Usage of linked open data for the measurement of mining tourism POIs' impact on the competitiveness of a destination: Research notes part 2

Csaba Sidor*[1], *Branislav Kršák *and* ***Ľubomír Štrba***

The manuscript follows up an earlier analysed issue on online open data resources with content on Slovakia's mining heritage and approaches that could support the integration of mining heritage into tourism destinations' offer. Since official databases containing spatial data on mining heritage have restricted licenses for reuse, the current part aims among other on various open non-spatial data and Open Street Map dump files' potential and possible reuse as a base spatial database for mining heritage Points of interests' identification within bounded destinations. The focus is on the Slovak towns of the former Association of Upper-Hungarian Mining Towns. The results indicate that even if Open Street Map does not totally cover mining heritage, it can be a valuable source for building up a base database on mining heritage and extended or linked with other secondary data. Additionally, for further integration and reuse, some base queries were created on a live database covering Annual financial statements. The tested and sorted sample dataset is suitable for further reuse with Web Map Services as GeoServer supporting OpenLayers library and classic desktop software as QGis or ArcMap. In terms of gaining as much spatial data on mining heritage as possible, the WMS service provided by the State Geological Institute of Dionýz Štúr seems to be useful for viewing data.

Keywords: *Mining heritage, smart destination management, OSM, spatial dump files.*

1. Introduction

There are different views on mining tourism's definition and its place within the tourism industry. Różycki & Dryglas (2017) point out that some authors identify mining tourism as part of industrial tourism, but some authors as Rybár & Štrba (2016) dispute this approach. Maksimović et al. (2016) state that mining tourism covers any tourist activity taking part in abandoned, closed or operated mining sites. Conlin & Jollifee (2011) defined the main purpose of mining tourism as conversion of mining's industrial value to valued heritage for the tourism industry. Consea (2010) suggests that "perfect" assimilation between mining activity and local idiosyncrasy is the premise for mining tourism's development. Rybár et al. (2012) emphasise that mining heritage merges not only technical monuments but also mining communities' activities tangible and immaterial outcomes.

Parts of Slovakia's Kosice region may be considered as descendants of the mining industries medieval golden age of the former Kingdom of Hungary. Already in the second half of the 15th century, five mining towns (Gelnica, Smolník, Jasov, Rožňava, Spišská Nová Ves) of the region with the towns of Rudabánya and Telkibánya established the Association of Upper-Hungarian Mining Towns. Until the 19th-century, the mining industry was the only major exception to Slovakia's' overwhelmed agricultural economy (Granatir-Alexander, 2005). As Rybár et al. (2012) state, between the 13th – 18th century, *there were periods when this region provided two-thirds of the world's gold production and three-quarters of world's silver production.*

As mentioned by Čech and Krokusová (2017), the use of old mining sites in research or tourism has engaged several authors. Mining tourism's offer, just as any form of tourism, is primarily demand driven. Thus, identification of its critical masses and understanding of its target groups' motivation, preferences and behaviour are more than necessary for its development in accordance with private-public-people partnership principals. Research results of Štrba et al. (2017) and Štrba (2018) on various aspects affecting the geo-site value and attractiveness are the closest to drawing up mining heritage points of interests' visitors' profiles. Smart destination management is currently one of the initiatives raising more awareness about information and communication technologies' positive impact on the administration and development of tourism industries (Bulhalis, 2014; Chiappa & Baggio, 2015; Boes et al., 2016). Among other with a focus on gaining essential knowledge by implementing data science approaches for supporting business intelligence integration into the decision making of stakeholders (Blišťan, 2007; Khouri et al., 2011; Bulhalis, 2014; Dugas et al., 2015; Kršák et al.,2015; Vojtko & Volfová, 2015; Höpken et al., 2015; Štumpf & Vojtko, 2016).

From the perspective of economic, environmental, social and marketing value spatial analysis is just as important for any form of tourism's development as in most industries (Stričík et al., 2013; Yalpir et al., 2014; Valjarević et al., 2015). Open Street Map (from now on OSM) with over 4 billion recorded spatial objects may be considered as the largest open geo community worldwide with one of the most complete and mature

[1] *Csaba Sidor, Branislav Kršák, Ľubomír Štrba,* Technical University of Košice, Boženy Nemcovej 32, 042 00, Košice, Slovak Republic, csaba.sidor@tuke.sk , branislav.krsak@tuke.sk , lubomir.strba@tuke.sk

crowdsourced geodatabase (Anelli et al., 2016). Baglatzi et al. (2012) acknowledge the semantic interoperability problems caused by freely used tags.

In regards to the title of the manuscript and the Slovak towns of the former "Association of Upper-Hungarian Mining Towns", the manuscript's aims are listed in the next lines. For a), determine whether the towns are still mainly mining industry economies and identify the structure of the towns' tourism industry from the perspective of local entities main economic activities. For b), identify the towns' territorial competency to tourism regions and destination management organisations. For c) determine whether OSM is suitable as a useful resource for creating basic spatial data on mining heritage. For d), identify Slovak NUTS3 areas with largest coverage of mining POIs from the perspective of OSM data. For e), determine a basic profile for mining heritage POI's visitors. For f), to identify main domestic source markets for the towns from the perspective of mining heritage's offers' communication. All of the aims will be accomplished via open data and solutions.

2. Material and methods

European Commission, 2008 identifies the economy of every industry through the aggregation of data on economic entities with so-called NACE (Nomenclature of Economic Activities) codes. The Ministry of Finance of Slovak Republic, 2011 launched the online version of the Registry of financial statements (from now on RoFS) with an open application programming interface (from now on OPEN API). Based on the OPEN API, the civic association Slovensko.Digital, 2016 developed a live Structured Query Language (from now on SQL) open database. The (RoFS) database covers basic and information with added value on economic entities registered in Slovakia. For this reason, open SQL RoFS database will serve for identification of the analysed territories' local mining and tourism industries structure.

Weiss et al. (2005), based on the request of the Ministry of Economy of the Slovak Republic, conducted the Regionalization of tourism in the Slovak Republic. Among the supportive document's main aims was to support the establishment of functional, organised and competitive destination management organisations (from now on DMOs), that would coordinate cooperation between tourism stakeholders for developing marketable images of tourism's offer at the local level (Weiss et al., 2005). The National Council of the Slovak Republic (2010) with Act no. 91/2010 about the support of tourism that created an official procedure for establishing 4P DMOs with a subsidiary grant mechanism. These two aspects will serve for identifying the analysed territories' regional and destination competency.

For determining whether OSM is suitable as a useful source for creating basic spatial data on mining heritage and for the identification of Slovak NUTS3 areas with largest OSM coverage of mining POIs, an OSM dump file covering Slovakia from the *freemap.sk* server, 2015 will serve as an outlet point. Within the manuscript dump file also refers to a database dump in Structured Query Language table with structured records (The PostgreSQL Global Development Group, 2017). PostgreSQL is an *open source object-relational database system* (The PostgreSQL Global Development Group, 2017b). Multiple solutions exist for harvesting OSM data. One of them is the combination of Osm2pgsql, PostGIS. Osm2pgsql is a *command-line based program that converts OpenStreetMap data to PostGIS enabled PostgreSQL databases* (OpenStreetMap, 2017). *PostGIS is a spatial database extender for PostgreSQL object-relational database* (Ramsey et al., 2017). The logical frame of the process is drawn up bellow (Fig. 1).

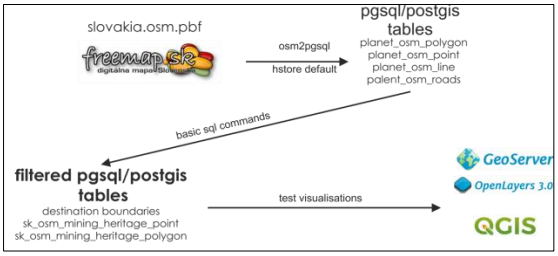

Fig. 1. Example logical frame of OSM data conversion and reuse (Source: self-elaborated).

Hundreds of open research articles are accessible on tourists' profiles and motivation towards different types of tourism and destinations (ResearchGate, 2017). Profiles on visitors mining heritage have not yet been conducted. Since as Rybár et al. (2012) suggest that mining heritage should also be associated with natural heritage, the most suitable starting point in Slovakia is research of Štrba (2018) conducted on criteria affecting to visit geo-sites with over 500 responders. Covering among other three main basic consumer id variables as sex, age, education and variables covering the importance of the availability of options of and dining and other, the data set of Štrba (2018) research will serve as an eligible resource for determining a basic profile of mining heritage POIs' visitors.

3 Results and Discussion

For identifying the mining and tourism industries' current state, only not terminated entities where taken into account. From the perspectives of the number of jobs in the industries, entities with self-employed legal forms id were given the value of one employer even if their organisation sized id had unidentified or zero value. The numbers of jobs were scaled by the minimum or maximum of organisation size id's variable. The minimum share on employment resulted from the total minimum sum of a number of jobs and the maximum possible share from the total maximum sum of the number of jobs. Thus, in some cases, the maximum possible share on employment is lower than in the case of the minimum possible share of employment. Using basic queries on the Slovensko.Digital datahub database's RoFS' schema the following results were obtained. According to the outcomes, the five Slovak towns' of the former „Association of Upper-Hungarian Mining Towns" (from now on -analysed towns) economy cannot be considered as overwhelming mining industries. Two entities with the main economic activity aimed at „Quarrying of building stone" (NACE 8110) and one entity at „Operation of gravel, sand pits" (NACE 8120) are creating the minimum of 13 and maximum of 21 job positions. A similar situation is in Kosice region (Tab. 1). Even though the outcome, it has to be pointed out that in terms of the number of jobs, the mainly mining industry is still a generator from 5 444 to 8 291 in the Slovak Republic.

Tab. 1. Mining industries position in the economy of Kosice region (Source: self-elaborated based on data from Slovensko.Digital).

Rank	*NACE code*	*Name of NACE category*	*No. of entities*	*Minimum no. jobs*	*Minimum % share on employment*	*Maximum no. jobs*	*Maximum % share on employment*
154	8110	Quarry.of building stone	16	232	0.12	401	0.13
277	8120	Oper.of gravel,sand pits	8	61	0.03	99	0.03
308	8910	Min.of chem,fertil.miner	2	50	0.03	99	0.03
375	8990	Oth.mining,quarryi.n.e.c	3	25	0.01	49	0.02
493	8920	Extraction of peat	10	2	0.00	2	0.00
532	9900	Supp.act.for oth.mining	1	0	0.00	0	0.00

Tab. 2. Mining industries position in the economy of the Slovak Republic (Source: self-elaborated based on data from Slovensko.Digital).

Rank	*NACE code*	*Name of NACE category*	*No. of entities*	*Minimum no. jobs*	*Minimum % share on employment*	*Maximum no. jobs*	*Maximum % share on employment*
153	5200	Mining of lignite	3	3000	0.16	3999	0.14
309	8120	Oper.of gravel,sand pits	94	922	0.05	1525	0.05
376	9100	Sup.act.for petrol.extr.	4	525	0.03	1048	0.04
390	8110	Quarry.of building stone	63	484	0.03	872	0.03
499	8990	Oth.mining,quarryi.n.e.c	26	141	0.01	262	0.01
500	9900	Supp.act.for oth.mining	22	139	0.01	207	0.01
502	7290	Min.of ot.non-fer.me.or.	6	135	0.01	217	0.01
558	8910	Min.of chem,fertil.miner	2	50	0.00	99	0.00
565	8920	Extraction of peat	67	43	0.00	53	0.00
610	6200	Extract.of natural gas	2	5	0.00	9	0.00

The tourism industry within the economy of the analysed towns also does not hold a superior position (Tab. 3), but it does provide from 386 to 522 jobs. The strongest tourism industry is in Spišská Nová Ves, which holds from 57.77 % to 59.96 % of employment within the tourism industry of analysed towns.

Tab. 3. Tourism industries position in the economy of the Slovak Towns of the former Association of Upper Hungarian Mining Towns (Source: self-elaborated based on data from Slovensko.Digital).

Rank	*NACE code*	*Name of NACE category*	*No. of entities*	*Minimum no. jobs*	*Minimum % share on employment*	*Maximum no. jobs*	*Maximum % share on employment*
48	56300	Beverage serving activ.	53	100	0.52	131	0.45
53	56101	Eating houses	63	92	0.48	128	0.44
70	56109	Other purpose consume	35	62	0.32	90	0.31
95	49390	Oth.pass.land transp.nec	45	47	0.24	48	0.16
121	55100	Hotels and simil.accomod	8	31	0.16	56	0.19
143	55200	Holiday accommodation	16	22	0.11	31	0.11
174	79110	Travel agency activities	9	14	0.07	19	0.06
211	49320	Taxi operation	6	7	0.04	7	0.02
222	79900	Oth.reserv.servat.act.	5	5	0.03	5	0.02
237	79120	Tour operator activities	4	4	0.02	5	0.02
318	51100	Passenger air transport	2	1	0.01	1	0.00
335	77110	Renting of cars	1	1	0.01	1	0.00

Three of the districts that cover four of the analysed towns (district Košice – vicinity excluded for its territory's extensive part is outside of the analysed towns' neighbourhood) make up a tourism industry with 808 to 1061 jobs, with the total minimum share on employment is 2.27 %.

Tab. 4. Tourism industries position in the economy of districts Rožňava, Gelnica and Spišská Nová Ves (Source: self-elaborated based on data from Slovensko.Digital).

Rank	*NACE code*	*Name of NACE category*	*No. of entities*	*Minimum no. jobs*	*Minimum % share on employment*	*Maximum no. jobs*	*Maximum % share on employment*
43	56101	Eating houses	138	214	0.59	293	0.54
48	56300	Beverage serving activ.	120	196	0.54	254	0.47
69	56109	Other purpose consume	66	121	0.34	174	0.32
93	49390	Oth.pass.land transp.nec	96	99	0.27	101	0.19
116	55100	Hotels and simil.accomod	18	65	0.18	104	0.19
143	55200	Holiday accommodation	49	48	0.13	57	0.11
203	79110	Travel agency activities	15	21	0.06	27	0.05
235	49320	Taxi operation	10	13	0.04	14	0.03
261	79120	Tour operator activities	7	9	0.02	11	0.02
277	79900	Oth.reserv.servat.act.	7	7	0.02	7	0.01
286	77110	Renting of cars	7	6	0.02	6	0.01
289	55300	Camping grounds	2	6	0.02	10	0.02
349	77210	Renting of recreat.goods	2	2	0.01	2	0.00
395	51100	Passenger air transport	2	1	0.00	1	0.00

In terms of the regionalisation of tourism of the Slovak Republic (Weiss et al., 2005), three of the analysed towns (Gelnica, Spišská Nová Ves, Smolník) belong to the Spiš tourism region. Rožňava belongs to Gemer tourism region and Jasov to Košice tourism region (Fig. 4). In terms of the analysed towns' competency, only two (Gelnica, Spišská Nová Ves) are members of a DMO (Fig. 4).

From the perspective of OSM data suitability for creating basic spatial data on mining heritage, the data set was uploaded to a PostgreSQL database using Osm2pgsql with default style. After sorting the dataset with simple queries into a new database, the results were tested in open applications QGis. Basic SQL queries were used to set up multiple types of spatial boundaries - the administrative boundary of the Slovak Republic for eliminating data from the source databases that do not belong to Slovakia. Secondly, boundaries of NUTS3 administrative boundaries were extracted for counties' coverages' visual differentiation. Thirdly, a layer of Slovak public administrations at LAU2 was extracted, for differentiation of municipalities belonging to DMOs. Fourthly, 36 DMO's boundaries by the registry of Ministry of Transport and Construction of the Slovak Republic (2017) were created to cover the main purposes of the manuscript (Fig. 2).

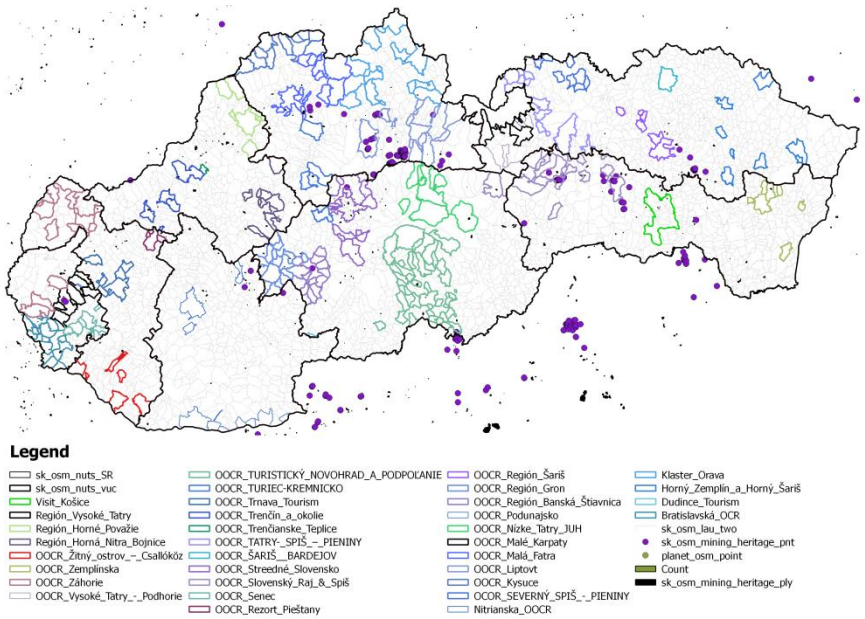

Fig. 2. Basic test of extracted OSM's data visualisation in QGis (Source: self-elaborated).

Since OSM contains over 1.5 billion tags, some tags that could be identified as points of interests related to mining heritage have been selected. From point elements, key-value man_made with adit, mineshaft and mine tags were chosen. From polygon elements key values landuse with quarry and man_made with adit, mine and mineshaft tags were chosen. Afterwards the created tables' records' were accounted with the basic count and group commands to determine the total share of objects' by their tags and number of records with a position in Slovakia. Further on the records positioned in Slovakia were accounted from the perspective Slovak NUTS 3

areas' share by joining the POI tables with the boundary table and help of the St_Contain and the St_Intersects commands on joined tables.

The analysed slovakia.osm.pbf data contained the total amount of 1 239 objects that may be considered as POIs of the mining industry and/or mining heritage. Point elements mostly contained adits (234 records), 74 mineshafts and only one record was tagged with the mine value. Polygon elements were represented by 1 017 objects mainly by the quarry tag (1 014 records), three mineshafts and only one adit. It has to be noted that only 16.03 % (213 records) of point elements and 50.99 % (517 records) polygon elements were located in Slovakia. The breakdown by NUTS 3 areas may be found below (Fig. 3). Overall, only 55 % of all element types were within the boundaries of the Slovak Republic. From the perspective of NUTS 3 areas, the Žilina county had largest share of mining heritage.

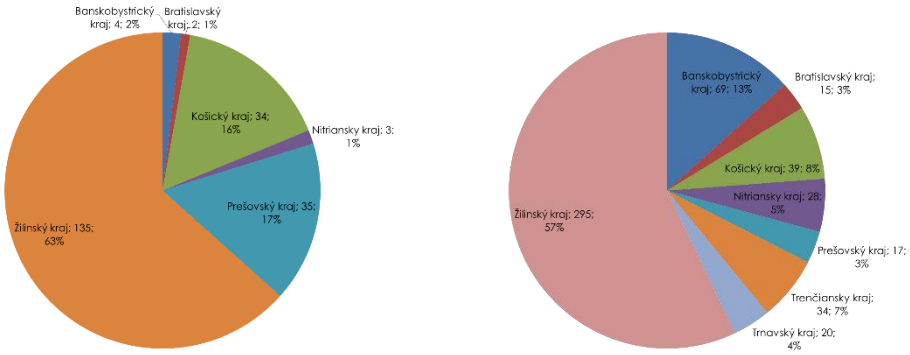

Fig. 3. Share of point elements (left) and polygon element (right) at Slovakia NUTS 3 level (Source: self-elaborated).

For comparison, the State Geological Institute of Dionýz Štúr's (2014) (from now on ŠGÚDŠ) Web Map Service (from now on WMS) on old mining works was used (Fig 4). As it may be seen, the overall coverage on Slovak Republic's mining heritage has large gaps. At first look at the tested area of analysed towns, it is obvious that ŠGÚDŠ's WMS covers a lot more data on mining heritage than the OMS dump file. Even if the WMS provides only viewing capabilities, it is obvious to say that south from the SPS destination there is larger number of mining heritage POIs in districts Gelnica, Rožňava, and Košice-vicinity, that are not managed by a destination management organisation nor a destination management company.

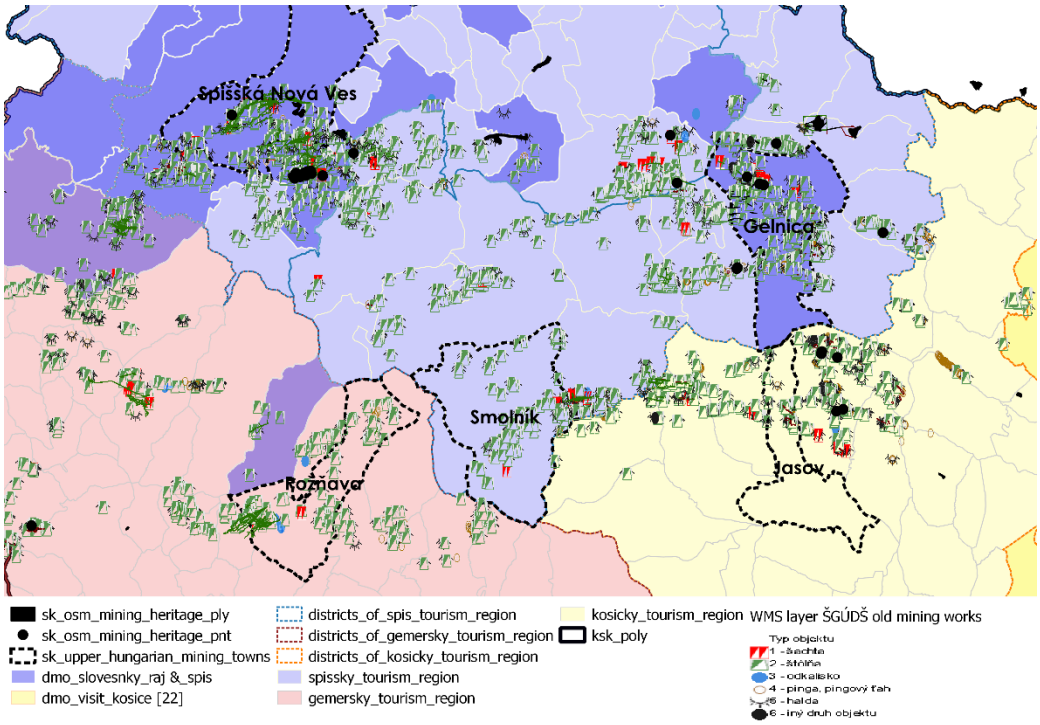

Fig. 4. Visualization of PostGis database connection with WMS of Old mining works published by ŠGÚDŠ in QGis (Source: self-elaborated).

Based on the analyses of Štrba et al. (2017) and Štrba (2018), outcome data set's responds' on criteria affecting geo-site visits and factors determining geo-site value from the general public perspective, the following was used to draw up main and secondary target groups, which could have over average interest in mining heritage POIs. The variable on education was excluded because the latest open data on population highest achieved an education at LAU 2 level is from 2011's National census. The share of responses by sex are almost equal (48.59 % female, 51.41 % male). Thus the sex variable is not critical. For establishing the main and secondary target groups, the age group and annual periodicity of visits were chosen. Through basic queries, the following target groups were chosen. As the primary target group was chosen the largest group with the highest annual periodicity of visits in the age of 21 – 35. As the secondary target group was chosen the second largest group with the highest annual periodicity of visits in the age of 36 – 50.

To identify the closest critical masses for the primary and secondary target groups, a CSV dump data set on population age groups from the Statistical Office of the Slovak Republic, 2016 was merged with OSM data (polygons of municipalities) and NUTS identification tags. According to the results of merged data, there are 38 municipalities in the domestic market with over a 5000 population falling in the primary target group (Fig. 5). From these municipalities, nine are under 120 minutes and three under 60 minutes by car to Rožňava. The secondary target matched with 49 municipalities in the domestic market with over a 5000 population, of which nine are under 120 minutes and three under 60 minutes by car to Rožňava.

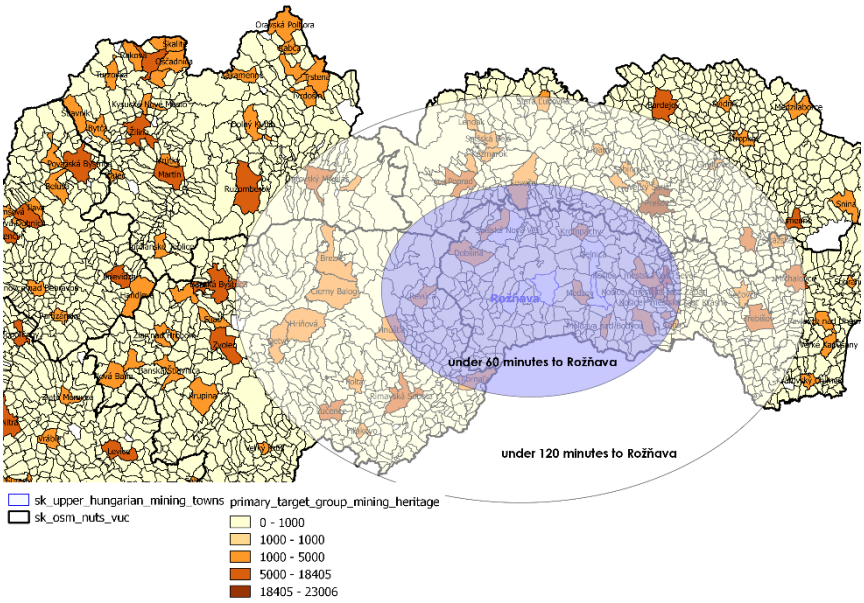

Fig. 5. Localization of primary target groups via Postgis – QGis connection based on population data (Source: self-elaborated).

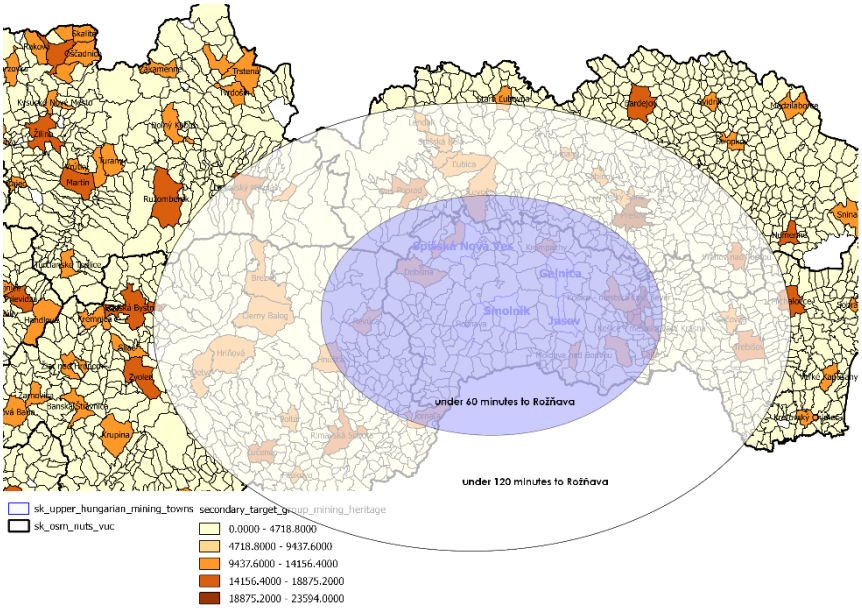

Fig. 6. Localization of secondary target groups via Postgis – QGis connection based on population data (Source: self-elaborated).

Conclusion and future works

To conclude, the results of the analysis indicate the following. The Slovak towns of the Association of Upper-Hungarian Mining Towns' mining industry are past its glory, but as the ŠGÚDŠ's WMS on old mining works show, the towns and their surroundings have a large number of objects, that are identified as mining heritage POIs. Except for Spišská Nová Ves, the local tourism industry in the analysed towns has not reached a significant position regarding creating jobs yet. It is necessary to state that the European Commission resp. Eurostat's methodology for accounting tourism industry stakeholders by their main economic activity than the methodologies used by Organisation for Economic Co-operation and Development or United Nation's World Travel Organization. Another fact worth mentioning is, that scaling counts of entities by their NACE codes is appropriate for identifying minimum aggregations. Since entities with other main NACE codes not referring mining or tourism industry may still conduct business in these industries, a more accurate solution for future works appears to be an additional categorisation by the listed scope of activities from the official Business Register's listings. In terms of participation in destination management, most of the towns public administrations are not yet in a DMO, but some of the commercial entities are already part of DMOs. The establishment of DMOs should be strictly on natural cooperation. Thus conclusions on possible integration of the towns into existing DMOs are creating new DMOs would be only pure speculations. However, the visualised data indicate more than a few options.

To conclude, the tested OSM dump file contains structural elements on Slovak mining heritage. However, since it is not being updated anymore, live OSM mirrors are more a suitable source. Nevertheless, OSM as an open resource is useful for building up basic geo content in terms of administrative boundaries, etc. From the nature of OSM's coverage of Slovak mining heritage, it seems that the most active GIS community is located in Žilina Self-governing Region. ŠGÚDŠ's database on mining heritage is probably the most suitable for raising awareness via DMO's channels about mining heritage POIs. However, the true potential of the WMS for spatial analysis towards gaining business intelligence currently ends at the viewing. On the other hand, all OSM data may be used for building up the basis of new spatial databases and can be extended and combined with other spatial data on tourism.

The established basic profile on mining heritage POIs' visitors in the future has to be extended. Data on education could be obtained by combining 2011s census with current partial data on graduates. Furthermore, social media data appears as a potential resource with additional value. In this matter data on purchasing power at the LAU2 level will be a crucial difference maker.

Most importantly structured data may be combined with non-spatial variables as efficiency, a number of visits, reviews, etc.; thus ultimately it may be a solid input for business intelligence systems taking up challenges within the tourism industry. All of the used open source data and resulted outcome merged data within the manuscript was integrated into the DBIS platform's database and will be made publicly available.

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