

Perceived capitalization of Wi-Fi as a free service at locations of accommodation establishments from Maramureș Land using Booking.com score data and mobile signal coverage data

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Received on 09-01-2024, reviewed on 25-05-2024, accepted on 20-06-2024

Abstract

Travelers nowadays expect to have a proper, constant, and free internet connection at their disposal almost everywhere, with the Wi-Fi service offered as a standard in tourist lodgings. Such is the importance of the service, that the issue of free internet access has become a crucial booking factor to be considered in the pre-reservation stage. The main working hypothesis argues that online booking platforms offer insights regarding the capitalization of internet connectivity in accommodation establishments as a free service. Focusing on a rural tourism destination, the Land of Maramureș, northern Romania as a case study, the paper proposes an empirical methodological framework designed in a GIS environment that concentrates on two key variables - the mobile aggregated signal coverage data in the study area as an independent variable, sourced from the map of mobile signal coverage in Romanian settlements developed by ANCOM (the National Authority for Management and Regulation in Communications) and the Wi-Fi secondary scores as the dependent variable, sourced from Booking.com score data to test the above working hypothesis. The testing of the working hypothesis was performed using spatial processing and analysis methods such as Inverse Distance Weighted Interpolation (IDW) and Regression Analysis.

Keywords: Maramures Land, rural tourism destination, free Wi-Fi, Booking.com, score data, mobile signal coverage data

Introduction

One particular service is considered an important amenity in any tourist establishment but is still not incorporated among the 'usual' facilities – access to internet as a free service on the premises of the accommodation establishments. Usually such a service is provided as Wi-Fi service. If at the level of many public institutions and spaces (indoor or outdoor) the internet (Wi-Fi) is available free of charge, it should be offered as free service in tourist establishments also.

According to insights from major booking platforms and community support blogs (Airbnb Community, 2023) travelers nowadays expect free internet access in their lodgings as a standard. The issue of free internet access has become a "key booking factor" (Bookink.com Partner Hub, 2023). This is supported by academic studies that highlight the service as being a top amenity. One such study was based on more than 50000 hotel guest responses and was carried out by an American data analytics and consumer intelligence company (Greif, 2010). The guests considered the service as being "the most important hotel amenity" (Bulchand-Gidumal et al., 2011, p.236).

The tourist businesses that understood the importance and impact of the shared internet access on their premises

and capitalized it through increased visibility of business and efficiency of operations, improved communication with tourists or better marketing actions, have increased the overall quality of their services, revenues and guest satisfaction (Bulchand-Gidumal et al., 2011).

Thus, the main working hypothesis of the study is: can Wi-Fi score data from online booking platforms such as Booking.com offer insights regarding the capitalization of internet availability as a free service in accommodation establishments from a rural tourism destination?

To test the above hypothesis a methodological framework comprising several steps was designed in a GIS environment in order to map the internet availability and quality of internet based on mobile signal coverage data and score data related to Wi-Fi as a service from booking platforms. The methodological framework was applied to a Romanian rural tourism destination – Maramureș Land.

The originality of the study resides in the bottom-up methodological approach that involves choosing two main variables – the independent mobile aggregated signal coverage in the study area and the dependent Wi-Fi scores. The latter evaluates the availability and quality of free internet access on the premises of tourist properties. The substantiations for the above methodological choices are stated in the dedicated chapter comprising the methodological details.

Theoretical background

Internet technology in tourism

For the tourism economy, the issue of access to a high-quality internet connection has become a major objective in recent years in many destinations around the world (Dredge et al., 2019) including in rural the areas such as Maramureș Land.

In a report analyzing many aspects of the digitalization processes in tourism (Dredge et al., 2019) Dredge and her team state that digitalization in tourism has a long reach and brings undisputed advantages. The study argues that digitalization in tourism leads to innovation that can inspire 'new business models, new value chains, new business ecosystems'. The innovations can stimulate new or customized tourist experiences, enhancing their satisfaction.

On the level of experience and personal engagement with the destination, internet technology greatly influences the tourism experience and the behavior of the tourists (Buonincontri & Micera, 2016; Lagonigro et al., 2020). The smartphones and their functionalities epitomize the holistic perspective of internet technology for the usual user, offering a broad "range of possibilities supporting travelers" (Wang et al., 2014). Many tourists, especially those who cater to their own travel needs, use internet technology as a tool or means to engage with the destinations they visit in all the phases of travel, including documentation and booking of services (Binkhorst & Dekker, 2009). More importantly, they use internet technology to share their experience with others (Buonincontri & Micera, 2016) in the form of creative content (photos, videos) or reviews that contain both positive and negative insights. These aspects reflect the engagement of the tourists with the destination, allowing them to create, based on memory associations, various psychological and emotional structures that underpin their cognition about the place (Beerli & Martin, 2004; Gomez et al., 2015; Yunis et al., 2018). From the tourism perspective the idea of being in places with different levels of familiarity but connected all the time introduces the notion of "digital elasticity" (Pearce, 2011, p. 41) between the two opposing situations – being home and being away, because the "mobile connectivity blurs traditionally sharp distinctions between" the two (Conti & Farsari, 2022, p.3)

On the other hand there are research perspectives (Tribe & Mkono, 2017) that shed light on the more subtle and not-so-beneficial implications of connectivity especially during travel – the impact of permanent connectivity and its alienating effects on tourists, substantiating movements such as digital-free tourism (Li et al., 2020).

Overall, both in academia and in practice, there is an endorsement of internet and mobile technology adoption (Law et al., 2018) in all areas of tourism activity, based on the assumption that such an adoption brings practical

added value (Mellinas & Nicolau, 2020) to all actors involved and other advantages to the tourism sector (Pearce & Gretzel, 2012; Li et al., 2018). For example, in a study combining results from a national survey carried out in Australia regarding the importance of Wi-Fi speed in tourism establishments, that involved approximately 200 hotels, with analyses of online reviews left by hotel guests, it was found that if Wi-Fi quality rises by 1%, customer satisfaction with the hotel increases by 0.1% (Grechyn & McShane, 2021).

Internet access in tourism facilities

The networking between tourists themselves or between tourists and providers is important due to the nature of the interactions and the establishment of a feedback loop. From the perspective of the tourist services providers, studies connecting service quality perception and online visibility with the business performance of rural establishments highlight the importance of online visibility for tourism businesses and the relationship between the online feedback of customers of rural tourism and the economic performances as a business consequence (Melo et al., 2016) and stress the importance of online reviews for travelers when considering a new booking (Zhang et al., 2014) because those reviews will influence a positive overall perception on the quality of the services in the pre-purchase phase (Browning et al., 2013). An empirical study that substantiates the gains for tourist establishment owners was conducted in 2010 by Bulchand-Gidumal, Melián-González and González López-Valcárcel and analyzed the importance of Wi-Fi in hotels through Tripadvisor reviews left by hotel guests. Reviews from more than 26000 hotels located in the first 200 most rated tourist destinations in Europe on Tripadvisor were taken into account. One of the main conclusions of this study was that hotels offering free Wi-Fi can improve their ratings up by 8% (Bulchand-Gidumal et al., 2011; Mellinas & Nicolau, 2020).

In a study carried out in 2017 on a statistical population comprising 120 participants engaged in the process of booking a hotel room online, Eriksson and co. focused on investigating the "relative impact of Wi-Fi on consumers' hotel bookings" (Eriksson & Fagerstrøm, 2017). Their results have shown that Wi-Fi price and reviews have a certain influence on consumer behavior and suggested that research and findings of this kind, can help tourist accommodation owners to market their business better.

Booking.com for example collects hundreds of millions of reviews every year. Having the largest share of reviews (Murphy, 2017), such a rich database has attracted the attention of academics and data brokers alike (Mariani et al., 2020).

Among the many tools provided on the platform, for owners and customers, the review system developed by Booking.com allows travelers to give feedback by making an evaluation of the experienced accommodation services. The feedback can be both quantitative, by

choosing a score, and qualitative, by writing a review. The free expression and sharing of opinions have an impact on brand buildup and reputation (Huerta-Álvarez et al., 2020) for local tourism entrepreneurs.

The scoring system on Booking.com

In September 2019, the scale of the numerical scoring system proposed by Booking.com was changed, from the 2.5 to 10 scale to a more conventional 1 to 10 scale (Mellinas & Martin-Fuentes, 2021). The scoring system proposed by Booking.com is a quantitative scale

represented through discrete, numerical values. The numerical scores have qualitative equivalents (Fig. 1).

The scoring system is divided into an overall score reflecting the global quality of services perceived by the tourists. Each establishment receives an overall score calculated by dividing the sum of all the overall scores to the total number of review scores received for that property. In order to get an overall score, an establishment must have at least 6 reviews. In addition, travelers have the opportunity to choose a set of sub-scores on multiple areas considered to be important for the quality appreciation of a property. The two scores are not interrelated.

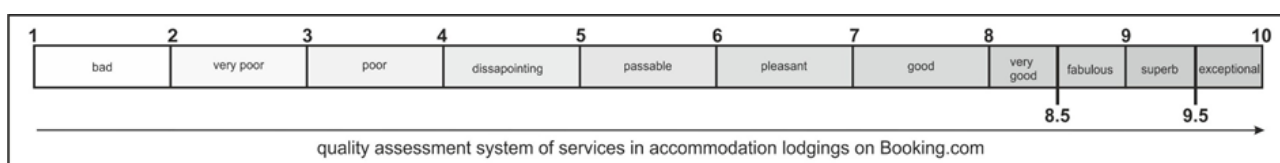


Figure 1. The Booking.com service quality assessment system available since September 2019

The lifetime of reviews (as a score or written review) was, until 31 July 2020, of two years. From that moment on Booking.com extended the lifespan by one year (Phillips et al., 2019).

The effects of the scoring system proposed by Booking.com were discussed in a series of academic papers that debated the idea of bias because of a perceived tendency to inflate scores (Mellinas et al., 2016; Mariani & Borghi, 2018). Also, the authors of the papers stated that the new scale can produce changes in the overall score that do not reflect changes in customer satisfaction (Mellinas & Martin-Fuentes, 2021).

Description of the study area and of the tourist accommodation network

Maramureş Land, a well-known tourism brand (Ilieş & Ilieş, 2015) is a region in northern Romania, at the border with Ukraine (Fig. 2) in the county of Maramureş. Being a land-type region, it represents a mental construction with no true administrative boundaries, but clear territorial, mentally enforced delineations. Its geographical unity is perceived by the collective consciousness of its residents (Ilieş, 2007) and acknowledged by its neighbours.



Figure 2. Geographical location of the study area - Maramureş Land

As all other land type regions, Maramureș Land has a strong cultural identity being renowned nationally and internationally for its vernacular wooden architecture (Ilieș & Ilieș, 2021) and for its unique traditions and folk costumes (Ilieș & Ilieș, 2021). The region covers 3238 km² and has a population of 211,408 inhabitants (Tempo Online-statistical data, 2023). The landscape has a complex topography dominated by mountains surrounding a central, corrugated depression that concentrates all 36 settlements and almost the entire social and economic fabric. The area has a predominantly rural character with 31 settlements being rural settlements comprising a population of ap. 115,346 (Tempo Online-statistical data, 2023).

The urban texture composed of only 5 small cities that concentrate ap. 96,062 people (Tempo Online-statistical data, 2023). The biggest city – Sighetu Marmăției – has a population of ap. 41,689 inhabitants (Tempo Online-statistical data, 2023) and represents the main urban center of the region. The uniqueness of its cultural heritage and its strong rural character have transformed Maramureș Land into a well-known and sought-after rural tourism destination (Fig. 2).

In Maramureș Land, the tourist accommodation network comprises a total number of 764 small to medium tourist establishments, totaling 10,386 bed places (Authorisation and Control-Romanian Ministry of Economy, Entrepreneurship and Tourism, 2023).

Table 1: Accommodation establishments from Maramureș Land: breakdown of types, number of units, number of bed-places and corresponding share (Authorisation and Control-Romanian Ministry of Economy, Entrepreneurship and Tourism, 2023)

Type of accommodation establishments	Number of units	Share (%)	Number of bed-places	Share (%)
hotels	15	2.0	972	9.4
motels	5	0.7	160	1.5
hostels	10	1.3	371	3.6
touristic boarding houses	174	22.8	2711	26.1
agroturistic boarding houses	112	14.7	1215	11.7
touristic villas	5	0.7	101	1.0
touristic chalets	5	0.7	97	0.9
apartments and rooms for rent	417	54.6	4330	41.7
houselet type units	13	1.7	150	1.4
campings	6	0.8	228	2.2
bungalows	1	0.1	27	0.3
touristic halting places	1	0.1	24	0.2
TOTAL	764	100%	10386	100%

The touristic and agroturistic boarding houses together with the apartments and rooms for rent account for 92.7 % of the total number of accommodation establishments from the area and hold a share of 79.5% of the total number of bed-places. According to statistical reports, in 2022 Maramureș Land had 148,849 unique visitors (Tempo Online-statistical data, 2023).

Methodology

The methodological framework has a bottom-up, empirical design due to the character and extension of the study area – a predominantly rural destination. The framework comprises several work stages schematically described below (Fig. 3).

The research can be traced on seven working stages, following two paths. Each path was designed around one of the two main variables used in the study – the 4G mobile aggregated signal coverage in the study area as an independent variable and the Wi-Fi review scores as the dependent variable. No other factors influencing spatiality were considered, as was the case in the proposed methodological framework of the study that analyzed the spatial pattern of Airbnb lodging in a Chinese city (Sun et al., 2022).



Figure 3: The research design

The independent variable description

The online presence is conditioned by internet access, distribution, and quality of connections. According to a report from the first half of 2023 detailing the statistical

breakdown of electronic communications data from the Romanian market (ANCOM-statistical data, 2023) on the national internet services market, there are several major internet providers, such as Orange Romania Communications, RCS&RDS, Telekom and Vodafone. These providers, combined, control ap. 98% of the fixed broadband (coaxial cable, optical fiber etc.) internet market and ap. 99.9% of the mobile internet market.

In Maramureş Land, the fixed and mobile internet markets are controlled almost entirely by the same providers. For this study, in the case of the independent variable the data regarding the internet availability on the premises of accommodation establishments, due to lack of spatial data in any format and lack of detailed territorial statistics for fixed broadband internet connections and associated parameters (territorial distribution, quality of the connections, speed etc.), we used only data regarding internet availability from mobile internet providers.

The necessary data to substantiate the independent variable were sourced from the map of mobile signal coverage in the settlements from Maramures Land. The map was developed by ANCOM (the National Authority for Management and Regulation in Communications) through a project of signal monitoring conducted between 2019 and 2020 along national and county roads (ANCOM-map of 2G, 3G and 4G mobile signal coverage on the territory of Romania, 2022). The reasons behind the decision reside in the availability of spatial data presenting the “mobile signal coverage for all technologies (2G / 3G / 4G) for each of the mobile providers engaged on the Romanian market. The map presents the spatial distribution of signal coverage as a grid along the routes taken during the field camping and classifies the signal quality into 5 classes. For this study, the 4G signal coverage option was used, as it is the most used technological solution (ANCOM-statistical data, 2023).

Considering the varied typology of Wi-Fi networks and the variety of providers, not just mobile service providers, this is the right moment to address the use of mobile signal data as indicator of Wi-Fi availability and quality of connectivity. Through the ANCOM map, this was the best option of readily available open source data offering spatial information on the signal coverage for various technologies from the main providers of telecommunications services. Therefore, it was considered an adequate proxy that satisfied the demands of the present study. This choice was also supported by the fact that, despite many different kinds of Wi-Fi networks available, the Wi-Fi data obtained from Booking.com does not distinguish between these typologies, with the reviews reflecting only the availability of the service and its perceived quality based on internet speed. A similar situation was encountered in another study focusing on review data from Tripadvisor (Bulchand-Gidumal et al., 2011).

The dependent variable description

Regarding the online presence of tourist accommodation establishments, one indicator of the importance given by owners is represented by their active engagement online in promoting and selling tourist services. In this case accommodation services on major online booking platforms. In Maramureş Land, Booking.com and Airbnb.com are the most popular booking platforms (Fig. 4).

The share of listings with an active presence on booking.com is of ap. 48% of the total number of accommodation establishments from the region. Booking.com is the most popular online reservation platforms in the area. For this study, we used only Booking.com score data – the Wi-Fi subscore – from accommodation establishments based in Maramureş Land with a valid and active Booking.com owner account, because of the market share it holds among the tourist establishments from the region (Fig.4).

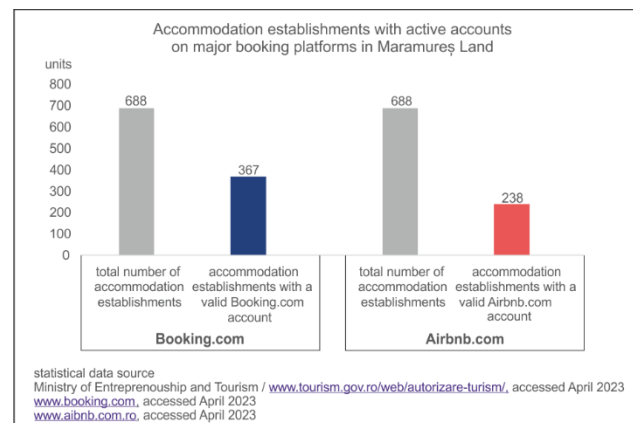


Figure 4: Comparison of number of listings on Booking.com and Airbnb.com in Maramureş Land

Booking.com as a reservation platform “enables properties all over the world to reach a global audience and grow their businesses” (Booking.com-company description, 2023). The Wi-Fi sub-score is not incorporated among the crucial facilities that can be reviewed through the 1 to 10 scale by tourists and is considered optional.

Although the text reviews represent a valuable data source, due to methodological incompatibilities, the corpus of text reviews was not taken into account because of the qualitative nature of the variable and the need for a different methodological approach.

Database build-up

The first stage assumed the build-up of a database comprising the necessary data sources for each path.

On the independent variable path, the assessment of signal strength extracted from the ANCOM map assumed the classification into 5 qualitative levels as equivalents based on measurements and thresholds for each technology - 2G / GSM, 3G / UMTS, 4G / LTE (ANCOM-

methodological aspects for the mobile signal coverage map, 2023). A different color was attributed to each class. For this study the same system of classification was used but the values were extracted only from the 4 G mobile signal coverage map, aggregated for all mobile coverage providers from the Romanian market. This technology was favored because it accommodates smartphones better by offering faster speeds and supporting the intensive mobile streaming activity.

On the dependent variable path, the Booking.com database compilation work assumed a primary data collection for all the accommodation establishments with an active and operational Booking.com account from Maramureș Land, followed by two verification and update phases. The database compilation work was divided into three intervals, between the beginning of September 2023 and the end of November 2023. The primary data were collected at the beginning of September 2023 (1 to 10 of September) and assumed the identification of a webcrawler.

For this study the Octoparse software solution was used. The search structure for the website indexation included the following key items and 2 criteria used to set a baseline in order to differentiate the establishments that will support the substantiation of the study's objectives:

- name of the establishment;
- address. The addresses were used in a second stage to geolocate the accommodation establishments through GPS coordinates;
- type of accommodation according to the Booking.com accommodation classification;
- number of reviews. The number of reviews was an important variable as it was used as a first criterion in setting up of the minimum baseline for including or excluding some of the properties in the analysis. Only establishments with at least 5 reviews were included in the analysis, as, according to Booking.com, an overall score can be generated only after a minimum number of 5 reviews are awarded by customers (Booking.com Partner Hub, 2023);
- overall review score (1 to 10);
- detailed review scores on all key areas (cleanliness, comfort, value, facilities, location, staff);
- the review score for Wi-Fi (1 to 10). This is an optional score on Booking.com platform and it does not affect the overall score for that particular property. This variable represents the 2nd main variable used in the spatial analysis phase. It was also included as the 2nd eliminatory criteria in the baseline establishment procedure.

Data verification and update

The results obtained by the webcrawler were compiled in an Excel spreadsheet file using the CSV format for QGIS compatibility. The second and the third interval represented a verification and an update of the database. The data collection was checked and updated between 20 - 30 November and assumed a value verification of all

scores on the key areas for the study - number of reviews, overall score, detailed scores and, of course, the review score for Wi-Fi. This was done as a checkup due to the assimilation of the former evaluation scale by recalculating score values based on the new Booking.com algorithms.

Address geocoding / file georeferencing / Data import into QGIS environment

On the independent variable path, since the ANCOM map from the www.aisemnal.ro platform, with a focus on the study area, was not available in a GIS compatible format, it was saved as an image and georeferenced in QGIS environment to support the vectorization of the 4G mobile signal. The vectorization work assumed the creation of a vector point layer with a single quantitative attribute – the signal strength (5 classes). This step was done manually and was labour intensive. The values were assigned to each point according to the color of the pixel representing a signal class on the georeferenced image. A numerical value from 1 to 5 was associated with the mobile signal coverage strength class, with 1 representing the no signal class and 5 representing the very good signal class. In a later stage the points from the vector layer comprising the vectorized values of mobile 4G signal in the area of study were interpolated using the IDW interpolation method in order to obtain a spatially continuous raster map presenting the mobile signal coverage for the entire surface of the area (see section – Data interpolation).

On the dependent variable path, the third stage assumed the geocoding of addresses, a procedure that involved the transformation of text values such an address into coordinates. For this step, the Google Maps solution was used. After the accommodation establishments were located based on their name, the coordinates from each location were copied in the Excel spreadsheet. The geocoding step was imperative as the location data of the establishments had to be made usable in a GIS environment. For our study, the QGIS solution was adopted as it provided all the necessary tools for the completion of the study. This step was followed by the conversion of the Excel Spreadsheet into a discrete data set (vector point layer) in QGIS, representing the geolocation of each tourist establishment. The vector point layer with the Excel database attached as an attribute table is considered discrete data as its key attribute field (free Wi-Fi score) describes a certain phenomenology with quantitative data that occurs only in certain locations.

Criteria-based query of data

This stage involved only the dependent variable path and assumed the querying of the geodatabase in order to satisfy the criteria, namely the minimum number of reviews and the presence of the optional rating - the

review score for the availability and quality of Wi-Fi. This stage concluded the vector file that highlighted the dependent variable used in the study. The query of the geodatabase data was done using query syntax in Fields calculator in order to satisfy the two criteria stated above.

The first criteria assumed a minimum number of 5 reviews per each tourist establishment. The threshold was established by Booking.com as the minimum number of reviews necessary to generate an overall review score. Even though the overall score was not actively used in the study, and the fact that the detailed scores are not connected with the overall score and do not impact its calculation, we considered it to be a sound baseline. The minimum baseline of 5 reviews implies using some weight in the process of mapping a review characteristic such as Wi-Fi availability.

The application of the second criterion assumed the selection of accommodation establishments that received in the aforementioned timeframe a Wi-Fi score. The procedure generated a vector point layer that satisfied the 2 conditions.

Data interpolation

An interpolation method was needed to represent an attribute as spatially continuous data (Khouni et al., 2021). The procedure aimed at obtaining a raster file from the vector points representing sampled 4G signal values from the ANCOM signal coverage map. In a raster file of this type, each pixel is a function of the signal coverage strength over the entire area of Maramureş Land. To this end, the independent variable was processed and mapped in a GIS environment through the IDW interpolation method (Inverse Distance Weighting Interpolation). This interpolation method allows the estimation of quantitative values about an attribute at unsampled points by using an algorithm that combines the values of sampled points with a weighed inverse function of the distance between them, assuming that the sampled points found closer to the unsampled ones share similar values that the ones located further (Jin & Heap, 2011).

The main advantage of the approach is the ability to emphasize the spatial variations of a variable value – in this case the 4 G mobile signal strength – as a continuous, with increased precision. For methodological conveniences, the five qualitative classes were coded with numerical values from 1 (no signal) to 5 (very good signal) as stated above. The addition of a weighted variable was mandatory in order to increase the influence of the variable on the resulting map. The analysis of the 4G mobile coverage signal as a spatially continuous field generated a single band raster layer.

Spatial analysis and visualisation

A spatial sampling algorithm (raster sample values algorithm) was used in order to determine the mobile signal strength at the geolocation of the tourist

establishments that satisfy the two selection criteria - at least 5 overall reviews and Wi-Fi review (Fig. 5). The 4 G mobile signal values at the location of the tourist establishments were extracted from the raster layer through the raster sample values algorithm and attached as a new attribute to a new vector point layer representing the geolocation of the tourist establishments.

Subsequently, the study's working hypothesis was tested using a linear regression algorithm. The method describes the level of dependence between variables.

Results and discussion

The methodological flow described in the previous section generated a series of cartographic outputs highlighting insights regarding the capitalization of internet availability as a free Wi-Fi service in the accommodation establishments from Maramureş Land with an online presence on booking platforms such as Booking.com. On the dependent variable path, the query satisfying the double criteria generated a vector layer containing 201 tourist establishments out of the 367 tourist establishments that were present on Booking.com at the end of the database compilation. The number represents just 29.2% of the total number of accommodation establishments from the region and 54% of the total number of accommodations with valid Booking.com accounts. It would have been expected that the number of accommodation establishments satisfying two minimal query criteria to be higher, even in a predominantly rural destination. One of the reasons for this situation is represented by the overall reduced number of available reviews on the Booking.com platform on each account, with several exceptions, of course. The average number of reviews is situated around 60, considering the fact that 72 establishments had no reviews at all. The issue of the reduced number of reviews or the lack of them on active accounts that have been in operation for more than a year, needs an in-depth focus in itself.

As expected, spatially, the 201 queried accommodation establishments are located in settlements with a developed accommodation infrastructure, and noteworthy attractions. The establishments can be grouped in two clusters. The first cluster comprised accommodation establishments located in the south-eastern part of Maramureş Land, in touristic hotspots such as Borşa, an appreciated winter resort, the neighbouring village of Moisei and the city of Vişeu de Sus. The second one, covering a larger area, comprises accommodation establishments situated in the north-western and south-western part of the region, also in settlements with touristic pedigree, such as the village of Breb, with well-preserved traditional architecture, the balneal resort of Ocna Şugatag, the village of Vadu Izei, the city of Sighetu Marmăției, the cultural center of

Maramureș land, and the village of Săpânța with its world-famous Merry Cemetery (Fig. 5).

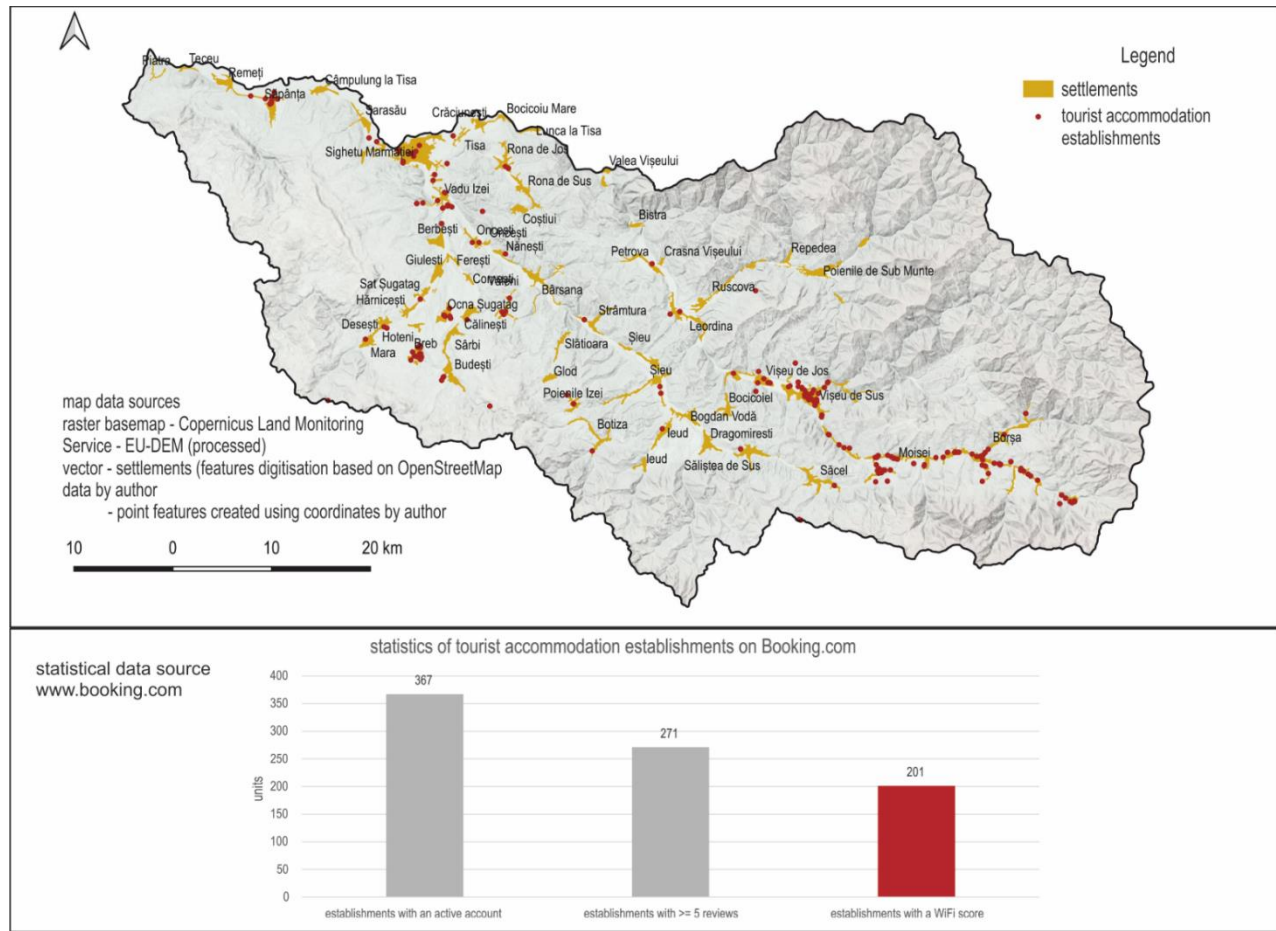


Figure 5: Location of accommodation establishments with at least 5 reviews and Wi-Fi score on their Booking.com accounts

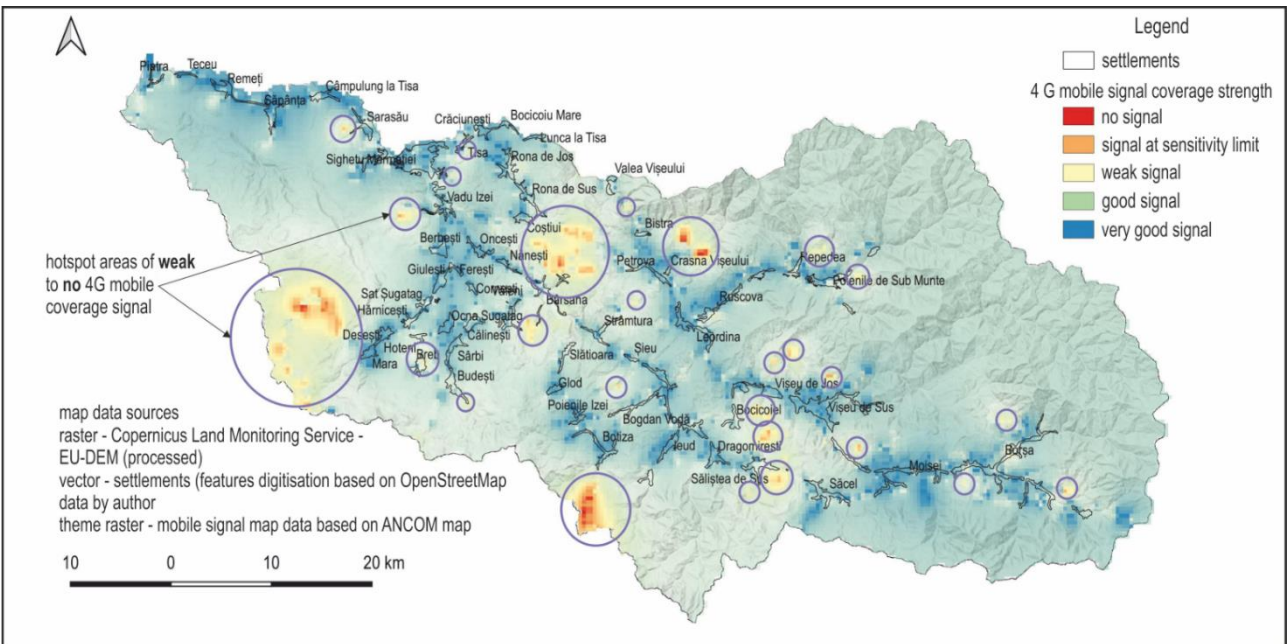


Figure 6: 4G aggregated mobile coverage signal in Maramureș Land

The spatially continuous map representing the 4G aggregated mobile coverage signal in Maramureș Land, obtained via the IDW algorithm (Fig. 6), shows that the region's main valleys, where all settlements are concentrated, present good and very good levels of 4 G mobile signal due to a strong infrastructure. Hotspots of problematic signal coverage (no signal to weak signal classes) are highlighted in several areas situated outside or at the extremities of the settlement perimeters, especially in hilly and mountainous zones. Several possible factors can explain these occurrences in a regional context, among them the relief of the region through obstructional factors such as slope gradient and direction, the presence of ravines, canyons or depressions. Other obstructional factors could involve the position, distance and range of network towers, some building characteristics, the tree cover and density, or the proximity to the border with frequent signal interferences etc.

Using the raster sampling algorithm described at the end of the methodological section, the 4G mobile signal

strength was extracted as a new quantitative attribute for each vector point representing the 201 tourist establishments, followed by hypothesis testing. No tourist establishments were found to be located in the problematic areas pertaining to the poor and no signal classes.

The hypothesis testing (Fig. 7) returned a R Squared value of approximately 0.98, suggesting a high level of dependence between the two variables that have a statistically significant relationship ($p = 0.000$). The location of the majority of tourist establishments along the region's main valleys, enjoy good to very good levels of 4 G mobile signal. This aspect contributed to the quality of mobile signal in tourist establishments that in turn favored high-quality Wi-Fi connection internet that generated a good rating on Booking.com. The majority of the tourist establishments (187 establishments) have registered scores above 7, which translates, according to booking scale values, into good up to very good and exceptional free internet availability.

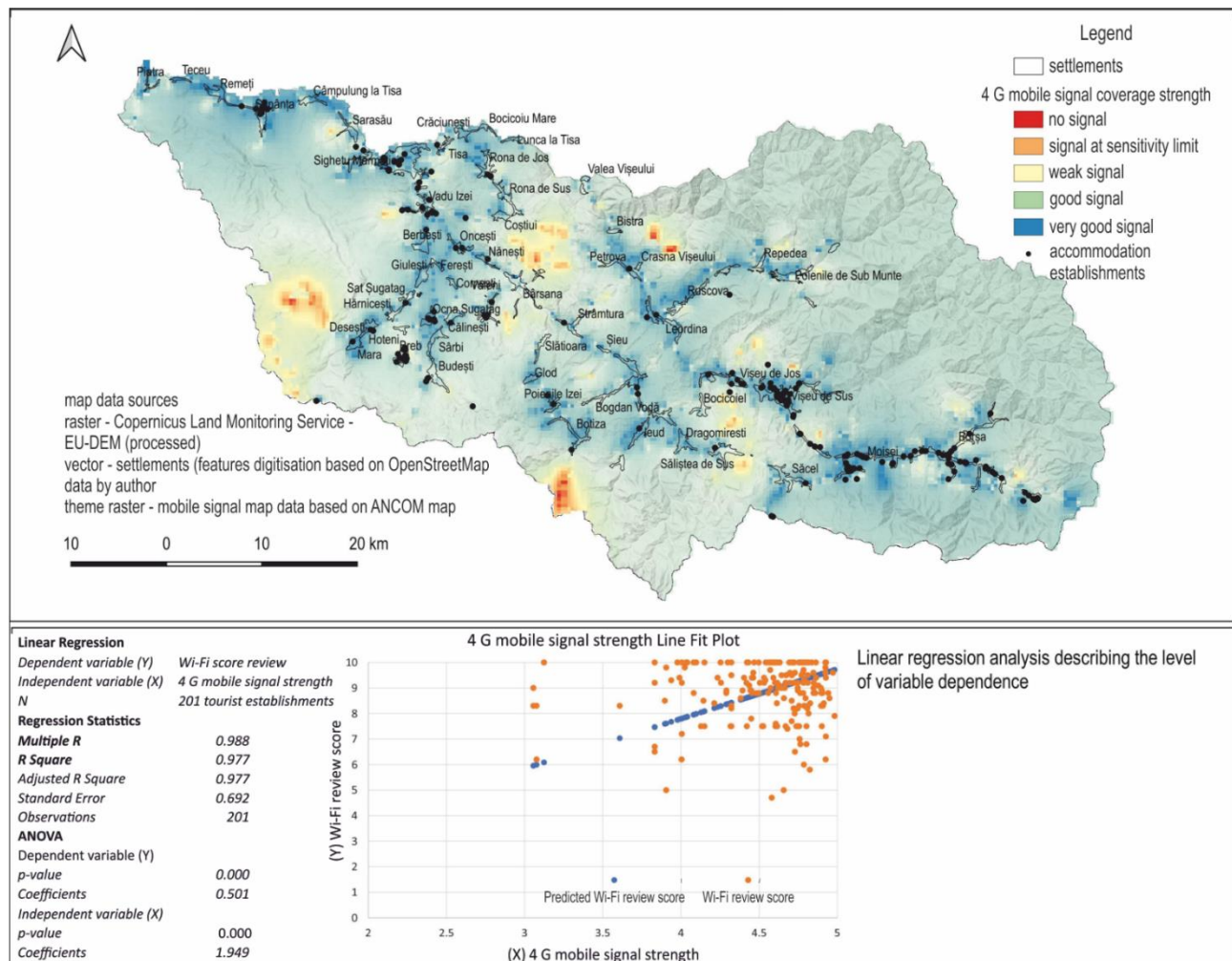


Figure 7: Results testing the level of dependence between the dependent Wi-Fi review score and the independent 4 G mobile signal strength

Considering the location of these establishments in areas with infrastructure networks, including mobile

communications, and the fact that the study focused only on the establishments with an online presence on an

accommodation booking platform, these first results were to be expected. Communicating online with potential clients and performing operations via an online platform indicates the existence of technological devices on the premises of the accommodation establishments that allow internet connectivity. The Booking.com Wi-Fi scores above 7 obtained by the majority of the tourist establishments indicate that ensuring a proper internet wireless connection for the clients while on the premises was paramount for the owners that have invested in appropriate devices (routers etc.) and subscriptions to various service providers operating in the area. This also indicated that the owners of accommodation establishments understood the importance of a good

internet connectivity for their guests and the positive impact it can have on their experience and capitalized it.

However, even though no accommodation establishments were located in the problematic areas with poor or no signal, the subsequent plot analysis identified several tourist establishments that do not satisfy the spatial positive correlation between the two variables and can be considered as not having a significant relationship. A total of 19 accommodation establishments were extrapolated as exceptions. Based on their traits in comparing the two variables, two distinct categories were identified (Fig. 8) using a double variable interrogation procedure on the vector layer containing the location of the 201 tourist establishments.

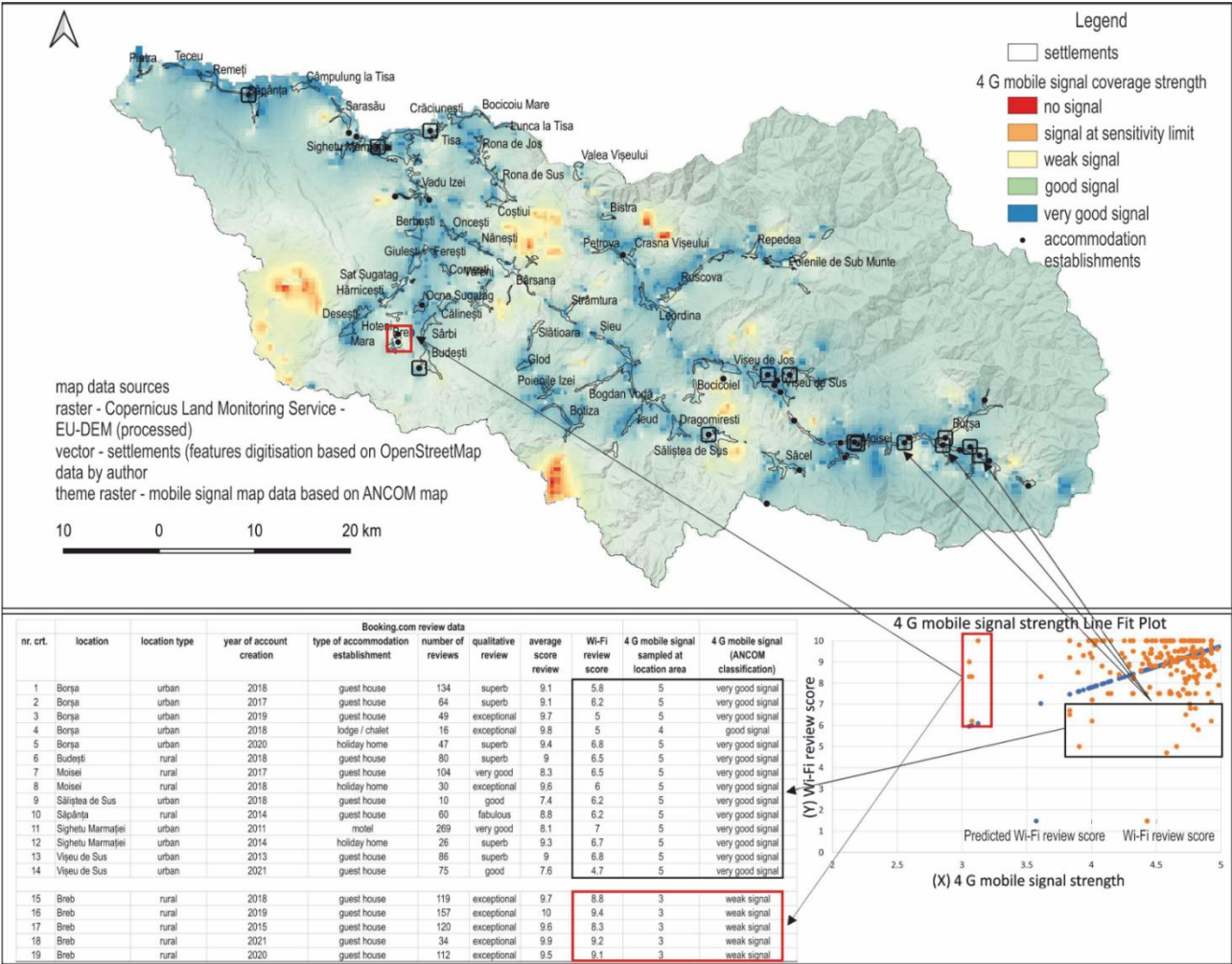


Figure 8: Location of tourist accommodation establishments with a low degree of variable dependence

The first category contains the tourist establishments that are situated in areas with good to very good mobile signal, but received reviews with scores under 7 for this amenity. According to the score scale elaborated by Booking.com, services and amenities perceived as being qualitative have to have a score above 7. Using fields calculator, all the establishments that do not satisfy the above criteria were extrapolated. There are 14 tourist establishments identified with Wi-Fi scores under or equal

to 7, mainly concentrated in the south-eastern part of the region, on the Vișeu Valley, in three settlements – Vișeu de Sus, Moisei and Borșa with 9 situations. Possible explanations could be related to the unwillingness or unawareness on behalf of the establishments owners to capitalize at least the availability and quality of mobile signal in their areas by offering Wi-Fi as a free service, hence catalyzing low score reviews as a reaction from tourists. Other motifs can include the presence of

obstruction elements that created disparities in the availability and quality of signal on their premises, factors that are not in their control, or other miscellaneous local features.

The other 5 tourist establishments are dispersed in several settlements from the western and north-western part of the region. This second group of tourist establishments have registered high Wi-Fi review scores (above 8.5) despite being situated in areas with weak 4 G mobile signal. All 5 establishments are clustered in the village of Breb, in the south-western part of the region in an area with weak 4 G mobile signal (the 3rd signal strength class). This suggests that the local accommodation providers acknowledged the importance of internet accessibility on their premises and have found technical solutions to surmount a problem that could have had negative impact on their image.

These dichotomic situations represent two extremes that deserve a future in-depth analysis in order to understand the nuances leading to the present findings.

The findings raise some practical implications for almost the whole spectrum of local actors in tourism. Overall, the use of aggregated 4G mobile signal data represented an adequate proxy for highlighting correlations with score data from reviews on the topic of Wi-Fi availability and perceived quality offered as a free service at accommodation establishments. Despite the fact that the number of accommodation establishments around which the issue was discussed was reduced to just 201, the results highlight the awareness of tourists regarding the service. It gives insight into the level of appreciation towards the Wi-Fi service as a way to improve their touristic experience and enhance their satisfaction, their personal engagement with the destination, and the service providers with whom they interact. Similar statements were made following other studies concerning Wi-Fi availability on accommodation premises (Bulchand-Gidumal, Melián-González, & González López-Valcárcel, 2011; Eriksson & Fagerström, 2017; Grechyn & McShane, 2021), that were addressed in the introductory and theoretical sections of this study. This statements are also valid for local authorities, accommodation service providers themselves, and other actors involved in tourism in the region as it can raise their awareness towards the power of easily available internet connections for tourists as an enabler for content creation and sharing about tourist spots and amenities found in the destination, augmenting its visibility and touristic appeal to a broader public. Studies such as this could also contribute by emphasizing the need to support, from the regional and local authorities' perspective, the continuous improvement and development of internet infrastructure across the region, especially in the areas identified as having problematic mobile signal coverage.

Conclusion

The empirical, GIS based methodological framework designed for this research offer insights regarding the capitalization of internet connectivity in accommodation establishments as a free service in a rural tourism destination.

The methods used in the study test the level of spatial correlation between the two main variables - the mobile aggregated signal coverage data in the study area as an independent variable and the Wi-Fi review scores as the dependent variable, sourced from Booking.com score data. The results highlight the importance owners give to Wi-Fi service as an amenity. A first indicator of importance given by owners is represented by their online presence on major booking platforms for advertising and selling tourist services. From the total number of 764 tourist establishments, 367 (48%) have online presence on Booking.com for example, the platform with the largest market share in the area, with 201 establishments satisfying the baseline criteria for this research.

The spatial analysis points out 187 establishments with a higher level of correlation between variables. In those locations, the availability and quality of 4 G mobile signal was capitalized as free Wi-Fi service, appreciated by tourists through score reviews on Boking.com. The results have also highlighted specific locations where the correlation between the two variables analyzed in the study seems to be reduced. In these situations, two opposing categories were identified – in the first category we find 14 tourist establishments that are situated in areas with good to very good mobile signal, but received poor reviews scores for this amenity.

The second category contains a cluster of 5 tourist establishments, all from the same village. The establishments are situated in an area with weak mobile signal, but have registered high Wi-Fi review scores on Booking.com. These situations are the most interesting and require further in-depth investigations in order to better understand the reasons behind these occurrences.

Funding

This research received no external funding.

Conflicts of interest

The authors declare no conflict of interest.

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