

Information and communication technologies and e-marketing on the Big Data database in the function of sustainable development strategy

Informaciono-komunikacione tehnologije i e-marketing u Big Data bazi podataka u funkciji strategije održivog razvoja

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Abstract: Economic and financial regional development must be in line with at least three diversified goals: (1) achieve sufficiently rapid development to respond to the needs of the population in a timely manner, (2) conserve natural resources for present and future generations, (3) accelerate technical and technological development. The application of modern information and communication technologies (ICT) requires a constant presence at the current level of expertise. The project "Culture and Nature for a Better Quality of Life" is funded by the European Union (EU) based on the benefits achieved by this project, the evaluation instruments. According to the evaluation requirements, from the project was required, to develop tourism in a particular area, to encourage environmental protection and sustainable development factors, and to purposefully enable the use of ICT tools to brand a tourist destination on the Internet, in interregional cooperation between the two countries (Serbia and Hungary).

The realization of project tasks is encouraged by an innovative software web solution, which is developed on the new dimensions of BigData databases. This web solution has played a significant role in the development of the tourist destination itself, advertising and selling its services on the Internet platform. The BigData platform provides the conditions for a comprehensive approach: it is suitable for all social networks, electronic portals of modern marketing and communication, with the use of modern software tools. The authors also researched instruments that will significantly improve IT services, especially in the conditions of using BigData, which are characterized by enviable speed, quantity, and variety of comprehensive information, at a given time and in a timely manner. Special attention was paid to the final economic results of the application of ICT in the sale of goods and services of this tourist destination, while preserving the postulates of sustainable development in the ecological habitat of nature of the Upper Danube. ICT and BigData have created conditions for raising the reputation of this attractive destination of healthy environment, and its importance in the international tourism market, which was presented within the results of project evaluation.

Keywords: Information and communication technologies, Big Data, electronic marketing in tourism, social media, public relations, web software solution, tourism project, sustainable development of the region.

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Sažetak: Ekonomsko-finansijski regionalni razvoj mora da bude usklađen sa najmanje tri diversifikovana cilja: (1) ostvariti dovoljno brz razvoj, da bi se pravovremeno odgovorilo na potrebe stanovništva, (2) neophodno sačuvati prirodne resurse za potrebe sadašnje i budućih generacija, (3) ubrzati tehničko-tehnološki razvoj. Primena savremenih informacionih i komunikacionih tehnologija (ICT) zahteva konstantnu prisutnost na trenutnom nivou ekspertskih znanja. Projekat „Kultura i priroda za bolji kvalitet života“ je finansiran od strane Evropske unije (EU) po osnovu prednosti koje je ovaj projekat ostvario, na osnovu instrumenata evaluacije. Prema evaluacionim zahtevima, od projekta se tražilo, da razvoj turizma u određenom području, podstiče očuvanje životne sredine i faktore održivog razvoja, i da se svrsishodno omogući upotreba alata ICT kako bi se na internetu brendirala turistička destinacije u međuregionalnoj saradnji između dve države (Srbije i Mađarske).

Realizacija projektnih zadataka, je podstaknuta inovativnim softverskim web rešenjem, koje je realizovano na novim dimenzijama baza podataka BigData. Ovo web rešenje je imalo značajnu ulogu u razvoju same turističke destinacije, reklamiranje i prodaju njenih usluga na internet platformi. BigData platforma pruža uslove sveobuhvatnog pristupa: dostupno svim društvenim mrežama, elektronskim portalima savremenog marketinga i komunikologije, uz upotrebu savremenih softverskih alata. Takođe autori su se bavili i istraživanjem instrumenata kojima će se značajno unaprediti IT usluge, pogotovo u uslovima korišćenja BigData, koje odlikuju zavidna brzina, količina i raznolikost sveobuhvatnih informacija, u datom trenutku i pravovremeno. Posebna pažnja je posvećena konačnim ekonomskim rezultatima primene ICT u prodaji robe i usluga navedene turističke destinacije, uz očuvanje postulata održivog razvoja u ekološkom staništu prirode Gornjeg Podunavlja. ICT i BigData su stvorili uslove za podizanje ugleda ove atraktivne destinacije zdrave životne sredine i njenog značaja na međunarodnom turističkom tržištu, što je predstavljeno kao finalni rezultat evaluacije projekta.

Ključne reči: Informaciono-komunikacione tehnologije, Big Data, elektronski marketing u turizmu, društveni mediji, odnosi sa javnošću, web softversko rešenje, turistički projekat, održivi razvoj regiona.

INTRODUCTION

The world order and all countries of the world, for a long time, have been facing the responsibility to harmonize their economic and financial development with three rather diversified goals.

1. To create conditions for a sufficiently rapid development of society, which would quickly respond to the needs of the population, both in urban and rural areas.

2. To preserve natural resources for the needs of the current generation, as well as for generations to come in the near or distant future.

3. To adopt expert knowledge and current level of progress in accordance with the accelerated technological development and the application of information and communication technologies (ICT), so that modern development can proceed smoothly.

At first glance, these three goals are diversified since today's generations have the right to access resources and a healthy environment for their own development, but at the same time they have the obligation to leave that right to future generations. Our National Sustainable Development Strategy defines sustainable development as a goal-oriented, long-term, continuous, comprehensive synergy process that affects all aspects of life (economic, social, environmental, and institutional) at all levels (Law on the Government, based on Article 17, paragraph 1 and Article 45, paragraph 1 of the Law, 2007). In this paper, the authors will emphasize the economic and innovative aspects of sustainable development, with the application of modern information and communication technologies.

European Territorial Cooperation (ETC) is an instrument of the European Union (EU) which encourages regions to create and preserve European values, through joint programs, projects, and networks. The European Territorial Cooperation Program (ETCP) supports cross-border, transnational, and interregional cooperation programs. This paper describes the impact and role of information technology in the process of project implementation, which encourages the development of tourist destinations in the region "Upper Danube". The project is financed from EU funds, and it was realized within the second IPA call of the cross-border program Hungary-Serbia. Cross-border cooperation helps to become regions, located on both sides of the EU's internal or external borders, economically and socially strong, promoting the values and goals of sustainable development.

In this regard, the paper points out the role and importance of modern information and communication technologies (ICT) in branding tourist regions, as well as in attracting EU funds related to balanced sustainable regional economic development. The synergy of selected EU financial instruments, the influence of modern ICT and BigData databases are in function of balanced regional economic development in the selected area, which will be presented as a case study of a European project in Serbia.

1. THE INSTRUMENTS OF SUSTAINABLE DEVELOPMENT AND TERRITORIAL COOPERATION

The goal of the national strategy is to balance the three key factors, i.e. three pillars of sustainable

development: 1. sustainable development of economy and technology, 2. sustainable development of society, based on social balance, and 3. environmental protection along with the rational disposal of natural resources. At the same time, the goal of the strategy is to merge these three pillars into a whole, which will be supported by the relevant institutions (2007). The European Union's territorial cooperation programs have similar goals. Namely, one of the basic goals of territorial cooperation in the EU is: reducing inequality between regions, and encouraging optimal, and sustainable economic development.

Chapter 10 of the National Sustainable Development Strategy emphasizes the need to create the conditions under which ICT affects "the acquisition, creation, dissemination and use of information and knowledge". "The strategy for the development of the information society in the Republic of Serbia needs to be harmonized with the experiences and institutional solutions practiced by EU countries", which is presented in this and similar projects, selected from the range of positively evaluated and funded projects by the EU (2007). The realized project is endorsed by modern ICT on BigData database, affecting the input and output results of the project to be supported on the Internet platform to improve tourism with balanced sustainable development of border regions of Serbia.

2. ICT ON BIG DATA FOR THE NEEDS OF MODERN INFORMATION SYSTEMS

The modern development of the economy and society is mostly presented on the Internet. Knowledge bases, information and business activities go beyond the current practice, where business activities of economic entities are supported by popular software applications. With the development of numerous applications, the influence of social media, individuals, and businesses, which are

present on the Internet, there has been a significant increase in the amount of online data (Priyadharshini, 2022). Bigdata base (BigData) takes precedence on internet-oriented platforms, where the data from economic and social activities are collected on various informal bases, and as such, they form huge databases, which generate information on all areas of society development. Therefore, the role of modern Big Data is imposed as a standard in the development of online society, because it is a system that supports different types and dimensions of data, their structure, area to which they relate, quantity and quality of information.

BigData are new dimensions of databases that contain large amounts of unstructured, semi-structured or structured data. Doug Laney defined Big Data as the three V's (Doug Laney, 2001):

- **Volume.** Organizations collect data from a variety of sources, including transactions, Internet of Things (IoT) devices, industrial equipment, videos, images, audio, social media, and more. Previously, storing all this data was too expensive.
- **Velocity.** Data and things (IoT) are easily found, read quickly, analyzed, and imported into all spheres of society. Various dimensions and amounts of data, which produce Radio frequency identification (RFI) tags, sensors and smart meters are driving the need to deal with torrents of data in real time. Such requirements offer economic entities a significant advantage over competitors.
- **Variety.** The data are contained in the BigData database supports all types of formats - from structured numerical data of traditional databases to unstructured text documents, e-mail, videos, audio, financial transactions, stock data, etc.

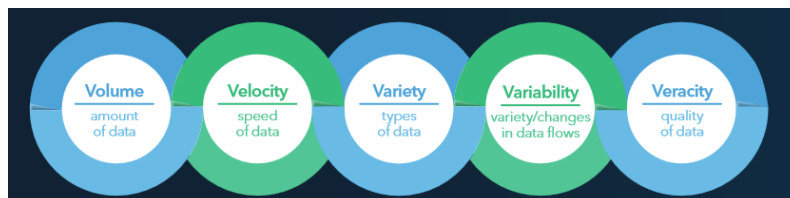


Figure 1: 3 V's of big data: Plus 2 - dimensions of big data

Source: www.sas.com

BigData contains large amounts of structured and unstructured data because they have very impressive data management mechanisms (Big). In the implemented project, BigData had a disproportionately important role in the preparation, analysis,

and formation of real-time data for the development of web solutions, with the aim of encouraging investment and development of tourist destinations in the border area

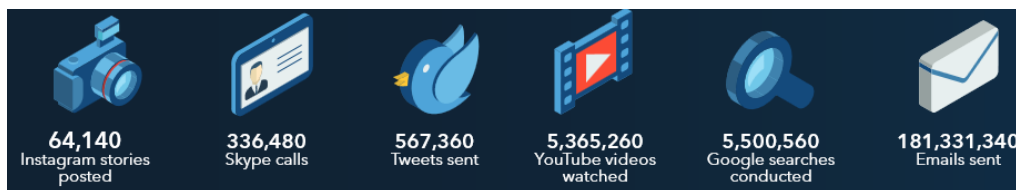


Figure 2: *Big Data - The basics of what it is and why it matters*

Source: www.sas.com

3. INFORMATION AND COMMUNICATION TECHNOLOGIES IN TOURISM

Regarding the fact that BigData database had a significant role in modern projects such as "Smart Cities". This type of technology was used in the implementation of software solution of the project "Culture and Nature for a better quality of life". BigData data played a key role in project preparation and selection of information, defining the conditions for launching tenders as a procedure for selecting project documentation, initial patterns for designing the layout of the Graphical user interface (GUI) and defining conditions and activities during the implementation of a ready-made web software solution. The role of ICT in the further development of the project, funded by the EU, is to use Web modern solutions and a comprehensive database of BigDat to improve the tourist destination and provide an enviable level of visitors. Potential visitors are also new members of the presented web portal of tourist destinations, encouraging the development of the region, both with their virtual and physical presence in the tourist destination of the border area.

The advantages and potential of BigData can be seen in the fact that collected and presented data are independent of the time dimension. If some information is published only monthly or quarterly, that does not exclude it from BigDat and it is continuously implemented on all web content. Also, data from our website does not require a disproportionate amount of storage space, but it still belongs to BigData data, due to the speed at which it is generated. Data are also collected from completely innovative devices, sensors, and other instruments (IoT), which in this case will significantly affect the correct assessment of the current situation with weather changes, climate, and other replicated content of the BigData platform (Pandey, 2021).

Electronic tourism services supported by social networks and web application solutions in the field of tourism have changed the nature and processes in the tourism industry, technical and social issues, the size, and speed of virtual markets in the digital economy. Large amounts of data require the processing of powerful techniques and tools, so the BigData database in our project supports inform-

ation generation tools that enable the development of software platforms for providing and maintaining tourism services. BigData collects and generates reliable information as a basis for cooperation and communication at the level of social groups, communication science and interaction between companies that provide services or sell goods in the tourism market (Pavlović et al., 2008). "Electronic Tourism is defined as the use of information and communication technologies in the tourism industry" (Kanellopoulos, 2007). The project "Culture and Nature for a Better Quality of Life" was approved by the European Agency for Reconstruction and implemented over a period of 24 months, in cooperation with the Regional Agency for Development of Small and Medium Enterprises Sombor (RAMSPP), the Tourist Organization of Sombor and The southern region of the city of Baja (EAR-a) (EAR, EU, Op.So, and VRs.) This project aimed to create a comprehensive tourist offer based on the potentials of nature reserves "Upper Danube", "National Nature Park Gemenc", as well as the cultural heritage of the cities of Sombor and Baja (Bošnjak, 2019; Bošnjak et al., 2019). The most important goal of cross-border cooperation between the two regions is to connect the content of tourist offers of both nature reserves, two cities, as naturally and flexibly as possible, as well as, to make the content of tourist offers visible, acceptable, accessible, and useful. The strategic tasks of the regional participants in the project were oriented towards the development of tourism and the new tourist offer of this unique cross-border region, with the characteristics of a rural area whose potential can be developed (Virijević Jovanović et al., 2021).

3.1. ICT objectives of the project

One of the goals of the project, from the ICT perspective, was to create a single trilingual database (in Serbian, Hungarian and English) and a web software solution that will present a renewed tourist offer to encourage tourism development in two cross-border regions: in Hungary and the West Bačka District in Serbia. To achieve this goal, the planned activities included analyzing the current situation on both sides of the border, designing a new tourism offer according to EU standards, coll-

ecting data to create a complex database for the development of a comprehensive website to develop a marketing strategy, and finally promotion and dissemination of results.

The implementation of international projects, from the perspective of project cycle management, included two general goals: (1) strengthening the regional economic potential through the development of the tourism sector and (2) balanced and sustainable development of the cross-border regions of Hungary and Serbia. Specific objectives were expressed through specific tasks that were realized during the project time frame:

- development of tourism marketing strategy for the Municipality of Sombor,
- transfer of knowledge and experience through the creation of appropriate tourist offers based on EU regulations, requirements, and rules,
- trilingual database and website that is in communication with modern social networks, as instruments of a specific marketing strategy,
- trilingual electronic catalog of the tourist offers for two cross-border towns: Sombor and Baja,
- implementation of the tourist offers on several platforms of social networks,
- research of current achievements of tourist offers of similar regions,
- connecting natural and ecological protected springs of Baja and Sombor,
- finding the target group, whether they are tourists or all members of social networks who are interested in the tourist offer,
- formation of the architecture of the website, in accordance with the thematic areas required by the project,
- define the time dimensions of data storage that are implemented on the BigData platform.

3.2. *Achieved benefits from the web project development at BigData*

The specifications that define web services are usually modular and generally there is no single document that fully defines those service. The result is presented in the form of specifications, protocols, standards and languages used in the project: SOAP (Simple Object Access Protocol), WSDL (Web Services Description Language) XML, UDDI (Univ-

ersal Description, Discovery, and Integration) protocol for publishing and discovering metadata about web services, HTML (HyperText Markup Language) hypertext markup language, CSS Cascading Style Sheets (PHP) is a specialized scripting language, a CMS (Content Management System) tool for managing the content of multimedia dynamic web solutions and, above all, the modern dimensions of databases: BigData.

The project website presents advertising, promotional, but also dynamic content that acts in creating a positive image of tourism in these two cross-border regions. The site is changing dynamically, depending on the change of input values, information that is analyzed through BigDat, and delivered in the appropriate format for a specific web solution, whose content in turn also depends on the information generated from the BigData database. For the needs of the project, the project team, in cooperation with the IT professional team and the team for communication and public relations, prepared information on possible features and content of the web project, to place the tourism offer, in a larger number of destinations to important types of users. Designed software solution, allows logging potential and old users to plan their requirements in relation to our tourism offer.

The achieved benefits from the new web solution on the BigData database are reflected in the accumulation of data from several Internet sources, social media platforms, sites that deal with online advertising, buying, and selling goods and services, databases of tourism companies and from other external sources of Internet content. The advantages of the architecture on which this web project is realized, are characterized by BigData categories, according to the rules defined by the World Tourism Organization (World Tourism Organization, 2021):

1. Tracking and monitoring,
2. Profiling visitors,
3. Measuring satisfaction,
4. Predicting visitor behaviour,
5. Cultural assets/resources.

Based on five key elements, the initial web page of the site has been developed, which enabled to collect data and create a database of potential visitors, their wishes, intentions, and goals. The home page of the web solution is an online platform to which every visitor, potential tourist or just a fan, can sign up, from any social network, and add their interest about the tourist destination:

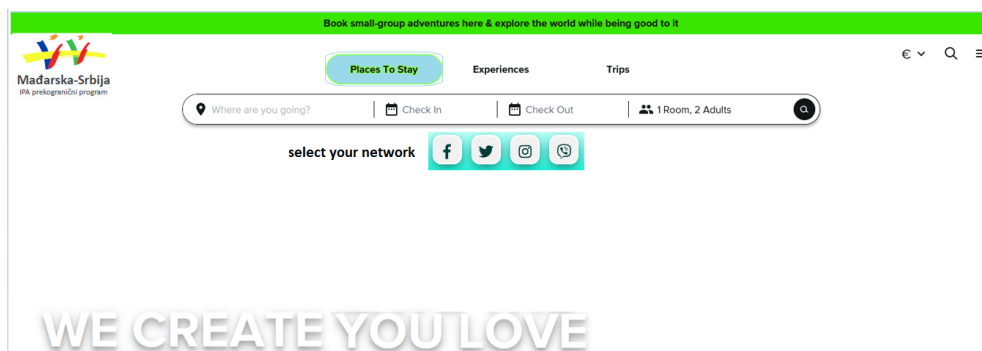


Figure 3: Logging of tourists and potential visitors
Source: Author

The key activities that participated in the creation of the web project that led to the improvement of tourism offer and the creation of potential tourist destination are the following:

1. Predicting and monitoring the movement of potential and market opportunities, conditions, supply, demand in real time for our and similar tourist destinations.

2. Identifying key points, which have been changing virtually, and hiding in large data sets (BigData), to act effectively and timely on business decisions and change the conditions of tourism offers.

3. To react quickly in order to mitigate the emerging risks or optimize the parameters that are at first glance unclear, complex or unacceptable to visitors. Such unforeseen events or potential threats imply weather or similar conditions that we may or may not be able to directly influence.

4. Identifying all the problems in the system of tourism offer in real time.

5. Constantly increasing the amount of information, which has provided huge potential based on when the marketing offer was created, which has been basing on real-time data.

6. Accepting all data about the potential visitors, i.e. customers and their wishes. Virtually influencing the movements of tourism offers and services, discounts and other purposeful activities in order to satisfy customer wishes.

7. The process of search and creating timely and accurate information from the BigData database, have affected the products and services in order to fully meet the requirements or even exceed customer expectations.

8. Adopting diversified income streams to find opportunities to increase profits, which means new investments in important tourist destination and nature reserve.

9. Regarding the significant amount of input information, questions, and suggestions of potential service users, the new communication channels have allowed tourism subjects to address them, directly or indirectly, and answer their requests, complaints, and questions in real time.

10. Studying the possible ways to increase profits, encourage investment in new ideas, new ways of thinking and expert staff. Encouraging innovation and the development of new business strategies, for new products and services. Fostering new forms of financing these innovative strategies of tourist destination: from EU funds, from government funds or from own funds, based on the increase in revenues (2022).

3.3. The examples of using defined standards for web project development with confirmation of achieved results

The website of the project "Culture and Nature for a Better Quality of Life" is based on the requests of users identified by analyzing BigData database. By extracting this data with the support of a database management system, a completely new dimension of information is generated, which affects the dynamic development of the website. The information is presented dynamically and in doses, which will significantly improve the electronic offer of the tourist destination in the two regions (Sombor and Baja). One of the project tasks was to create a new web project which will: research the needs of potential visitors and ensure constant communication with the customers. In this regard, actions had to be taken to fulfil the tasks in the most complete form in order to harmonize the tourist offer with the requirements of its potential visitors. Everything that was achieved during the realization of the project was presented to the public in the form of a dynamic website, realized on the platform of the latest technological possibilities. Visually, the website presents a new set of tourist offers, based on vivid images of untouched nature and habitats of

rare birds, cultural and urban creations and motifs that emphasize the quality and strength of underdeveloped but very attractive tourist destinations. In the continuation of this paper, the content of the web project is described, with colorful and informative web pages, with tourist offers of the two cross-border regions and the surrounding tourist attractive locations. Everything is supported by various formats of multimedia content that is dynamically, quickly in real time remembered and analyzed in the BigData database. Website linked to other applications directed to social networks and various other

software tools for placing offers, products, and services. The following are several websites that are independently separated from the complete software solution in order to present parts of the tourist offer, as well as the method of data collection by future users of our services, who log in to the website. By logging in to the site, the software solution takes data from the logged-in user (personal data and data on his interests and wishes) and stores it in a database, which will expand the view of future innovative tourism development.

TURISTIČKA PONUDA

» Edukativna šetačka staza, Štrbac“ (do 20 osoba)

Upoznavanje sa različitim eko sistemima kroz šetnju uređenom stazom obeleženom informativnim-edukativnim tablama, stolovima i klupama u dužini od 5 km sa mogućnošću posmatranja ptica sa uređene osmatračke platforme na bari „Šarkanjoš“.

(kapija „Štrbac“, Kiđoš, staza čeka, obrok, školski čas)

09.00 h -Polazak iz Sombora	ulaznica ,deca	311,07
09.30 h -Dolazak u ŠU B.Monoštor	ulaznica ,odrasli	619,81
10.00 h -Polazak u „Štrbac“	organizacija	3112,00
10.15 h -Kapija „Štrbac“	vodič(1 dan)	2596,00
10.45 h -Kiđoš” ,most	ručak	400,00
11.00 h -Edukativna staza	prevodilac	2575,00
12.00 h -Čeka za posmatranje ptica		
13.30 h -Ručak		
14.30 h -Povratak		
15.00 h -Kiđoš” ,most		
15.15 h -Povratak u Sombor		
16.15 h -Sombor		

» Ekološka učionica „Baračka“

Home Gornje Podunavlje Gemenc Sombor Baja O nama O projektu Web development CULTURE & NATURE

Figure 4: Tourist offers (p. 1) in the special nature reserve "Upper Danube"

BAJA

Turistička ponuda

Izlet gemenc šumskom železnicom

1. Poludnevni program koji se organizuje svaki dan od maja do oktobra

Prva varijanta

08:30 Polazak Gemenc šumske željeznice iz Porbolja

08:59 Stanica u Malometelelo - 90 minutno zadržavanje radi šetnje po edukativnoj šetackoj stazi uz mogućnost posmatranja ptica sa osmatračkog tornja

10:49 Nastavak putovanja vozicom do stanice Gemenc - obala Dunava.

11:37 Odmor na obali Dunava - odmoršte sa decim igralištem, klupama, stolovima, nadstrešnicom za slučaj kiše

11:47 Polazak za Porbolj

13:05 Povratak na željeznicu stanicu u Porbolju.

Mogućnost razgledanja izložbe koja prikazuje Gemenc šumu i izložbe pčelarstva.

Druga varijanta

10:00 Polazak Gemenc šumske željeznice iz Porbolja

10:29 Stanica u Malometelelo - 20 minutno zadržavanje radi šetnje po edukativnoj stazi uz mogućnost posmatranja ptica sa osmatračkog tornja

10:49 Nastavak putovanja vozicom do stanice Gemenc - obala Dunava.

Home Gornje Podunavlje Gemenc Sombor Baja O nama O projektu Web development CULTURE & NATURE

Figure 5: Tourist offers (p.2) in the special nature reserve "Gemenc"

Project activities lasted 1 year. After the tourist offer was completed, and presented on the new website, the economic and financial sector of the tourist organization in cooperation with the project team analyzed the achieved business results. The following parameters were analyzed: the revenue that was generated in the previous period (during the season from May 1 (2015) to May 1 next year (2016) and during the time when the new website began operating, and the reconstruction of the tourist complex nature reserve "Upper Danube" had been completed. The testing lasted for the next year and the results were impressive. The number of overnight stays in renovated facilities (hotels) increased by as much as 19%. Second: the number of visitors who only visited the habitat without overnight stays increased by about 35%. Third: the income generated only by the company of the tourist organization of the mentioned region increased by almost 30%, compared to the entire last season until May 1. However, the project team did not investigate how much the income of the surrounding companies has increased. This finding could be useful since they also have their own private accommodation capacities and rich restaurant offers of food specialties in this region. The analysis has concretized the results and identified numerous advantages: The joint tourist offer of the cross-border region has been improved: a multimedia database supported by BigData has been created, an e-tourism strategy has been developed on a multilingual website supported by all social networks, and electronic advertising material has been formed. The cultural and historical institutions of Sombor and Baja received an indirect benefit from this project, which encouraged the economic development of both regions.

CONCLUSION

From the economic point of view, tourism participates significantly in the state's profits. Investing in the tourist offer necessarily requires a comprehensive assessment of natural conditions, financial capabilities, but also responsibilities in order to be in line with sustainable development. Globally, it is estimated that tourism accounts for as much as 10% of world GDP and that every 11th job opens a branch of tourism.

The project "Culture and Nature for a Better Quality of Life" was implemented through an interdisciplinary approach in the preparation and implementation of project activities supported and financed by various EU institutions. The project activities were endorsed by a modern ICT and BigData database for collecting and exchanging information,

which is why it was chosen as one of the most successful projects of the first CBC call Hungary-Serbia. The true measure of the success of this project is illustrated by the fact that in the mentioned two-year programming period, the number of tourist visits increased by over 25% on average, annually. Innovative ICT through the development of web projects on the BigData platform has provided continuous monitoring of the current state of tourist offers as well as dynamic designing of new activities in accordance with the trends of supply and demand on social networks in the field of tourist services. Innovative software support on the powerful BigData was presented in the form of a kind of recommending system, with the goal of constantly making decisions on the formation and changes in the tourist offer. The software solution has made the destination not only attractive for tourists, but it has also enabled the sustainable development of this important nature reserve.

Acknowledgement

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