Maximizing the potential of mining tourism through knowledge infrastructures

***Branislav Kršák*[1], *Csaba Sidor*[1], *Ľubomír Štrba*[1], *Mario Molokáč*[1], *Ladislav Hvizdák*[1], *Peter Blistan*[2], *Gabriela Kol'veková*[3], *Erika Liptáková*[3], *Radoslav Delina*[4] *and* *Peter Mesároš* [5]**

The proposed paper deals with different approaches to the issue of shortage of relevant customer behavior data and key performance indicators for evaluating and planning for mining tourism. Mining tourism's offer is concentrated in tourist destinations emerging from tourist sub-regions or other areas of interest that by unwritten rules may or may not copy administrative boundaries of NUTS 5 areas. Management of mining tourism's offer is a part of destination management organizations' processes, which within their planning are dependent on huge amounts of data as key components of their knowledge infrastructure. In Slovakia, the issue of knowledge infrastructures in tourism is approached by the Tourism Satellite Account (TSA) with redeemable value to the national economy and published only as an informative report. On the other hand, regarding tourism destination management on the principles of knowledge-based economy, publicly available statistics at levels of NUTS 4-5 do not have an exact information value regards to the performance of mining tourism's offer. These facts cause lack of effective support of mining tourism in Slovakia and create significant barriers in information cooperation of tourism stakeholders. Data management and analysis may be challenging to tourism stakeholders. Information technologies offer advanced features as detection of qualitative patterns and hidden dependencies as well as the possibility of continuous study of destination's KPI evolution. Different examples around the world show that information collected in ICT knowledge infrastructures can be used as intelligent decision support tools. *The tools* can connect *tourism and mining tourism* stakeholders into *a* system based on knowledge and provide them with solutions to complex problems without having deep technical expertise. *The results show that the issued problematic of data shortage in destination management could be solved through implementation of destination business information systems based on continuous information cooperation of relevant state authorities and stakeholders. The group of authors are members of a research team currently working on a project with the aim of developing an interactive business intelligence system for the support of complex decision making and planning in tourism market conditions of the Kosice county.*

Key words: *KPI, DSS, DBIS, DMIS, TSA, open data, mining tourism, destination management*

Introduction

In general, mining tourism offers tourists „to see and get to know: mining technologies, factors clarifying raw material extractions, its processing, business activities leading to the output, the former technical devices and facilities, the importance of significant historical personalities and families who importantly influenced mining operations, event that forever changed the entire region by establishing new Technologies etc. (Rybár, 2013)". In other words, mining tourism brings together the aspects of industrial, technological, cultural and ethnographic heritage into a cognitive-educational-experience oriented form of tourism. Products of mining tourism are considered from the perspective of tourism destinations as components of the destinations' offer.

With no doubt, history has proven throughout the centuries that mining has enriched Slovakia's industrial and cultural heritage. Nowadays, in terms of mining tourism, there can be identified more than a hundred of mining sites with a historical impact. For example, internationally significant mining centers historically known as the Golden cities (Kremnica, Banská Štiavnica, Hodruša - Hámre), or the towns of the so-called Upper Hungarian mining route (Gelnica, Smolnik, Jasov, Rožňava, Spišská Nová Ves) and tens of other interesting sites may be found among them (Rybár et al., 2014). On the one hand, academics and the professional public acknowledge the importance and potential of these historical mining sites. However, on the other hand, their "remaining" potential in terms of mining tourism has not yet been fully recognized or utilized as destinations' tourism products till these days (except the area of Banská Štiavnica, Kremnica).

[1] *Branislav Kršák MSc., PhD., Csaba Sidor, MSc., Ľubomír Štrba, MSc., PhD., Mário Molokáč, MSc., PhD., Ladislav Hvizdák, MSc., PhD.,* Department of Geo and Mining Tourism, Institute of Earth resources, F BERG, Technical University of Kosice, Letná 9, 042 00 Košice, Slovakia, branislav.krsak@tuke.sk , csaba.sidor@tuke.sk , mario.molokac@tuke.sk , ladislav.hvizdak@tuke.sk

[2] *Assoc. prof. Peter Blistan, MSc., PhD.,* Institute of Geodesy, Cartography and Geographical Information Systems , F BERG, Technical University of Kosice, Letná 9, 042 00 Košice, Slovakia, peter.blistan@tuke.sk

[3] *Gabriela Kol'veková, MSc., PhD., Erika Liptáková, M. A.,* Department of Economic Theories, EKF, Technical University of Kosice, Letná 9, 042 00 Košice, Slovakia, gabriela.kolvekova@tuke.sk , erika.liptakova@tuke.sk

[4] *Assoc. prof. Radoslav Delina, MSc., PhD.,* Department of Banking and Investment ,EKF, Technical University of Kosice, Letná 9, 042 00 Košice, Slovakia, radoslav.delina@tuke.sk

[5] *Assoc. prof. Peter Mesároš, MSc., PhD.,* Department of Construction Technology and Management, Faculty of Civil Engineering ,Technical University of Kosice, Letná 9, 042 00 Košice, Slovakia, peter.mesaros@tuke.sk

Considering that Slovakia's Tourism development strategy 2020 does not contain a single mentioning about mining tourism, one could think that hundreds of years of cultural and industrial history are not a national issue. The Marketing strategy 2014-2020 of the Slovak Tourist Board is a little bit friendlier to mining tourism. Mining centers as Banská Štiavnica, Kremnica, Banská Bystrica are considered as target destinations for urban destinations, but, in general, aspects of mining tourism are hidden under the product theme cultural and sightseeing tourism. It is appropriate to mention that the Marketing strategy considers the Central Pohronie region's mining cities appropriate for guided tours regarding the Austrian market (SACR, 2013). On the other hand, it has to be said that there are activities towards developing mining tourism. Projects like the Upper Hungarian mining route, Terra Montanae or the Slovak Mining route have brought some success.

Even if some Slovak destinations do contain components of mining tourism products, from the perspective of product management and marketing most of the DMOs do not work with them as a marketable offer, but more or less as the heritage of the past (except for Banská Štiavnica and Kremnica).

The necessity of reliable data incorporated in knowledge infrastructures in regards to destination management and mining tourism

Knowledge infrastructures may be defined as „robust networks of people, artifacts, and institutions that generate, share, and maintain specific knowledge about the human and natural worlds (Edwards et al., 2010)." These infrastructures may be considered as „ecologies or complex adaptive systems; they consist of numerous systems, each with unique origins and goals, which are made to interoperate by means of standards, socket layers, social practices, norms, and individual behaviors that smooth out the connections among them (Edwards et al, 2013)".

In the case of Slovak mining tourism, DMOs as responsible administrators of their destinations are exposed to a variety of barriers due to a shortage of relevant data that could reliably measure the potential economic impact of mining tourism on the destination. The shortage of relevant data is causing the absence of required knowledge infrastructures that are necessary for answering key questions within the processes of planning and implementation of activities aimed at establishing and measuring key performance indicators of new tourism products and destination management in general. The absence of relevant data appears to be an obstacle in decision-making about the use and transformation of mining facilities attractive to tourism in the Slovak Republic. This demonstrates the need to introduce new methods of obtaining the necessary information into practice (Čulková et al, 2013). The general necessity of reliable data for efficient and sustainable management of tourism became a recognized issue 25 years ago. Since 1995, WTO has been working on the design of the so-called Tourism Satellite Accounts (from now on TSA) with the aim to:

- increase and improve knowledge of tourism's relationship to overall economic activity in a given country;
- provide an auxiliary instrument for designing more efficient policies in specific areas;
- create awareness among the various players not directly involved with tourism of the quantitative importance of this industry (in monetary and physical term) and by extension its role as an important economic factor in all the industries that produce goods and services demanded by visitors (WTO, 2000).

The European Commission (EC) characterized data as innovative currency for the knowledge economy, as the basic raw material for a wide range of information products and services follow-up to new possibilities of analysis and visualization of data from different sources. In the field of science, there is an increasing trend of global cooperation through the Internet, using huge data sets, computing resources, and high-performance visualization. According to EC, e-science is the key to the solution of scientific discovery and education. The conditions under which public data were made available for commercial or non-commercial use have an impact on competition and competitiveness (European Commission, 2011). The main objectives of the EU's policy itself in the field of open data are also promoting research and innovation, as well as support systems (platforms) to facilitate decision-making of companies (Rizzi, 2014). The European Commission established the European system of indicators for sustainable tourism destinations for monitoring, managing and improving the sustainability of a tourist destination controlled and managed at a local level. The basic principle of the indicators is sharing duties, responsibilities and decision-making within the destination. Involving local stakeholders within the destination in order to join forces and work together on gathering and transmission of information is an effective way of efficient destination management. The document itself regarding information cooperation emphasizes that collection of data would simply be a process of concentration of the individual data sources in one place to create a detailed picture of the tourism sector in destinations (European Commission, 2013).

In Slovakia, the issue of tourism knowledge infrastructures has been approached by the TSA, which is meaningful to the national economy of the State, published only as an informative message (Statistical Office SR, 2015). On the other hand, the data accessible at the levels NUTS 4-5 are not meaningful for an exact destination in terms of destination management on the principles of knowledge infrastructures. Slovak

destinations usually do not only arise from districts but mainly based on historical and current regional and sub-regional ties, from smaller communities in the form of clusters, for whom the availability of real data is largely limited. These issues in Slovakia are causing the lack of effective support of management of destinations and create significant barriers to information cooperation of tourism stakeholders within the processes of establishment and management of new viable tourism products.

Complex knowledge infrastructures are essential for destination management in general. For example, to have the possibility to answer basic and advanced questions about the current and future possibilities of mining tourism as part of the destination's marketable offer, the DMOs must have specific data not only about the offer's characteristics, but also about the offer's performance in relation to key performance indicators in regards to tourists' behavior. Building a self-sufficient knowledge infrastructure appropriate for tourism destinations containing existing or potential partial products of mining tourism depends on several factors.

The reliability and accessibility of Open Data are key issues. Public authorities and their institutions gather huge amounts of data via their own channels relevant to the management of tourism product. For example, data about tourism stakeholders and their performance (basic ID, incomes, expenditure, basic characteristics and numbers of visitors/tourists), travelling trends (performance of public transportation), relevant environmental data (weather forecasts/historical data on weather), citizens (income/expenditure) etc. must be accessible for DMOs at the level in detail in regards to the boundaries of the destination. Of course, public data must have the attributes of Open data sources, but also must be accurate, not only formally enlisted. "To fully benefit from Open Data, it is crucial to put information and data into a context that creates new knowledge and enables powerful services and applications" (Fermoso et al, 2015).

Another key issue is the attitude of the destination's stakeholders to information cooperation. From a long-term perspective, each destination's offer's market value is strong as the cooperation of its stakeholders. The same goes for its knowledge structure of private-public partnerships. Collecting data from tourism and sharing it via the DMO's channel should be a must for stakeholders united under the DMO, regardless whether from the private or public sector. Arnaboldi and Spiller have summarized key issues in the field of stakeholders' collaboration. Need for consensus-based decision making and Information sharing and dissemination have been identified as one of the key issues for maintaining stakeholders collaboration (Arnaboldi, Spiller, 2011).

DMO's marketing research activities must be supported by public authorities and private corporations. Due to increased competition in tourism, DMOs are under severe pressure to decide how to promote their destination's offer. However, DMOs can coordinate destination marketing effectively and efficiently by integrating activities and resources in cooperative processes (Lemmetyinen, 2011). Since their budgets are limited to elementary tasks of the organization in many cases, marketing research is not always a priority. Public authorities should be more supportive, for example by collecting categorized data tailored to the needs defined by the DMO. Global travel corporations and corporations specializing in all kinds of internet services dispose huge amounts of essential date about tourists and general customer behavior. These data should also be accessible for DMOs for their research needs via partnership cooperation.

In the era of ICT, the choice of appropriate technological solution is a critical issue for tourism destinations. ICT and the Internet are the most efficient ways to disperse any kind of information (Pitoska, 2013). Internationally, the issue of implementation of information and communication technologies that support complex decision-making and planning in the practice of the business environment is more than the current (Čarnický, Mesároš 2013). The constantly increasing impact of ICT on the tourism is creating the necessity of implementation of innovative management methods of destinations based on the analysis of real data outputs. The interdisciplinary nature of the tourism sector is identically reflected in the current management of destinations (Griffin 2013). While private companies are mostly working only with their internal and market data, DMOs need to work with regard to all factors and changes in the area affecting the destination's competitiveness, thus, the correct selection of a package of ICT solution is also essential. Analyzing data from surveys is still a challenging field, in which special expertise and information technologies offer advanced features, such as the qualitative detection of hidden patterns and dependencies, as well as the possibility of continuous study of phenomena. Information collected in the knowledge infrastructure may be used by means of intelligent decision support tools, which can involve stakeholders in the tourism system based on knowledge and provide them with solutions to complex problems without having deep technical expertise. Continuous update of electronic knowledge using algorithmic methods for automatic control of irregularities is possible by implementing new knowledge and with repairing or decommissioning obsoletes. (Stalidis, Karapistilos, 2014).

Decision support systems for DMO's

According to Baggio and Caporarello, a „decision support system (from now on DSS) can be considered a class of computerized information systems that support business and organizational decision-making activities (Baggio, Caporarello, 2005)". In other words, a DSS is an interactive multitask software with the basic goal to support decision making through the extraction, collection, and analysis of all relevant data to the decision maker

(Baggio, Caporarello, 2005). The concept of DSS may be dived to 5 basic types: Communications-Driven, Data-Driven, Document-Driven, Knowledge-Driven and Model-Driven (Power, 2002).

A DMO as the responsible administrator of a destination has to be able to decide on its operational and strategic planning on the basis of accurate and reliable data and knowledge. Tourism is a highly interdisciplinary market consisting of different stakeholders from all three sectors (private, public, NGO). Therefore, for the processes of destination management, all 5 types of DSS are considerable for implementation. The lower mentioned purposes are only basic examples:

- components of Communications - Driven DSS: for supporting communication between the DMO's stakeholders,
- components of Data-Driven DSS - for collecting various essential internal and external data into usable datasets by the DMO for planning,
- components of Documents-Driven DSS - for collecting relevant updates of policies affecting the stakeholders,
- components of Knowledge-Driven DSS - for implementation of processes of data and knowledge mining,
- components of Model-Driven DSS - for processing data according to basic statistical models.

DSSs for tourism may be enhanced by the application of Geographic Information Systems (GIS) and techniques of Multi-Criteria Evaluation (MCE) and Analytical Network Process (ANP). Spatial data can be used to explore conflicts, examine the impacts and assist decision-making (Aminu et al, 2014).

K&K project's DMIS

A suitable example is the Swedish K&K project implemented in the destination Åre. The introduction of hybrid DSS constructed for the purposes of a Destination Management Information System (from now on DMIS) has not only allowed the DMO to observe the processes of classic KPI development, but also the economic performance, marketing effectiveness and the satisfactory of visiting experience.

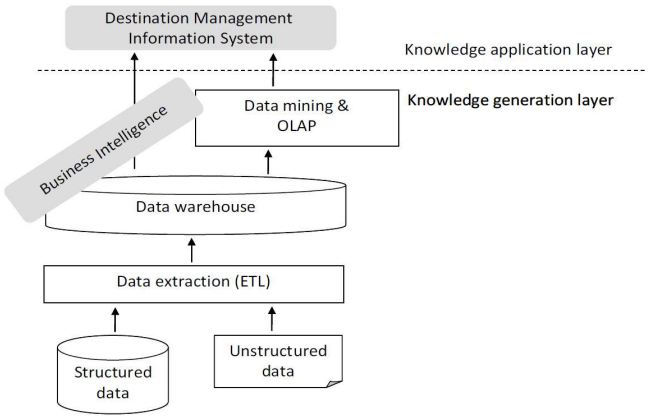

Fig. 1. Framework architecture of DMIS Åre (Fuchs, 2011).

The main objective of the DMO is to monitor the fulfillment of strategic goals through the analysis of customer based data and support decision making to achieve the destination's strategic goals (Fuchs, 2011). Technically, the DMIS (Fig. 1) extracts, stores, processes and by using methods of business intelligence (i.e. Data Mining and OLAP) generates essential knowledge about the destination. (Fuchs, 2011).

Košice region's Destination Business Intelligence System

Another example of efforts to develop a knowledge driven destination is the project designed at the Technical University of Košice, Slovakia. The primary goal of the project is to develop a fully automated pilot Destination Business Intelligence System (from now on DBIS), an intelligent platform based on the principles of Living Lab covering the territory of Košice region and its partial destinations. From the perspective of destination management, the goal is to support Košice Self-governing Region's (region's administrator) comprehensive decision-making and planning of future development activities in tourism by:

- monitoring outputs of processed data in the defined area of the region,
- analysis of the actual development of partial trends in the area of the destination,
- making decisions on the basis of mutual relations between performance indicators tourism destinations,

- planning new market entries by modeling and testing (investment projects, services, events, new attractions, etc.),
- development of cooperation with public and private tourism stakeholders through increased cooperation at the level of data sharing,
- a unified system of garnering feedback from target groups (consumers of tourism services).

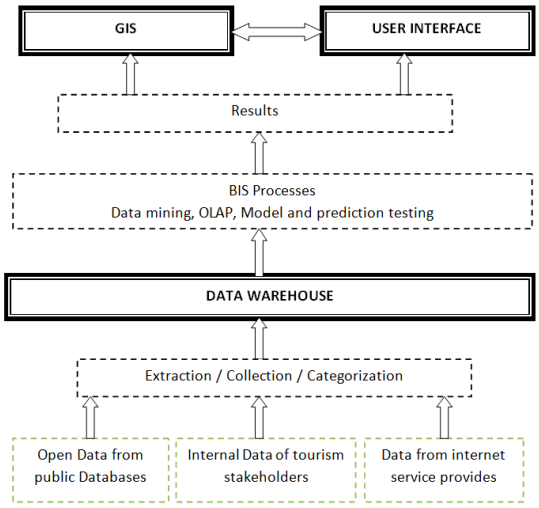

Fig. 2. Proposed basic functional architecture of TUKE's DBIS (Kršák, 2015).

The DBIS (Fig. 2) platform's framework consists of two key components – Back Office (the platform's administration interface) and Front Office (platform's user interface). The back office is represented by DBIS's automatically synchronized data warehouse that will perform the following:

- automatically collects publicly available data relevant to the destination,
- automatically communicates with external data providers at the level of tourism (secondary tourism offer providers, primary tourism offer administrators),
- monitors and analyzes development trends in the destination's market,
- generates predictions of conditions in the destinations by development trends,
- alerts and warns the user in the case of market extremes and hazards,
- generates recommendations based on mutual logarithms between trends in the destination,
- tests model scenarios based on new user inputs into the data bank of the BIS,
- generates questionnaires on destination's target groups based on the analysis of trends.

The data warehouse of the DBIS will be interconnected with its own GIS that will perform the following tasks:

- projects data and trends of the BIS data bank to interactive cartographic layers in real time horizons,
- projects data and trends of the BIS data bank on the base of GPS coordinates to interactive cartographic layers in real differentiated space,
- projects the interactions between various trends in the destination based on the BIS data bank's logarithms,
- projects predictions of future conditions of the BIS data bank to interactive cartographic layers,
- projects model scenarios based on new user inputs into the BIS data bank.

The Front office's user interface will perform the following tasks:

- communicates with the user of the Destination BIS,
- projects to the user the outputs of the BIS data bank and interconnected Geographic Information System,
- allows the user to track trends and logical predictions,
- it gives the user the space to model own inputs.

TUKE's DBIS prototype is planned to launch in 2018. The result of achieving the primary objective will be the implementation of new methodology in destination management based on the principle of a living lab. This will move Slovak destination management to a level of the scientific approach that will prepare DMOs to the constantly changing market conditions of the tourism business environment. The Kosice self-governing

region will be the first in Slovakia to support tourism stakeholders for three years with tailored information about the real performance of the destination.

Conclusion

The question is, how could a Destination Business Information System support the development of mining tourism products? Placing mining tourism's offer in the knowledge structures of a DBIS, will allow DMOs to analyze and test their performance and possible potential. Each object of mining tourism interest could have its own categorized place within the data warehouse and the DBIS's GIS. For example, the performance trends projected within the GIS would show, which objects of mining tourism are situated in places with lower or higher movement of tourist/trippers. By measuring the interest of tourists/trippers in these locations via the DBIS's responsive e-questionnaires, the DMO would be able to distinguish the offer's real business value and decide responsibly whether to strengthen its support. Another example may be the results of evaluating tourism KPIs and consumers' interest in predefined historical sub-regions with mining tourism offer. By understanding the demand of tourists towards new tourism product types in the destination, the DMO may use the results of the analysis for creating new activities regarding the objects of mining tourism offer. Although all this is possible, the true challenge is to pursue all relevant stakeholders to information cooperation and data sharing on a regular basis. As it has been already said, mining has left a great heritage to our generation. With the help of knowledge structures and results obtained by hybrid DSS applications, it is a worth of try to convince stakeholders that mining sites and related historical objects may be the correct decision for developing mining tourism products. Furthermore, results within the issue will be disseminated within the outcomes of TUKE's DBIS development.

***Acknowledgment**: This work was supported by the Slovak Research and Development Agency under the contract no. APVV- 14 - 0797.*

References

[1] Rybár, P.: Banský turizmus (Mining tourism). *Technical University of Košice, vol. 1, p. 90, ISBN: 978-80-553-1362-7, 2013*

[2] Rybár, P., Molokáč, M., Hvizdák, L., Štrba, Ľ., Bohm, J.: Upper Hungarian mining route, *SGEM 2015 Conference Proceedings, vol. 1, p. 793-798, ISBN 978-619-7105-17-9, 2014.*

[3] Slovak Tourist Board: Marketing strategy of the Slovak Tourist Board for the years 2014-2014, *p. 198, 2013*

[4] Edwards, P., N. et al.: Knowledge Infrastructures: Intellectual Frameworks and Research Challenges, *University of Michigan School of Information, p. 40, 2012*

[5] Čulková, K., Mixtaj, L., Weiss, E.: Prediction of the financial situation development of minig firm in conditions of Slovak Republic, *Metalurgia international, vol. 18, no. 5 p. 252-255-ISSN 1582-2214, 2013*

[6] Mike Moore, WTO: The Tourism Satelite Account (TSA): "A strategic project for the World Tourism Organizations, Note by Secretary-General at the 63rd and 64th session, *p. 17, Madrid, 2000*

[7] European Commission: Open data, an egine for innovation, growth and transparent governance in Communication from the commission to the European parliament, the council, the European economic and social committee and the committee of the regions, *p. 13, 2011*

[8] Rizzi, D.:European Commission DG Communications Networks, Content and Technology: The open Data policy, *p. 26, 2014*

[9] European Commission, Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs: The European tourism indicator system - Toolkit for sustainable destinations, *Luxembourg: Publications Office of the European Union, p. 60, ISBN 978-92-79-29339-9, 2013*

[10] Statistical Office of the Slovak Republic: Informative report - Tourism Satellite Account in the Slovak Republic, *p. 10, 2015*

[11] Fermoso, A., M., Montserrat M., M., Beato, E., Berjón, B.: Open linked data and mobile devices as e-tourism tools. A practical approach to collaborative e-learning, *Computers in Human Behavior, Volume 51, Part B, p. 618–626, 2015, ISSN: 0747-5632*

[12] Arnaboldi, M, Spiller, N.: Actor-network theory and stakeholder collaboration: The case of Cultural Districts, Tourism Management, *Volume 32, Issue 3, Pages 641–654, 2011, ISSN: 0261-5177*

[13] Lemmetyinen¸ A.: The Role of the DMO in Creating Value in EU-funded Tourism Projects, Scandinavian journal of hospitality and tourism, Volume 10, Issue 2, Pages: 129-152, 2010, ISSN: 1502-2250

[14] Pitoska, E.: E-Tourism: The Use of Internet and Information and Communication Technologies in Tourism: The Case of Hotel Units in Peripheral Areas (April 11, 2013). Tourism in Southern and Eastern Europe, pp. 335-344, 2013; 2nd International Scientific Conference Tourism in South East Europe *2013. Available at SSRN*:http://ssrn.com/abstract=2289872

[15] Čarnický, Š., Mesároš, P.: Business intelligence and knowledge management: a business perspective, 1st ed. Brusel : *EuroScientia, p. 168 s., ISBN 978-90-818529-1-3, 2013*

[16] Griffin, K.: The impact of ICT applications on the Hospitality & Tourism Industry. *Travel Information Systems. Available at* http://academia.edu , *p. 10, 2013*

[17] Stalidis, G., Karapistolis, D.: Tourist Destination Marketing Supported by Electronic Capitalization of Knowledge, 2nd International Conference on Strategic Innovative Marketing, *Procedia - Social and Behavioral Sciences, volume 148, p 110-118, 2014*

[18] Baggio, R., Caporarello, L.: Decision Support Systems in a Tourism Destination: Literature Survey and Model Building, itAIS 2005 – 2nd Conference of the Italian chapter of AIS (Association for Information Systems), *p. 15, 2005*

[19] Power, D., J.: What is a DSS? The On-Line Executive Journal for Data-Intensive Decision Support, *online at* http://dssresources.com/papers/whatisadss/index.html , *2002*.

[20] Aminu, M., Matori, A., N., Yusof, K., W.: A spatial decision support system (SDSS) for sustainable tourism planning in Cameron Highlands, Malaysia, 8th International symposium of the digital earth (ISDE8), Book Series IOP Conference Series-Earth and Environmental Science, *Volume 18, Article Number: 012139, DOI: 10.1088/1755-1315/18/1/012139, 2014*

[21] Fuchs, M., Höpkenb, W., Lexhagena, M.,: Big data analytics for knowledge generation in tourism destinations – A case from Sweden. *Journal of Destination Marketing & Management, Volume 3, Issue 4, December, p. 198–209, 2014*

[22] Fuchs, M.: K&K project: Engineering the knowledge destination. *Available at* http://researchgate.net , *p2, 2011*