set of independent variables, concerning topography, transport infrastructure, cultural heritage sites, and socio-economic features, is calculated. The results of

the statistical tests for measuring redundancy (Variance inflation factor or VIF test, Mennis 2006) suggest that the following candidate variables are included, normalized by the total census tract's area:

- number of historical buildings in the TLS' census tract;
- number of restaurants and facilities in the TLS' census tract
- proximity to the historic center of the municipality);
- distance from the airport;
- hectares of natural protected areas in the TLS' census tract;
- distance from the municipality's beach.

A spatially-lagged explanatory variable is added to control for spatial autocorrelation of the dependent variable. The presence of spatial autocorrelation (Anselin 1988) related to the value of the normalized TPPI, is detected through the Moran's test (Moran 1950).

Tab. 1. GWR model: influence of each explanatory variable on dependent variable.

Variable	Coefficient	Std. Error	z-value	p-value
TPPI_lag [19]	0.0663	0.0307	2.1621	0.0306
Constant	0.0031	0.0102	0.3012	0.7633
N_restaurants	-0.0390	0.0300	-1.3013	0.1932
Proxy_historic_center	0.4748	0.0585	8.1146	0.0000
N_hist_buildings	-0.0273	0.0313	-0.8724	0.3830
H_natural_areas	0.0027	0.0096	0.2834	0.0777
Distance_airport	0.7661	0.0340	22.5511	0.0000
Distance_beach	0.5470	0.0383	14.2922	0.0000

The result of the local Moran's index is quite significant at the second order of contiguity in respect of results obtained using a threshold distance of 2,500 meters: adjusted R-squared is less than 40%, the p-value of the dependent variable's coefficient is very significant (1.0 10⁻⁸) and the value of the Moran's index is 0.024. The very low p-value indicates that the spatial autocorrelation of the dependent variable is highly significant. The results regarding the goodness of fit of the spatial regression, shown in Table 1, are significant: R-squared, namely the measure of the size of the variance of the dependent variable explained by the set of the explanatory variables, is as high as 86%, indicating that variables in the model are able to explain about 86% of the TPPI's variance. The results of the GWR are quite significant for the description of the spatial distribution of TPPI. The coefficients of the variables related to the distance from the airport, to the proximity to the city centre and to the proximity to the beach, which concern the TLSs' location, show positive signs and are almost always significant (p-values less than 5%). The variables related to the restaurants and to the historical buildings are not very significant, for the p-values are bigger than 10%, while the hectares of natural protected areas show a positive sign and a 8% significant coefficient. Overall, these findings suggest that the spatial interest of the tourists is quantitatively influenced the geographic locations and the services supply.

Finally, the last step concerns the complementary extraction of SMGI from Instagram and Foursquare, eliciting further knowledge related to specific public spaces in Cagliari municipality, namely the Poetto beach and the Regional Park of Molentargius. Integrating data from multiple sources may allow detecting POI in the study area, easing to understand the reasons behind the GWR model explanatory variable 'proximity to the beach'. Data collection is conducted for the

period May 2012-May 2013 and results in a dataset of 34,776 geotagged photos. Then, a cluster analysis by DBSCAN algorithm (Ester et al. 1996) is run on the dataset, identifying 220 clusters of interest in the area. The results confirm the major interest of users toward the coastal area, probably because of the presence of popular venues. In order to gain further insights about the users' preferences, a Foursquare SMGI extraction is carried out identifying the type of the most visited venues in the clusters.

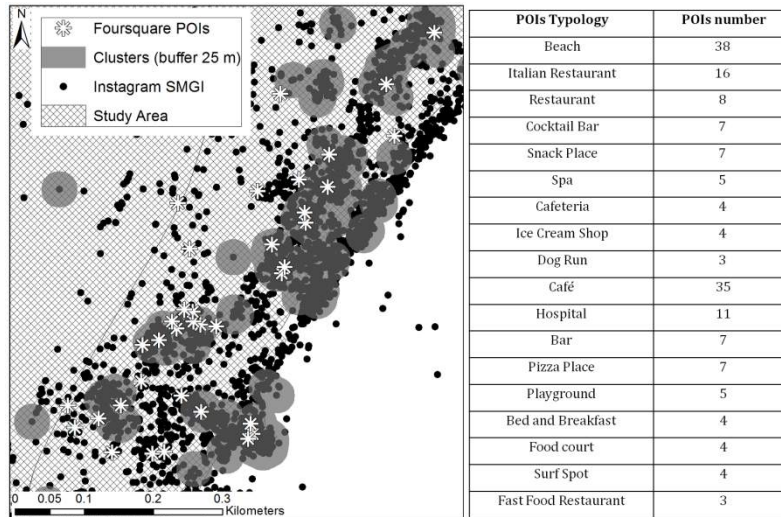


Fig. 2. Most visited Instagram SMGI clusters and Foursquare POIs.

The extraction results in a dataset of 177 POIs, which are assigned to clusters and evaluated in terms of typology and specific degree of attractiveness, as shown in Figure 2. The obtained results demonstrate the SMGI opportunities to supply information related to the geography of places, while enabling at the same time a more detailed characterization of the public spaces with information usually not available to planners.

Conclusions

This paper discusses a methodological approach for exploiting SMGI, a novel source of information that may be integrated with official information and used in tourism planning, in order to take into account a multifaceted tourists' oriented view on strategic development issues. The findings, providing insights on the Cagliari's tourism dynamics, might be effectively implemented into planning policies whose objective is to increase the tourists' satisfaction and foster sustainable development policies. With reference to the results obtained for Cagliari destination, several policies may be identified, such as:

- improving protection of the municipality of Cagliari's natural areas, since the coefficient of variable 'H_natural_areas' is positive and significant;
- improving the accessibility of the Cagliari's historic centre, since the coefficient of variable 'Proxy_historic_center' is positive and significant;
- the accessibility of the Cagliari's beach and increasing the supply of facilities for tourist reception since the coefficient of variable 'Distance_beach' is positive and significant;
- improving the range of offered amenities along the beach, since users and tourists may be attracted by a diversification of services, as suggested by the identified clusters' area (Instagram) and successful detected POIs (Foursquare).

In conclusion, users' preferences knowledge in supporting the tourism planning processes may represent a significant implication for future research in the field of social sciences and tourism

management. As a matter of fact, the proposed case study emphasizes the importance of the stakeholders (users or tourists) within the inclusive processes. In this regard, their behaviours may strengthen or discourage the existing power relations fostering more democratic and transparent processes. Early results are promising and disclose challenging research opportunities, which may bring innovation to tourism planning, design and decision-making.

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