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Examples of secondary online data for raising awareness about geo and mining heritage

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Abstract
The paper analyzes the potential of secondary spatial data and online user-generated content. Special focus is dedicated to social networks and travel platforms, respectively their open application programming interfaces as tools for using third party platforms with the combination of open machine-readable data for raising awareness about geo and mining heritage. Existing good practise within harvesting of open access machine-readable data from the social network Facebook, the hybrid map service Google Places and the travelers' application Foursquare was used for constructing the current partial online image of the Zemplín geopark as a selected example area with a higher density of geosites and objects of mining heritage. Subsequently, based on the pilot results, the harvested data's suitability was analyzed for both tourism services' consumers' satisfaction and geosites' visitors' experiences' monitoring, and the creation of feedback for selected geological and mining heritage points of interest. Even though the current volumes of records representing geosites and mining heritage within the analyzed platforms are low, the results could help to strengthen the relationship between tourism service providers and geosites as an essential part of primary resources within the shared online communication environment.

Keywords
Geosites, geotourism, open-access data, machine-readable data.

Introduction

The necessity to integrate continuous collection and analysis of own, open and big data into destination management organizations' planning and decision-making processes for establishing destination knowledge structures has been in the scope of several types of research (Ritchie and Ritchie, 2001; Baggio and Caporarello, 2005; Ritchie and Ritchie, 2001; Chang and Liao,2010; Baggio and Cooper, 2010; Fuchs et al.,2011; Xiang et al., 2014; Fuchs et al., 2014; Sabou et al.,2016). In general knowledge infrastructures were defined by Edwards et al. (2010) as *"robust networks of people, artefacts, and institutions that generate, share, and maintain specific knowledge about the human and natural worlds"*. In terms of tourism knowledge structures, data may be considered as a central asset in destination management (Pesonen and Lampi, 2016).

The European Commission (2011) based on the Digital Britain report, acknowledged data as the knowledge economy's currency. The role of data in tourism knowledge management has been recognized for several years. The issue of monitoring tourism and its sustainability has been a topic for over two decades. Fuchs's et al. (2014) pointed out the fact that for a long-time, sustainable tourism used to be misused as a political catchphrase with several definitions but remaining a blurred concept. Delaney and MacFeely (2014) and many other emphasizes that consumption and expenditure in tourism are dispersed across a wide range of industries: transport, accommodation, catering, entertainment, culture, sports, and other related services. Not only at the destination level, but in general, tourism statistics have become consequently difficult to compare with other economic sectors (Delaney and MacFeely, 2014). Ionescu (2014) pointed out another issue that there are cases of inappropriate use of tourism indicators or without combinations of related indicators. Thus, the results of the analysis are put out to the danger of inconsistency. Quantifiable data has become an essential asset not only in destination management but also in the processes of conducting evidence-based policies impacting tourism. Already in 1995, concepts of Tourism Satellite Accounts were designed to increase and improve knowledge of tourism's relationship to overall economic activities at the level of member states (UNWTO, 2008). At present, national partial tourism data, data from related industries, data about related social a demography aspects of EU member countries are open and accessible at Nomenclature of Territorial Units for Statistics (hereinafter NUTS) levels 1 - 3 level (European Union, 2017). For local destinations represented by destination management organizations (hereinafter DMO) uniting local public and private stakeholders operating at district (hereinafter LAU 2) levels, this data is only partially usable. There have been efforts with the aim of building knowledge structures based on down to top principals using information and communication technologies (hereinafter ICT) and data mining methods to fill the gaps at local destination management. Examples of tourism intelligence systems may be identified all across Europe. The Swedish DMIS for advanced observation of destination Åre, the TourMIS Austrian marketing information system for tourism managers, European Travel commission's dashboard demonstrate the power of reliable data in destination management (Fuchs et al., 2015; Sabou et al.,2016; ETC, 2017).

Due to tourisms' nature, most of the related industries' products cannot be tested (for example, accommodation, meal, ride in an amusement park etc.), online feedback has become one of the main factors within potential visitors' decision making. With 2.6 billion active monthly users, the social network Facebook may be considered as the global environment for creating user-generated content (Clement, 2020). The Google search engine covering more than 60 % of all monthly desktop searches worldwide, is the global leader for online information distributing (Netmarketshare, 2020). For the above mentioned, Google and Facebook may be considered the essential platforms for the monitoring of customers' level of satisfaction and other points of interests' visitors' experiences. Service providers within tourism are capable of communicating the content of their products via their own or secondary communication channels. Without active marketing of geo and mining heritage carried out by local administrators as destination managements organizations, protected areas' management organizations, museology institutions or local governments, the content of these objects is primarily distributed by visitors communicating their experience within their communities or via online user-generated content (hereinafter UGC) concentrated on social media, and travel & tourism related platforms. While orally communicated experiences of visitors are recorded by the person receiving the information, open access UGC may be used for continuous monitoring of both tourism services' consumers and visitors of geo a mining heritage points of interest. Tourism service providers are dependent on primary tourism resources, which, to a large extent, comprise of geological heritage and state of the landscape. In terms of Slovakia's mining history and its anthropogenic results, objects of mining heritage contribute to the total value and potential of primary tourism resources in several local areas. For the relationship between the tourism industry and primary resources to result in natural and sustainable tourism development, it is necessary to work with both local economy data and data related to geo and mining heritage (Newsome and Dowling, 2018).

The global aim of the paper is to analyze the usability of open governmental data with the combination of social media and travel & tourism related web applications' data accessible via open application programming interfaces (hereinafter open API) for raising awareness about and monitoring of points of interests related to geosites and objects of mining heritage.

Materials and Methods

The protection and preservation of natural objects or landscapes and their attributes as geological structures or relief form as parts of global heritage are essential for future generations' opportunity to study planet Earth's geological history and admire nature's astonishing beauties (Štrba a Rybár, 2015). Covering several aspects of this issue, as geology, geomorphology, tourism, management, and economy, the most complex approach may be found in the concept of Geotourism (Štrba a Rybár, 2015). In terms of Geotourism, an object with a certain potential for Geotourism is referred to as a geosite (Reynard, 2008; Bujdosó a kol., 2015; Štrba a Rybár, 2015). More specifically, Štrba & Rybár (2015) define geosites as geological or geomorphological objects, that have achieved scientific, cultural, historical, esthetic, or social-economic value due to human perception or use.

Mining tourism resources connect aspects of industrial, technological, cultural, and ethnographic heritage into a cognitive educational and experiential form of tourism (Rybár, 2013). Różycki & Dryglas (2017) indicate a missing unified agreement within the academic community, whether mining tourism is identical to industrial tourism. While industrial tourism mainly relates to the industrial nature of the visited object or area, mining tourism covers several aspects related to the mining industry (Różycki & Dryglas, 2017). According to Rybár (2013), the variety of mining heritage relevant within mining tourism are objects and phenomena that provide to see and get to know:

- mining technologies,
- processes explaining mining and raw material processing,
- historic mining objects,
- stories of historical personas with a significant impact on the mining industry,
- mining traditions (Rybár, 2013).

Mihalič (2013) focusing on environmental resources' performance in destinations has identified several approaches and perspectives of tourism resources' categorization. Some authors emphasize environmental attractions and attractors as primary resources and tourism services as supportive resources; some distinguish primary resources as non-reproducible and secondary as reproducible (Tisdell, 1991; Ritchie and Crouch, 2003). From these perspectives, among primary tourism potential may be included natural preconditions and socio-cultural results of anthropogenic activities (Mihalič, 2013). In terms of tourism resource categorization, both geo and mining heritage may be placed among primary resources. Geological heritage objects can be classified as natural tourism resources, and geological processes as primary preconditions (climatic, geomorphological, hydrogeological). Objects of mining heritage may be assigned to anthropogenic sources (technical and industrial objects, museums) and intangible aspects related to the traditions of mining to cultural and social events.

Štrba et al. (2018) within their comparison of nine methods of assessing geosites identified intersections among indicators binding to objects' uniqueness, conservation status, economic potential, added anthropogenic and cultural value, accessibility, added functional value, representativeness, vulnerability, ecological value, level of protection and observation conditions. While the above-mentioned indicators were identified in more than half of the methods, less than half of the methods used indicators related to information availability, distance from tourist centres, nature of the surrounding country, visiting rates, marketing, road infrastructure, traffic capacity, and educational value. One of the methods within the comparison, constructed by Štrba and Rybár (2015), focuses comprehensively on the evaluation of geosites both in terms of scientific value and in terms of tourism (in the form of geotourism) and its marketing. Within their method, one object is evaluated in ten categories, but the maximum value of the criteria in individual categories is identical. This way, the maximum value of criteria such as physical accessibility, availability of information, relevance for tourism, the value of the services provided is in balance with the criteria tending more to scientific and environmental value.

For geoheritage conservation, education, and geotourism in an area a geopark may be established. The United Nations Educational, Scientific, and Cultural Organization (hereinafter UNESCO) defines geoparks as a nationally-protected area containing many geological heritage sites of particular importance, rarity or aesthetic appeal, that operates as an integrated concept of protection, education and sustainable development (UNESCO, 2006).

Based on the report of the Office Government of the Slovak Republic (2016) about the Zemplín area's potential of inclusion among geoparks, the Zemplín Geopark is located in the southwest of the Trebišov district. In the core of the area arises from the Tokaj wine region in Tokaj hills. In the southern part and the western part, the geopark borders the Hungarian part of the Tokaj wine region, and in the north, it borders the Zemplín Hills (see Figure 1). In the eastern sector, the river Ondava flows into the river Bodrog, which further flows across the southern sector of the territory (see Figure 1). Within the scope of the paper, the report's third annexe containing the area's passport from the perspective is essential. The passport contains 80 localities comprising from 3 archaeological sites, 22 geosites, 19 mining heritage objects, 5 historical and 10 cultural-historical landmarks, 4 recreation zones, and 7 objects related to viticulture. All of the objects may be considered as points of interest. Most of the objects are in the core of the geopark in the Tokaj Wine Region. On the other hand, almost half of

the geosites are located on the outskirts of the geopark in the village of Brehov. According to Kršák et al. (2017), the essential density of water elements in the form of 4 rivers, numerous wetlands, abandoned meanders and other water structures, resources of water tourism could become in the case of meaningful cooperation between the geopark, officials and local stakeholders the areas' future building block of sustainable tourism development. From their perspective, the Somotor channel comes as an interesting potential waterway connection between the core and east part of the theoretically extended geopark (Kršák et al., 2017).

Several examples of online UGC's use within tourism research may be found from all around the world. Dolan et al. (2019) used the Qantas airline's reviews at Facebook for identifying, categorizing, and analyzing patterns in customers complaining practices from the perspective of a brand's co-creation and co-destruction. Within a combination of textual and feedback and user demographics extracted from data related to check-ins via Facebook at points of interest, Kerson et al. (2017) created personalized itineraries. Based on UGC and check-ins data from Foursquare, Aliandu (2015) used Naive Bayes probabilistic classifiers for analyzing sentimental values of visitors' feedback Kupang, Indonesia. Chorley et al. (2013) analyzed the visitors' personas from the perspective of conscientiousness, extraversion, friendliness, and neuroticism on a sample of 173 globally active Foursquare users. De Vries (2013) used live user data recorded by Google Places for identifying and monitoring user hotspots. Other authors focus on web data scraping techniques from tourism-related platforms without and open application programming interface as Booking and TripAdvisor. Silva et al. (2018) identified spatiotemporal patterns in the Hospitality based on ad-hoc routines for web data extraction over aggregations of point-based grids. The Python-based Scrapy framework was used for extracting user feedback from Booking and TripAdvisor with the aim of conducting sentimental analysis over textual user comments (Martin-Fuentes et al., 2018)

Since data representing points of interest at social media and travel & tourism platforms are registered mostly by tourism service providers for marketing purposes or by visitors sharing online their experience, the availability of open access governmental data related to geo a mining heritage is essential. In the case of Slovakia, the most complex in the field is the State Geological Institute of Dyonýz Štúr's (hereinafter ŠGÚDŠ) web services accessing data mapping significant geological localities, old mining sites, and geomorphological areas.

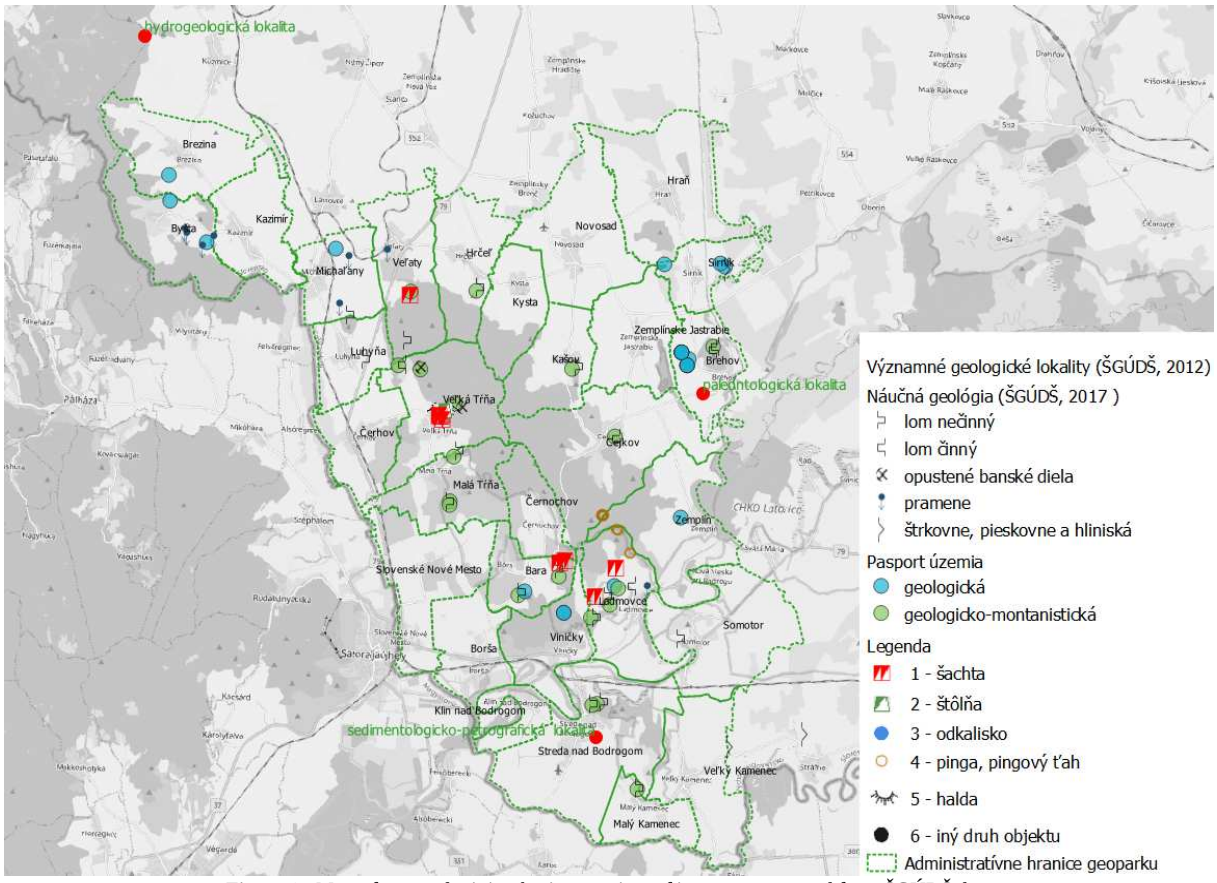

Figure 1. Map of geo and mining heritage points of interests extracted from ŠGÚDŠ data

ŠGÚDŠ's datasets were used as professionally selected input data for spatial representation of geological and mining heritage from experts the point of view (See Figure 1). Besides the above mention report's passport

wast processed into a structured format projection via vector layers (See Figure 1). Most of the mentioned and other related research used third party applications as Ncapture, Netvizz, LikeAlyze a Karma for extracting UGC, which has limits in terms of geographical coverage. Sidor et al. (2019) within their effort to identify service providers with an obligation towards local occupancy taxes created a simple reusable way to extract data from Airbnb, Booking, Facebook Places, Foursquare, Google Places, and TripAdvisor.

For the paper's aim, the Sidor et al. (2019) method was used to create a radial grid layer (1 point per 1000 meter) over the area of the Zemplín geopark (See Figure 2). The points of the layer were further used for making extraction calls to Facebook Places Graph API, Google Places API, and Foursquare Venue API. For the purposes of semi-automatic data extraction, a simple radial based loop in Python connected to the relevant APIs was used. Afterwards, according to the data providers category and type identifiers, records relating to primary natural and anthropogenic tourism resources were separated and aggregated from the users' interactions. Afterwards, the walking accessibility of the geosites and objects of mining heritage enlisted within the above-mentioned passport, from a sample of Points of interest with a higher volume of interactions was tested in the environment of the Google Distance Matrix API.

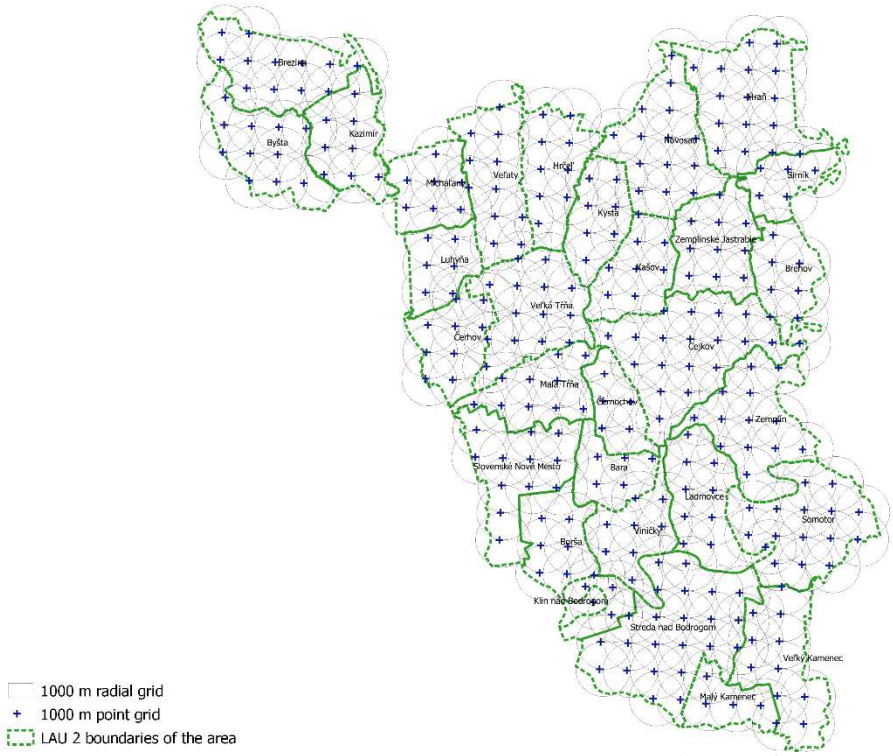

Figure 2. Radial grid layer over the boundaries of the Zemplín geopark

Results and Discussion

Within the examination of ŠGÚDŠ's map service, additional records of geo a mining heritage were identified (See Figure 1). The data set named *Significant geological localities* contained one object representing a paleontological locality in the Brehov municipality and a sedimentological and petrographic locality in the municipality of Streda nad Bodrogom. Within the ŠGÚDŠ map server, a data set named *Educational geology – Zemplín hill also* containing records of geosites (8 springs, 2 gravel pits - sand pits - clay pits) and mining heritage (5 active quarries, 2 abandoned mining works, 14 idle quarries) with the are of the geopark was identified. Most objects are concentrated in the municipalities Ladmovce (4), Byšta (4), Michaľany (3), Veľká Tŕňa (3). Other municipalities contain two objects (Veľaty, Brehov, Streda nad Bodrogom, Malá Tŕňa, Bara or one (Sirník, Kašov, Somotor, Malý Kamenec, Veľký Kamenec, Hrčeľ, Cejkov). In another data set of the institute named *Old mining sites*, 29 objects were identified, comprising ping moves (15), shafts (10), tunnels (2), and heaps (2). Most objects are concentrated in the municipality of Cejkov (10), followed by the municipalities of Veľká Tŕňa (9), Ladmovce (7), Bara (2) and Veľaty (1). Based on the attributes of the objects, it can be stated that none of the objects needs to be physically remediated.

From the 324 extracted objects within the area of the geopark, extracted from Facebook Places Graph API, 104 records contained actual rating, with an average of 11 ratings per object and an average rating of 4.65. In terms of tourism resources categorizing, 38 objects had a category identifier belonging to Hospitality, 27 of them contained an actual rating with an average of 26 per object and a 4.75 average rating. While most objects are

highly rated, only two of them have more than 100 ratings. In the case of natural and anthropogenic tourism resources, 28 objects were identified, from which only 3 were rated. One of the objects, the complex of tuff wine cellars in Malá Tŕňa may be considered as an object of mining heritage (See Figure 3).

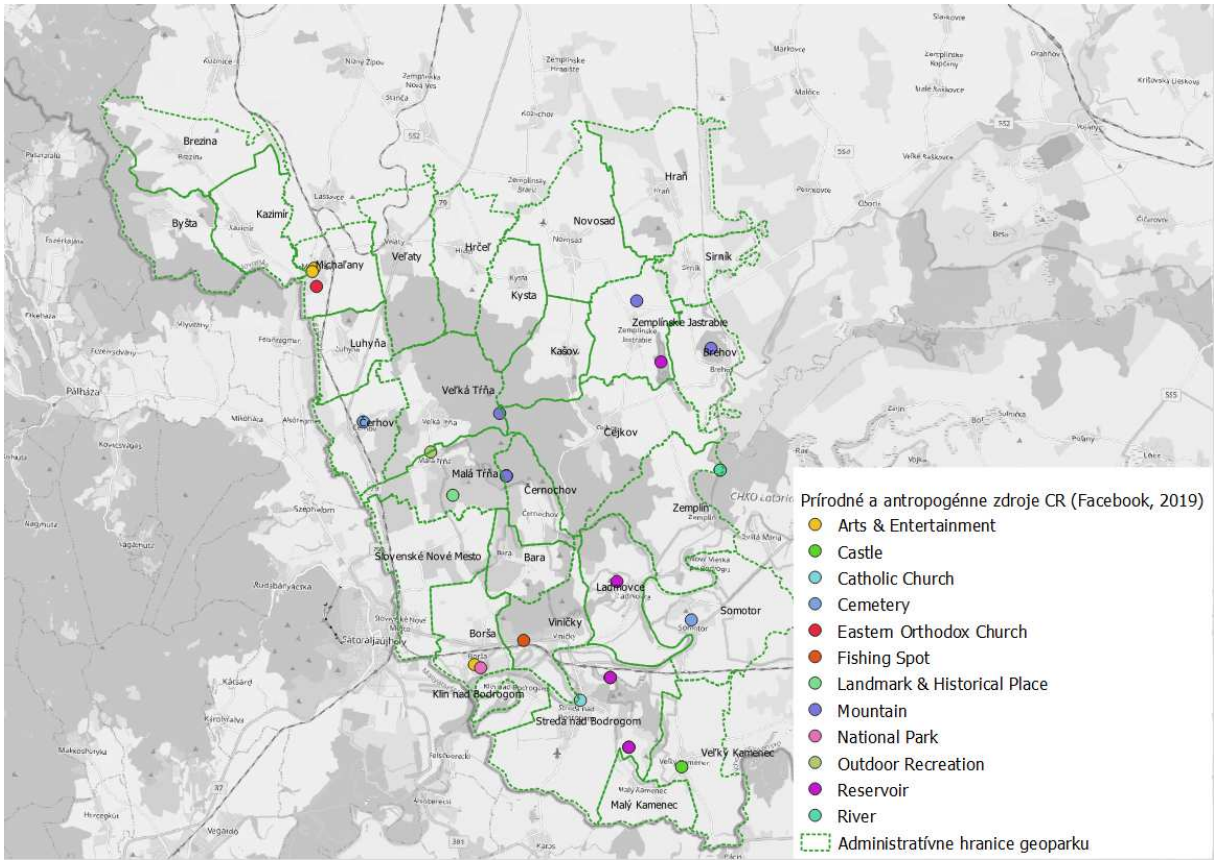

Figure 3. Map of natural and anthropogenic POIs extracted from Facebook Places Graph API

From the perspective of user check-ins, 186 objects elicited a user reaction, with an average of check-ins pre objects. Logically, most check-ins contained records of municipalities. Tourism service providers average 422 check-ins per object, most of them were recorded at cafes, lodging and restaurants as Espresso Bodrog (3192), Zlatá Putňa Restaurant & Pension (2448), TOKAJ MACIK WINERY (2188), Chateau GRAND BARI (1377), Korona Étterem (1274), Penzion Aqua Maria (1240). Objects of natural and anthropogenic resources average 195 check-ins per record. Concerning the number of "likes" and check-ins (See Figure 4), the best results were achieved by the Tokaj Lookout Tower, an unnamed point in the village of Hraň, Rákoczi castle in Borša and the castle in Veľký Kamenec.

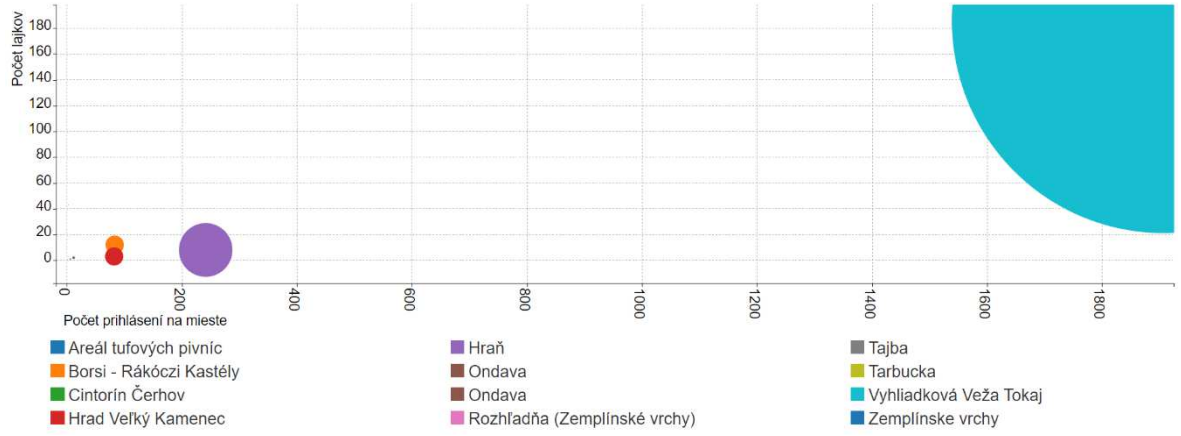

Figure 4. The ratio of the number of check-ins and likes of natural and anthropogenic objects within Facebook Places Graph API

Of the 305 Google Places objects identified in the geopark, 120 had an actual rating, on average 14 ratings per object, and an average rating of 4.2. From the total number of objects, it was possible to unambiguously assign 17 records to tourism service providers, of which 12 had an actual rating, with an average of 89 ratings per object and an average rating of 4.4 points. While most objects have a high average rating, only 2 objects have more than 100 ratings, namely Zlatá Putňa - Restaurant & Pension (540.0) and Korona Restaurant (315.0). Within natural and anthropogenic tourism resources, it was possible to unambiguously identify 14 points of interest according (See Figure 5), of which 8 were rated (average of 121 ratings with an average rating of 4.65). One object represents geological or montane heritage (Mineral spring in the municipality of Ladmovce with one 1 rating). In terms of the ratio of the number of ratings, the criteria above 100 ratings, were met by three identical objects as in the case of Facebook Places Graph API, namely the Observation tower Tokaj (572.0), Mansion F. Rakoczi II. (213.0) and Veľký Kamenec Castle (173.0) (See Figure 6). Other evaluated objects reached below the number of five ratings.

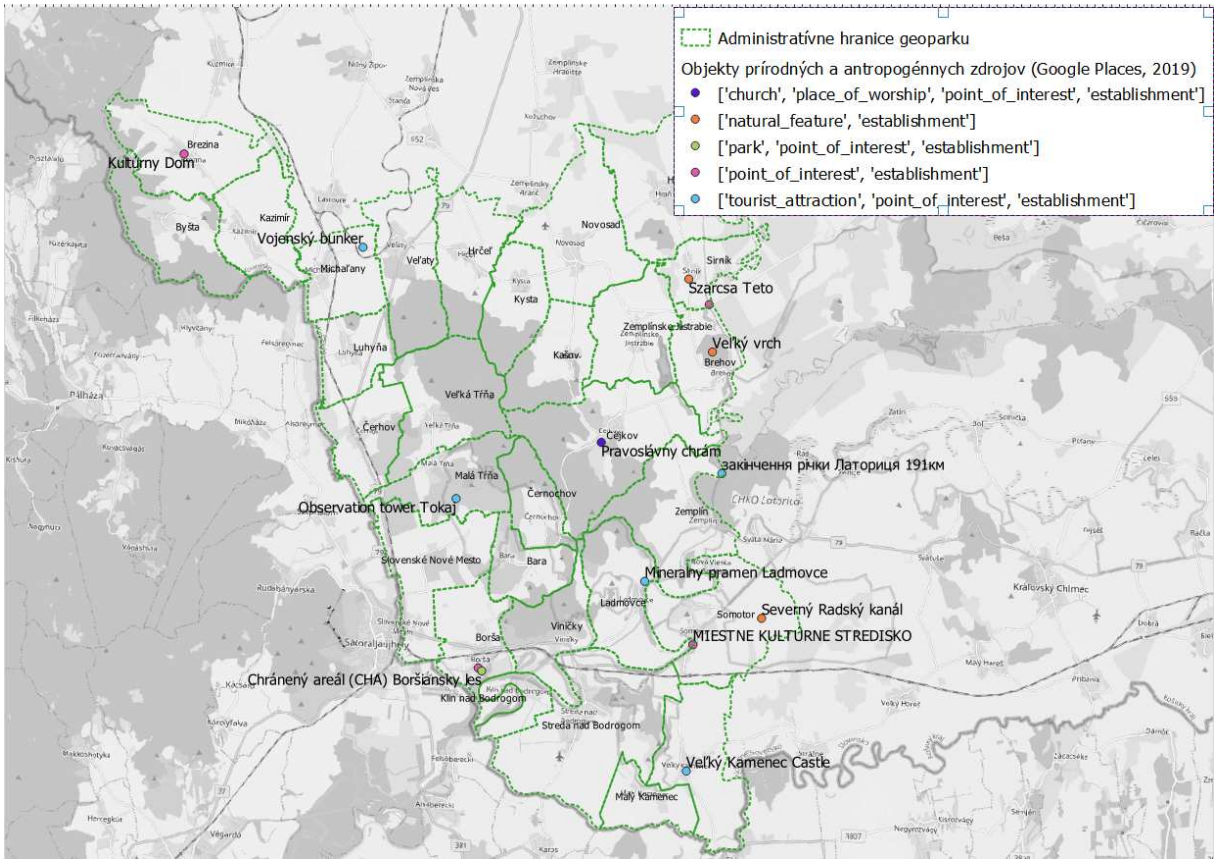

Figure 5. Map of natural and anthropogenic POIs extracted from Google API

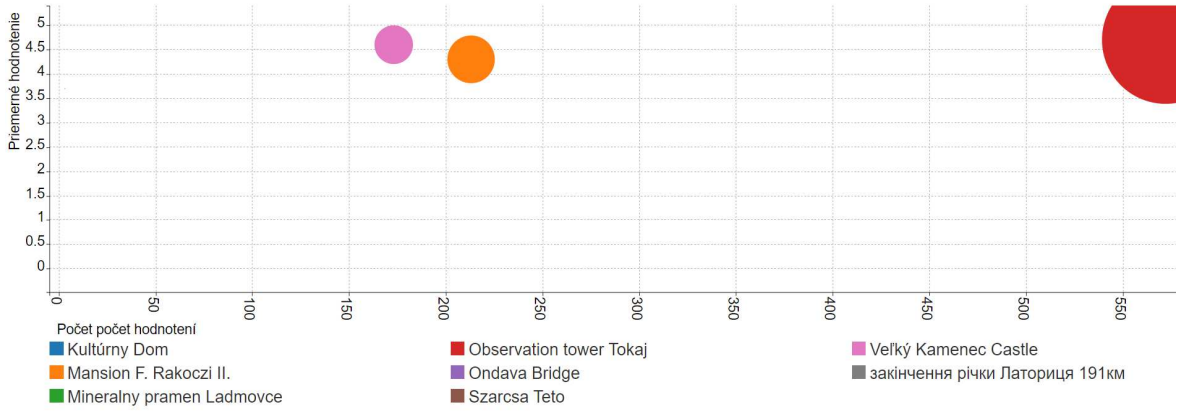

Figure 6. The ratio of the number and average evaluation of natural and anthropogenic objects within Google Places API

Within the Foursquare Venue API, only 35 objects were identified in the area, of which 18 objects could be assigned to tourism service and only 7 objects related to natural and anthropogenic tourism resources (See Figure

7). In both cases, the objects showed mostly zero feedback values or very low values. One facility within the Hospitality sector generated 19 on-site check-ins (Tokaj Macik Winery) with a high average rating (8.1 out of 10), and the area's dominant in the form of the Lookout Tower achieved 7 on-site check-ins with a rating of 7.8 points.

Foursquare is actively used by almost 15 million travellers globally each month. The low level of feedback on the platform may be subjectively caused by the use of the Foursquare application mainly by users from countries that cannot be objectively included among the main markets of inbound tourism in the Košice region, except the United Kingdom with a 2.2% share of the application.

Figure 7. Map of natural and anthropogenic POIs extracted from Foursquare Venue API

Due to a higher concentration of user-generated content (check-ins, ratings) at the social network Facebook, the top 5 objects, in terms of check-ins on the spot were selected for pilot testing (See Table 1). Three of the five objects are accommodation services providers, and all five are part of the Hospitality sector. Thus, it may be assumed that their main target groups consist of tourists and one day visitors. Since the database of the Google Distance Matrix currently does not contain walking routes (cycling or hiking trails, sidewalks) between the selected objects of geo & mining heritage and the pilot set of objects representing Hospitality stakeholders, generalized road routes within 5 km distance were used.

The basic results (See Table 1) of the distance test indicate that three of the Hospitality stakeholders are relevant in terms of geo and mining heritage objects' density and user interactions at Facebook. The Espresso Bodrog café with over 1000 check-ins is situated near 2 geosites (visible structures of Perlit and volcanic glass) and 5 mining heritage (abandoned quarries and quarries used as wine cellars) POIs with an average distance of 3.43 km. However, the disparity between a higher number of check-ins and a low number of ratings (0.01 rating per check-in) may indicate that café is a hotspot for local communities. The highest density of geo & mining heritage POIs within 5 km was identified at the Zlatá Putňa Restaurant & Pension in the municipality of Viničky. The restaurant (0.08 rating per check-in) is situated within the limit to 5 mining POIs (4 quarries and unmined perlite bearing) and 2 geosites (sites of volcanic glass and obsidian). The Tokaj Macik Winery providing also accommodation services (0.04 rating per check-in) is situated within the limit to 5 abandoned quarries. The winery itself has an underground system of historic wine cellars in its immediate vicinity, which may also be considered as an object of mining heritage, and also is closest to the geopark's iconic watchtower. The other tested objects did not achieve relevant results.

Table 1. Basic results of the distance test of Facebook POIs and geo & mining heritage

Name	Municipality	Number of check-ins	Number of ratings	Average rating	Number of geo & mining POIs in 5 km	Average distance (km)
Espresso Bodrog	Streda nad Bodrogom	3192	20	4.8	7	3.43
Zlatá Putňa Restaurant & Pension	Viničky	2448	207	4.8	8	3.75
TOKAJ MACIK WINERY	Veľká Tŕňa	2188	78	4.9	5	2.28
Chateau GRAND BARI	Slovenské Nové Mesto	1377	23	4.8	3	2.63
Korona Étterem	Veľký Kamenec	1274	108	4.9	1	2.8

Conclusions

Overall the largest volume of objects was identified at Google Places (500) and Facebook Places (456). In terms of user interactions, with an overall average of 200 check-ins per object, Facebook Places may be considered the most suitable for pilot communication of the 80 points of the interest from the geopark's passport. Additionally, the 29 objects identified within ŠGÚDŠ's dataset on old mines are for consideration of further examination as suitable points of interest.

Due to the landscape of the area (large areas of vineyards and meadows), most walkable trails to objects of geo & mining heritage is not recorded by web map applications as Google Maps or Apple Maps. This may lower the overall experience of a visitor or a geotourist, in order to not to flood the geopark's online environment with geo and mining heritage objects at once. The first reasonable step should be to assess the objects from the geopark's passport by the methodology developed by Štrba & Rybár (2015). Afterwards, the paths to most relevant objects' should be at least uploaded to Google Maps. For both practical and research purposes, the objects of geo a mining heritage within the passport of the area should be updated as points of interest in all three platforms. Firstly, to raise awareness about their existence and accessibility among users of the examined platforms. Secondly, to generate a critical mass of user-generated content and feedback that could reach a wider online audience. Thirdly, to create an opportunity for administrators of both the Tokaj Wine Region destination and Zemplín geopark to monitor both tourists and geotourists satisfaction and feedback. If the objects related to geo and mining heritage were to be registered under the account of one of the administrators of the area, additionally all textual feedback (users' written review) at the platforms could be extracted for implementing methods of sentimental analysis.

The possible issue of visitors in environmentally vulnerable areas and their irresponsible presence in private vineyards must be addressed by the public authorities and local administrators. Even though the areas are publicly accessible via officially marked trails, continuous on-site informing of visitors about correct behaviour towards the local environment, communities and their properties is an essential part of developing sustainable forms geotourism.

Since none of the platforms' categorization of objects contains identifiers as geosite or mining heritage, the use of appropriate combinations should be reasonable. For Google Places, it could be suitable to use a unified list of identifiers *["tourist_attraction", "point_of_interets", "natural_feature"]*, but with different keywords as geosite, mining, spring etc. For Facebook Places Graph API the identifier *"TOURS_SIGHTSEEING*" and for Foursquare Venue API the list *["Nature Preserve", "Scenic Lookout", "Other Great Outdoors"]* could be sufficient enough for the initial registration of the objects.

Even though data and feedback on geo and mining heritage sites in the examined area of Zemplín geopark were significantly absent, the results prove that monitoring of both satisfaction in the tourism sector and monitoring of experiences from visiting geo and mining heritage points of interest is possible by methods of continuous machine extraction of data from the social network Facebook, web application Google Places and travel platform Foursquare.

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