

## THE GIS TECHNOLOGIES` PRODUCTS FOR INCREASING THE TOURIST ATTRACTIVENESS OF THE DESTINATION (ON THE EXAMPLE OF CHERNIGIV REGION)

Analyzing of GIS technologies` products for strengthening the tourist attractiveness of the destination and research of possibilities of GIS-technologies at the formation of a tourist product is **the purpose** of this work. The relevance of this study lies in the need to apply innovative approaches to GIS technologies` usages in the development of national tourism products. The research **methodology** is based on the application of the statistical method of data processing, the cartographic method of research with the use of GIS, and the method of spatial analysis. General scientific, systematic and informational approaches are also used. An analysis of existing products of GIS technologies and the state of their implementation in tourism, the study of interactive maps and geoportals as tools for the successful solution of problems in the modern tourism sector **are the results of this study**. It has been found that geoportals significantly help to form a national infrastructure of geospatial data. In the publication I consider two levels of GIS implementation: national and regional. I give vivid examples of newly created national geoportals and tourist geoportals of the regions of Ukraine, interactive maps of amateur tourists. I consider in more details the development of GIS technologies` products of such a tourist destination as Chernihiv region. In particular, as an example, an overview of one of the most functional in Ukraine geoportals – The Geoportal of the urban cadastre of Chernihiv region is given. A thematic tour of Chernihiv region was projected with the help of GIS. **The scientific novelty** of this study is to identify the features of the use of cartographic research methods, especially GIS technologies in order to study the tourist resources of the territory, the creation of new regional tourism products. I propose to use the method of spatial analysis in the creation of the thematic tour. **The practical significance** lies in the use of GIS technology products to create cartographic products, such as maps, series of maps, atlases, 3D models, virtual tours. It helps to study in detail the tourist objects of the region contribute to management decisions, and further development and promotion of tourism. The database created during the study can be used to form other types of tourism products. The proposed method of using spatial analysis in the creating of the tour can be useful for expanding the GIS technologies` field of usage.

*Key words:* GIS technologies; geoportal; interactive map; set of geospatial data; database; tourist product; tourist attraction; GIS technologies` product; tourism; tourist destination..

### Introduction

The current state of tourism development in Ukraine is characterized by a shift of emphasis from outbound tourism, which until recently prevailed in tourist flows, to domestic and inbound tourism. This requires the active development and promotion of national tourism products. In Ukraine, tourist destinations just begin to take shape, due to the slow integration of Ukraine into the world economic space, that is why it is so important to facilitate this process.

Creating a national tourism product is a complex process that requires not only a detailed study and analysis of the tourist destination but also the application of communication policy to promote it in domestic and international markets.

The cartographic method of research can significantly help in the study of the destination, as well as create additional opportunities for making and analyzing management decisions, promote successful marketing activities, and more. An innovative approach in tourism implies that the successful development of tourism requires the creation of a new or replacement of an existing tourism product and the use of advanced information technology

With all the variety of specialized cartographic works in the field of tourism (tourist maps, plans, schemes, etc.), it should be recognized that they are focused more on tourists and tour operators than on managers of the tourism industry. The shortage of

tourism synthetic maps is obvious, as there is a need to make decisions on the organization of tourism processes and tourism infrastructure. Modern information technologies, especially GIS technologies, can be of great help in solving these problems. They can also serve as a powerful tool in determining the tourist attraction of a destination.

This study is relevant due to the need for a detailed analysis of the possibilities of using GIS technologies in the development of national tourism product.

The task of the study is to analyze the innovative practices of using GIS technologies in the development of national tourism products in order to promote tourism attractiveness in the international market of Ukraine in general and Chernihiv region in particular.

### **Methodology**

Modern ideas about cartography as an important method of fixating objects, events, phenomena in the space, and ideas about GIS technologies as such, which allow combination data about objects with their spatial characteristics are considered as the theoretical and methodological basis of this study.

The statistical method of data processing, method of spatial analysis, and such general scientific research methods as analysis of the object-subject component, synthesis of ideas about the object of study, explanation of the conceptual and terminological apparatus, generalization, and comparison of research results have been used in the study. The object of the study is Chernihiv region as a tourist destination, the development of which contributes to the formation of a national tourist product. The products of GIS technologies, called for expanding the capabilities of the cartographic method of the research in studying of this destination are the subject of the study. A systematic approach to the study of the object is also used, which consists of identifying patterns and mechanisms of its formation from certain components. Among them are the geographical area, tourist and recreational resources, tourist infrastructure. The internal and external connections of the system, the process of combining the basic concepts into a single integrated system are taken into account, using an informational approach. It is implemented through information technology, transmits knowledge

in symbolic form in cartographic products, and is displayed in organizational decisions.

### **Analysis of recent research**

The scientific literature repeatedly considers issues, problems, and prospects of application of modern GIS-technologies for tourism development and reveals the experience of their implementation in solving practical problems.

Research on tourist mapping is conducted at the Taras Shevchenko National University of Kyiv (Datsenko, Ostroukh, 2007); in DNVP "Cartography" (Onyshchenko, 2019).

The development of scientific bases of system mapping for the needs of tourism is carried out at V. N. Karazin Kharkiv National University paying attention to the issue of information and cartographic support of tourism (Peresadko, Shpurik, 2010; Prasul, 2004).

The use of information systems and in particular GIS-technologies in tourism has also been considered by other national scientists (Hliebova, 2012; Melnychenko, 2008; Lutai, 2012; Artemenko, 2015; Prasul, 2004; Kulyk, 2018; Mikhieiev, Noskova, Chudakolov, 2015; Cherniaha, 2010; Kupach, 2015). In particular, Kharkiv scientists analyzed tourist information portals, identified the basic requirements, software, technologies for the creation of GIS in the tourism sector. As a result of the study, a GIS model was developed in the form of a web-application (Mikhieiev et al., 2015).

Issues of developing of practical recommendations for the promotion of tourism products via the Internet are also widely covered to convey information about a particular type of service to consumers, analysis of information systems for data processing in the tourism sector (Danil'chuk, 2008). Hotynian, Tomchenko and Semenenko considered the possibilities of using web/GIS/remote sensing technologies in recreational tourism activities, methods of creating tourist web-sites (Hotynian et al., 2010).

Among the foreign publications are those devoted to the disclosure of the essence, the description of the peculiarities of the formation of geoportals at different territorial levels (Crompvoets, 2017; Medolińska et al., 2017; Yamashkin et al., 2020).

Thus, in particular, the study of the problem of spatial and temporal systematization of information about cultural landscapes on geoportals; about

geospatial data infrastructure for tourism and recreational development of the region is devoted to the work of Russian and Serbian scientists (Yamashkin et al., 2020).

The studies of the Greek author on “geocollaboration” in the implementation of travel and the impact of geoportals on the travelers` trip are of great interest (Sigala, 2009).

## Results

### *Using GIS technologies` products in tourism.*

Not only individual tours, routes, guides and tourist cartographic products are supposed to be the tourist products, but also entire regions, such as areas, which are a special type of tourist product due to geographical features (Mykhailichenko, 2012).

Tourism is one of the traditional industries that uses GIS technology. GIS is considered to be the most promising information systems for solving business management and monitoring problems in the field of tourism. They help to develop projects for perspective tourism planning development. A variety of paper, electronic and digital maps, interactive maps, 3D models, virtual tours, databases and data banks, geoportals are products created through the use of GIS technologies and used in the tourism industry.

The success or failure of GIS implementation depends not only on technology but also on the human factor. The more users use GIS, the more opportunities they have to take an active part in decision-making, and the more likely they are to implement planned projects and use the investments effectively. Such opportunities are realized through network technologies and open access to data.

### *Geoportals*

For tourism, geoportals can be a very powerful base for making and supporting management decisions by public authorities, local governments. They are also interesting and useful for tourist market participants and citizens. I will dwell on this type of GIS technology products in more detail.

A geoportal is a network form of GIS implementation. The word “geoportal” is formed by merging the morpheme “geo” with the word “portal”. The portal (from the English portal – the main entrance, gate), information portal, Internet portal, or web-portal means the starting point of

thematic search in the network. It is also a server that provides direct access to users to a certain set of servers, including information resources installed on them, web-applications that meet the purpose of the portal (Koshkarev, 2008).

On the other hand, a geoportal is an access point or a tool for accessing a geospatial data infrastructure (GDI). GDI means a set of laws, institutional frameworks, standards, technical regulations, technological means and human resources required for the collection, processing, storage, dissemination and use of geospatial data based on ensuring wide access to them by governmental and non-governmental organizations and the public (Karpinskyi, 2006).

Geoportals in the international scientific community are defined differently. For example, “geo-registry”, “geospatial universal service”, “geospatial platform”, “geospatial data service” or “spatial portal” (Crompvoets, 2017). However, the goals of searching and accessing geospatial data are similar.

Web-portal and service-oriented technologies of production, storage and access to information resources can be used to create geoportals. It can be a variety of GIS server products (for example, ESRI's ArcGIS server product, or an open-source GIS-platform QGIS, and others).

Geoportals can be implemented at the global, national, regional and local levels.

Global covering the whole world are based on partnership, and are governed by international organizations. Examples of global geoportals are: Google Maps (<http://maps.google.com>), Google Earth (<https://www.google.com/earth>), OSM (<https://www.openstreetmap.org>), GEOSS (<http://www.geoportal.org>).

National geoportals cover one state. An example of a local geoportal can be a tourist geoportal of Guatemala (<http://www.geovisitguatemala.com>). When uniting states into a single entity (a community), there may also be a common geoportal. An example is the geoportal of EU member states – INSPIRE – an access point to the European IHD (<https://inspire-geoportal.ec.europa.eu>).

Regional geoportals can cover the state, province, region, while local geoportals cover a relatively small area (for example, a city). An example of a regional geoportal is the geoportal of the urban cadastre of Chernihiv region of Ukraine (<http://mbk.cg.gov.ua/>).

An example of a local geoportal can be a geoportal of Polish city Sokolka (<https://sokolka.e-mapa.net>).

For 2014, about 120 countries had their own national geoportal (among them: USA, Canada, Chile, Denmark, France, Germany, India, Lithuania, Luxembourg, Malaysia, New Zealand, Norway, Poland, Qatar, Serbia, Spain, Switzerland, Great Britain, Venezuela, etc.).

#### ***Implementation of GIS technologies in Ukraine***

In Ukraine, the large-scale application of GIS technologies for forecasting and planning was associated with the creation in 2001 of the General Scheme (Genskhema) of territorial planning of Ukraine. It was the most important component of the national system of long-term forecasting of socio-economic development of the country, its regions and settlements, the basis of the whole set of urban planning documentation. The General Scheme became the first town-planning work of this level, developed from the beginning to the end with the use of GIS technologies (Polyvach, 2012).

The first significant steps in the formation of a national geospatial data infrastructure (NGDI) in Ukraine were taken in 2004-2006. This was done by the State Service of Geodesy, Cartography and Cadastre of the Ministry of Environment of Ukraine, whose specialists laid the foundations for further development of the system. In particular, a cartographic web-server of the experimental Ukrainian cartographic network was created for publishing and supporting electronic maps on the territory of Ukraine as a whole, regions and individual cities on the Internet. It is used by most web-portals, enterprises and citizens of Ukraine (Kamenieva, 2020).

But only in September 2015, the work on the establishment of the NGDI of Ukraine in the pilot area has begun.

The geoportal of the administrative-territorial structure of Ukraine (<https://atu.gki.com.ua/ua/karta>) became an important acquirement – an information portal with information about the administrative-territorial structure of Ukraine. The portal contains: administrative-territorial units, topography, settlements, roads and railways, long-term plans for the formation of community territories, budget passports of communities, data on united territorial communities, etc.

The public organization UkrGeo has recently implemented a project to create a geographic information resource GEOPORTALUA (<https://geoportalua.com>), which combines specialized geoportals. It contains a basic geodata set for the territory of Ukraine (collected by categories: urban, rural, water, forestry, defense and security). In particular, it contains an interactive map of cultural heritage Ukraine sites with 3D models of these objects (<https://map.geoportalua.com/culture>).

The Law on National Geospatial Data Infrastructure entered into force only in June 2020. It is applicable from January 2021 (Law of Ukraine “On National Geospatial Data Infrastructure”, 2020).

At the regional level, work on the establishment of NGDI began to be implemented several years ago. Some regions already have their own geoportals of urban cadastre (Kyiv region – <http://koda.geoportal.org.ua/ua/map/main>; Dnipropetrovsk region – <http://mbk.dp.gov.ua>; Donetsk region – <http://donmbk.in.ua/geoportaly/donoblast>; Lviv region – <http://loda.cadastre.com.ua>; Odessa region – <http://gradportal.od.ua>; Sumy region – <http://193.34.93.127/gisMapMBKWeb/index.php>; Chernivtsi region – <http://ecomm.maps.arcgis.com/home/webmap/viewer.html?webmap=6d9d06b7e26644ef8609916816c53432>; Chernihiv region – <http://mbk.cg.gov.ua>).

#### ***GIS technologies in tourism for the development of the regions of Ukraine***

If we consider tourism as a component of the NGDI, it should be noted that information on tourist objects and tourist infrastructure objects falls within profile geospatial data. (This includes all types of sectoral and thematic geospatial data, which are created on the basis of basic geospatial data).

In 2012, the project of local history enthusiasts “Ukraine Incognita” (<http://ukrainaincognita.com>) has started, which currently contains more than 100 thousand pages, has maps, descriptions of attractive attractions with photos, stories, videos, tours, and a lot of interesting information. The developers plan to print guides and maps of Ukraine and further fill the site with interesting content.

In 2014, Google Ukraine launched a large-scale campaign “Digital Transformation of the Regions of Ukraine”. Its goal is to reveal the country's tourism and investment potential. Work on the project has begun in Lviv and Rivne regions. The first region to open for virtual travel was Kherson region – the project “Travel Kherson region”. For 4 years in cooperation with local state administrations, the project was implemented in 14 regions. Thus, together with Odessa local authorities in 2016, an interactive tourist map of Odessa region was created (<http://discoverodesa.com.ua>), which presents the sights, as well as little-known tourist sites of the region in the form of photospheres, photo tours, videos and photos. In 2016, interactive tourist maps “Hidden Treasures of Mykolaiv Region” (<http://travelinmykolaiv.com.ua/>), “Discover Kirovohrad Region”, “Discover Ivano-Frankivsk Region” were also created.

Project sites differ in subject and content. For example, the project "Discover Ivano-Frankivsk region" focuses on the authentic culture and history of the region: here you can take a virtual tour of the Easter egg museum in Kolomyia or virtually ride the Carpathian tram.

In the same year, the interactive atlas “Tourist Zhytomyr Region” was launched on the “Google Maps” service (<https://www.google.com/maps/d/u/0/viewer?mid=1wYkdGWG7HoCxKCdLrxWYO-vGIZI&ll=50.69396517298676%58>), which currently contains 655 thematic tourist sites. It was developed by three Zhytomyr cyclists on the basis of their own content.

In 2017, travel sites “Discover Cherkasy region”, “Discover Vinnitsa region”, similar web-sites for Dnipropetrovsk and Zaporizhzhia regions appeared, in 2018 – sites “Travel Sumy region”, “Discover Kyiv region” and “Discover Kharkiv region” (<https://discover.kh.ua>). The web-sites contain regional monuments of architecture and nature. You can choose locations and learn about their detailed location, work schedule, interesting places around, and more. Some locations can be viewed in 3D tours.

In the same year, another interesting project was launched – “Ukrainian architectural monuments. Heritage” (Fig. 1). Its purpose is to show restored architectural monuments, religious buildings and other historical monuments of Ukraine. According to the authors, it was created for documentary photo-fixation of what is often on the verge of extinction ([https://www.google.com/maps/d/u/0/viewer?mid=1Q-QIDKZr\\_KSMC-3\\_bYWT8gr5-Qaw&ll=49.77166999584471%2C26.96431161250007&z=6](https://www.google.com/maps/d/u/0/viewer?mid=1Q-QIDKZr_KSMC-3_bYWT8gr5-Qaw&ll=49.77166999584471%2C26.96431161250007&z=6)).

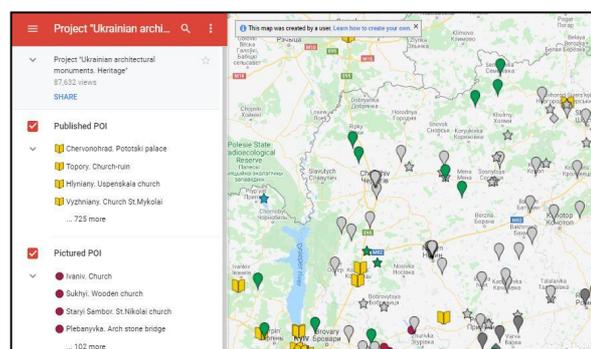


Fig. 1. A fragment of the interactive map “Ukrainian architectural monuments. Heritage”

Currently, more and more electronic and interactive maps are appearing in Ukraine for those who like travelling to their native land. In summer 2020, an interactive map of Ukrainian sights “What to see – Ukraine” with real photos appeared on the “Google Maps” ([https://www.google.com/maps/d/viewer?ll=48.71127693363862%2C29.163433550000025&z=5&mid=1nlskjs8\\_rQPSMdYVVo\\_EajzD9BvmL\\_1Q2](https://www.google.com/maps/d/viewer?ll=48.71127693363862%2C29.163433550000025&z=5&mid=1nlskjs8_rQPSMdYVVo_EajzD9BvmL_1Q2)) (Fig. 2).

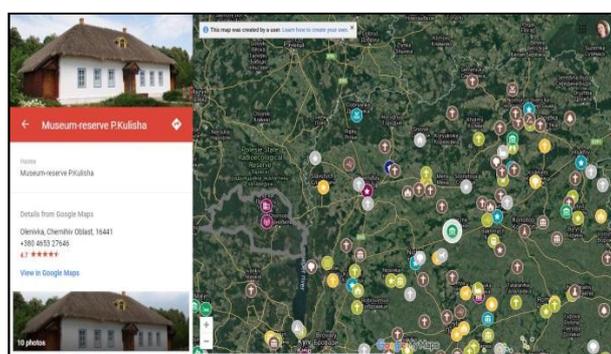


Fig. 2. Chernihiv region on the interactive map of Ukrainian sights

According to the author's concept, tourist objects in this project are sorted not by type, but by the level of interest. This is a manifestation of the subjective approach of its author (traveler Volodymyr Omeliukh) to the significance of these monuments.

Another interesting and attractive interactive tourists map posted on the Internet is the map "Prehistoric Ukraine", which shows objects from the Paleolithic to the Middle Ages. The project is under development ([https://www.google.com/maps/@48.3141667,31.3636648,6z/data=!3m1!4b1!4m2!6m1!1s1U7tQcIs46fNHQeuTN5\\_JqVeelUUUFsAX](https://www.google.com/maps/@48.3141667,31.3636648,6z/data=!3m1!4b1!4m2!6m1!1s1U7tQcIs46fNHQeuTN5_JqVeelUUUFsAX)).

#### ***Implementation of GIS technologies to increase the tourist attractiveness of Chernihiv region***

The planning structure of Ukrainian health and recreational institutions` network which was proposed by the General Scheme provided for the creation of 23 districts with centers in cities of regional significance.

On the territory of Ukraine, according to the General Plan of Territorial Planning in 2001, 4 tourist districts were identified; Chernihiv region belongs to Dniiper district. Chernihiv tourist region according to the degree of development, the state of natural resources, the importance of sightseeing facilities, the availability of highways, the development of material resources belonged to the international and national. This area was defined as one of the others for priority development until 2010, but its development of 2019 did not meet the set indicators. Unfortunately, in 2019, the General Plan for the location of objects and infrastructure of tourism in Ukraine has not been developed.

In Chernihiv region, only cities of regional significance (Chernihiv, Pryluky, Nizhyn and Novhorod-Siverskyi) and district significance are fully provided with the General Plan. However, part of this urban planning documentation needs to be adjusted. Currently, the rate of outdated general plans is very high, and there are urban-type settlements that are still not provided with general plans (Ministry of Development of Communities and Territories of Ukraine, 2019).

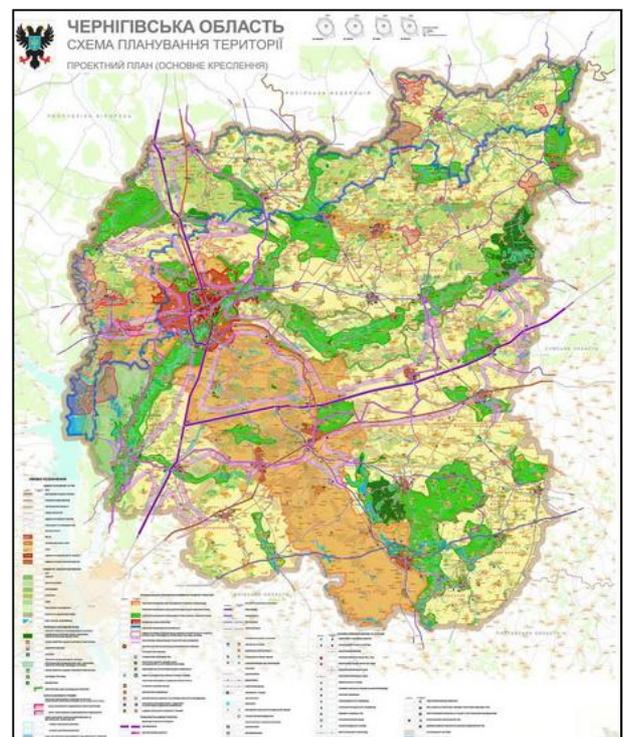
The regional settlements are provided with general plans by 89.7 %, the work on the preparation of general plans of Korop and Kozelets is being completed. In 2015, a new general plan for Varva was approved, and in 2016 for Sedniv.

According to the administrative-territorial structure of Ukraine in Chernihiv region, there are 1465 rural settlements. But only 28 are provided with new town-planning documentation.

Today, all 22 districts of Chernihiv region are provided with district planning schemes, but almost all this documentation is outdated, it does not fully meet the requirements of modern legislation and needs an urgent updating.

Since 2011, 35 general plans, 29 zonings, 27 detailed territory plans within settlements, and 25 outside settlements have been developed and approved in the Chernihiv region. These cartographic materials were developed by DP Ukrainyski Derzhavnyi Naukovo-Doslidnyi Instytut Proektuvannia Mist "Dipromisto" Imeni Yu. M. Bilokonja. It was based on the General Plan of 2001, and the initial data was provided by the departments and divisions of the Chernihiv Regional State Administration.

Thus, the following was created: the scheme of territorial planning (the region in the system of adjacent territories, the project plan – the main drawing – Fig. 3, the scheme of location of cultural heritage sites, the scheme of formation of tourist and recreational system and others).



*Fig. 3. The scheme of planning the territory of Chernihiv region, 2001 (in Ukrainian)*

However, most of the available urban planning documentation is outdated. In addition, the main part of it is mostly presented only in paper form, which does not meet the requirements of Part 3 of Article 2 of the Law of Ukraine “On Regulation of Urban Development”.

The slow pace of development (updating) of urban planning documentation in the settlements of the region is mainly due to an insufficient funding of expenditures from local budgets, the lack of updated digital cartographic material (Chernihiv Regional Council, 2020).

In 2019, the section “GIS map of Chernihiv” appeared on the web-site of the city council [chernigiv-rada.gov.ua](http://chernigiv-rada.gov.ua), where we can see plots with information about the cadastral number, owners or tenants of land plots in the mode of a map or satellite image (Fig. 4) (Official web-portal of Chernihiv City Council, 2020).

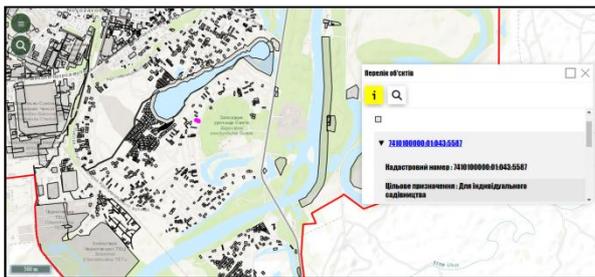


Fig. 4. A fragment of GIS map of Chernihiv with information about the land plot (in Ukrainian)

The reference information about the region can also be obtained from the Public Cadastral Map of Ukraine (<https://map.land.gov.ua/>), which contains various cartographic materials and displays combined information from different information layers (for example, the boundaries of Ukraine administrative-territorial units, the boundaries of settlements, districts, etc., which are included in the State Land Cadastre, soils, forests, nature reserves (Fig. 5–6).

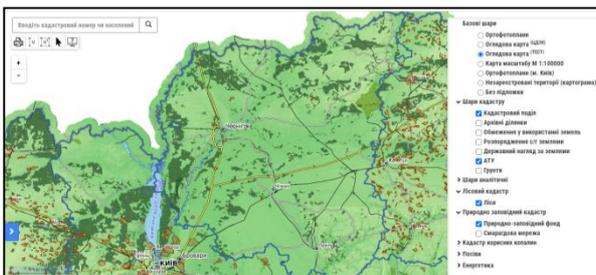


Fig. 5. The Chernihiv region on the Public Cadastral Map of Ukraine (in Ukrainian)



Fig. 6. The Mezynskyi National Nature Park on the Public Cadastral Map of Ukraine (in Ukrainian)

The geoportal “The tourist Chernihiv region” (<https://chernihivregion.travel/turystychni-objekty>) became a significant acquirement for the region (Fig. 7). On the interactive tourist map of the geoportal, we can see the location of such objects as the tourist objects themselves, objects of tourist infrastructure, nature reserve fund, places of active recreation. There are many beautiful photos of various attractions.

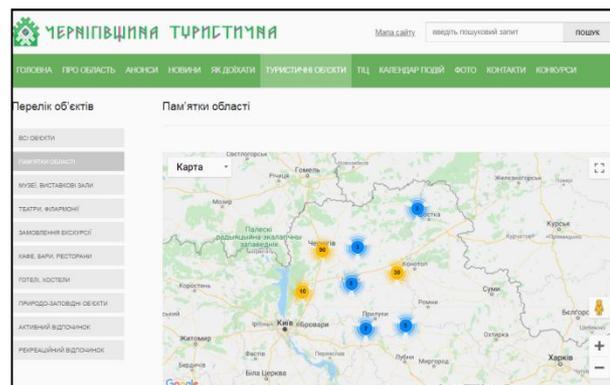


Fig. 7. The interactive map of Chernihiv region (in Ukrainian)

In 2019, a geoportal of the urban planning cadastre of Chernihiv region (<http://mbk.cg.gov.ua>) was created to implement the regional target program for creating and maintaining the urban cadastre of Chernihiv region for 2016–2019. This geographic information system was launched by the Department of Urban Planning and Architecture of the Chernihiv Regional State Administration. It works on the GIS platform SOFTPRO (Fig. 8) (Department of Urban Planning and Architecture of Chernihiv Regional State Administration, 2020).

The geoportal contains more than 180 information sets of spatial data, which are collected in 26 categories. The filling of this geoportal with information is still ongoing, so it works in test mode. Among the proposed data sets in this geoportal, there

are already monuments of national and local importance, the rubric “Tourism” with tourist objects. Thanks to the geoportal in free access on the web-site general plans of settlements of the area are available.

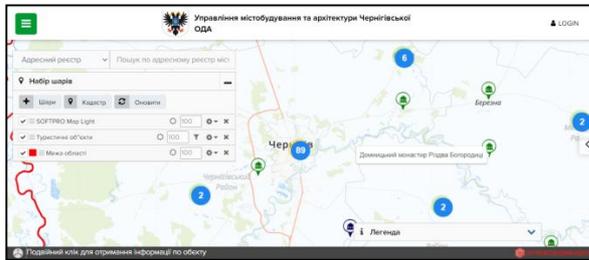


Fig. 8. A fragment of the geoportal's page of Chernihiv region on the SOFTPRO platform (in Ukrainian)

The quality of the geoportal depends, among other things, on what additional features the user has. This cartographic web resource acts as an access point to a large number of information data sources, has a system of tools for viewing and retrieving geographic information, its visualization, download, and distribution. The geoportal functions of scaling, identification of object's thematic content, overlay of visible data sets, an image of legend are well implemented.

The geoportal now also contains schemes of planning for 2011 in raster form, with a legend (Fig. 9), which can be viewed online with the ability to scale the image on the screen.



Fig. 9. A fragment of the Schemes of cultural heritage objects located on the geoportal of Chernihiv region (in Ukrainian)

However, the geoportal does not yet have good discovery services that allow user to search for geospatial datasets using metadata. The metadata itself is not yet filled with sufficient and comprehensive information; it often contains “no information” fields. There is also no geographical directory, no

geoprocessing functions, coordinate transformation. However, in terms of functionality and content, this geoportal can be considered as one of the most powerful in Ukraine. It should also be noted that today it is the most powerful basic GIS platform for Chernihiv region.

In addition to geoportals, web resources with interactive maps are increasingly appearing on the Internet. Exclusive interactive maps of Ukraine can be interesting for tourists traveling to Chernihiv region, for example:

- the map of outstanding trees created on visicom.ua (<https://maps.visicom.ua/c/31.94824,51.29456,8/po/oldesttreesukraine?lang=uk>);
- the map of wooden temples (Fig. 10) (<http://www.derev.org.ua/chernih/chernih.htm>);
- the map of technical monuments (Fig. 11) ([https://www.google.com/maps/d/u/0/viewer?mid=1b8Hv\\_BCnYBfIPSky4ze4Xwa\\_6Hmy6GoB&ll=51.229925281764224%2C32.080697029366476&z=8](https://www.google.com/maps/d/u/0/viewer?mid=1b8Hv_BCnYBfIPSky4ze4Xwa_6Hmy6GoB&ll=51.229925281764224%2C32.080697029366476&z=8)).



Fig. 10. A map of Chernihiv region in the project “Wooden temples of Ukraine” (in Ukrainian)

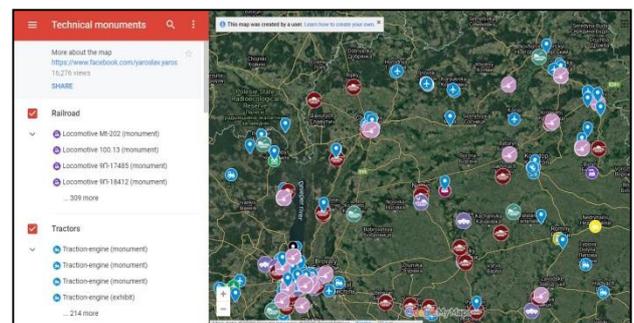


Fig. 11. Chernihiv region on the interactive map of Ukraine technical monuments

Such projects, created by amateurs in tandem with GIS specialists, are an evidence that interest of tourism in Chernihiv region, as well as in Ukraine as a whole is growing. No wonder an effective planning of territorial development, which involves the development of urban planning documentation and ensuring its publicity and implementation of GIS of urban cadastre and its publicity is obviously one of the operational goals in the draft Strategy for Sustainable Development of the Chernihiv region for the period up to 2027 (2019).

**Project of innovative tourist product of Chernihiv region using GIS-technologies**

In this study, a new thematic tour of the Chernihiv region was considered as an innovative tourist product. For projecting the tour, attractive tourist objects were first identified and the location of accommodation facilities in Chernihiv region was clarified, using GIS technologies.

To implement this project, shp-files containing more than 900 tourist objects, including 241 historical and cultural objects (as of 2019), were found in the open data of OSM. The QGIS program was used for the analysis.

During the study, a database was formed, which also included tourist objects of Chernihiv region, which are highly rated by connoisseurs. Museums, theaters, sacred buildings, parks, estates, palaces, monuments, architectural structures, viewpoints, etc. were chosen as the categories of attractions, among all the objects. Selected tourist objects I display on the heatmap (Fig. 12):

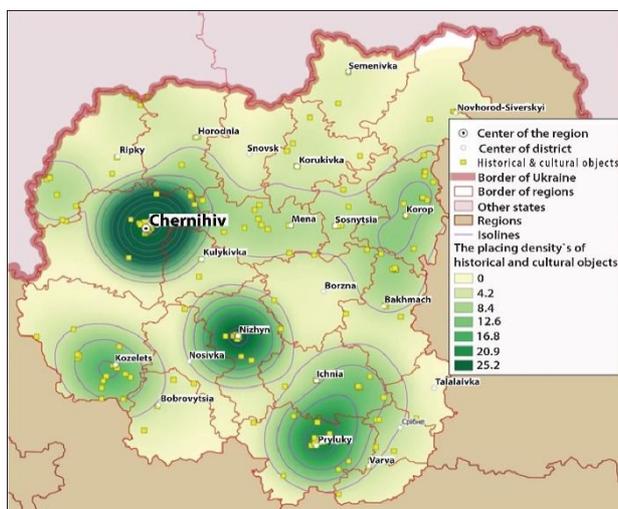


Fig. 12. The heatmap of historical and cultural objects of Chernihiv region, created in QGIS

The analysis of this map allowed identifying the places that are most attractive in the region (it is based on the mutual position of historical and cultural objects among themselves and their evaluation). These are the territories around the places: Chernihiv, Nizhyn, Pryluky, Kozelets, Korop, Mena, Sosnytsia, etc. Chernihiv turned out to be especially attractive, around which there is the highest density of historical and cultural objects in the region.

When analyzing the attractiveness of tourist accommodations (hotels, motels, hostels, hotel complexes, guest houses, etc.), 95 objects were entered into the database. The rating of attendance of each hotel or motel (on a 10-point scale), which was set as the average of all ratings contained in several web resources was taken into account. Among such web resources I use the following: google.com/maps, booking.com, tripadvisor.ru, stejka.com, doroga.ua, uahotels.info, turpravda.ua and others.

The following heatmap (Fig. 13) shows the density of the location of the tourist accommodations by the degree of their attractiveness. To create this map, a statistical method of data processing, where the research criterion was a standardized average has been used.

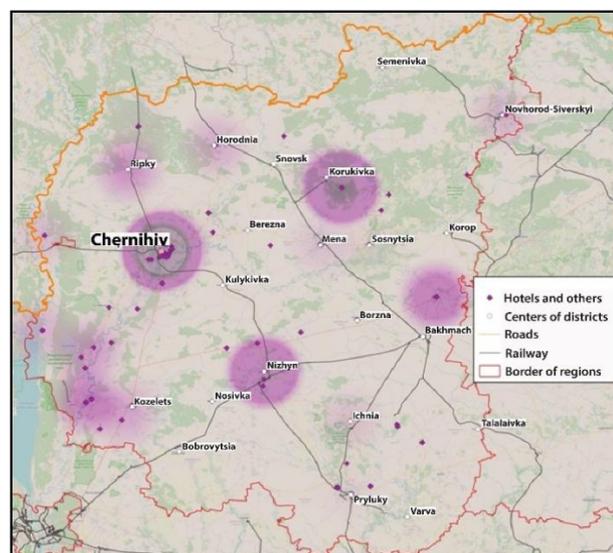


Fig. 13. The heatmap of standardized attractiveness of tourist accommodations in Chernihiv region

The normalized estimate of the attractiveness of tourist accommodations  $Rat_{Norm}$ , which was measured in the range from 0 to 1, has been calculated by formula (1):

$$Rat\_Norm = \frac{Rating * Rat\_Num}{\max(Rating * Rat\_Num)}, \quad (1)$$

where *Rating* – the average rating of the accommodation by visitors (from web resources, rated on a 10-point scale);

*Rat\_Num* – number of guest ratings;

$\max(Rating * Rat\_Num)$  – maximum product.

According to the results of the map and the database analysis (Fig. 13), it can be assumed that hotels in Chernihiv, Nizhyn, Baturyn and the village of Brech in the Koryukiv region are the most visited and popular in the Chernihiv region. In Chernihiv the most popular hotels are: “Ukraine”, “Hradetskyi”, in Baturyn – the hotel “Parusa Maklaia”. The hotel complex “Khutir Rybatskyi” in Nizhyn is also very popular. Hostel “Leo” in Chernihiv, hotel “Kvelta” in Nizhyn and hotel “Druzhba” in Ripky village are not such popular but the same visited.

The analysis allowed using the acquired knowledge to project a tour, which, if successfully promoted, can be popular among connoisseurs of historical and cultural monuments. In my study I project a cultural and cognitive tour of the historical settlements of Chernihiv region, which will pass through 14 settlements included in the list of historical settlements of Ukraine. These are such settlements as: Lyubech, Chernihiv, Sedniv, Sosnytsia, Novhorod-Siverskyi, Korop, Baturyn, Borzna, Sribne, Pryluky, Ichnia, Nizhyn, Kozelets, and Oster. With the help of QGIS, the appropriate route was formed so that it passed the most attractive places identified in the preliminary analysis. The route of the tour I demonstrate on the map (fig. 14).

This tour lasting 3–5 days I project for a group of 10-20 people. A line trip by bus or minibus is planned (depending on the number of people). The total path length during the trip is calculated using lines length measurements in QGIS, which helps to determine the cost of transportation services.

According to the results of the analysis of accommodation facilities conducted in this study, the most attractive places to stay or spend the night during the tour were chosen.



Fig. 14. A tour route through the historical settlements of Chernihiv region

### The scientific novelty 0 and the practical significance

The scientific novelty of this study is to identify the features of the use of cartographic research methods in general and GIS technologies in particular to study the tourist resources of the territory, the creation of new regional tourism products. It is proposed to use regional geoportals of the urban cadastre and sets of geospatial data in them to form the image of a tourist destination, to reveal its uniqueness. I propose to use the spatial analysis in the projection of the tour.

The practical value of the study is that the identified products of GIS technology can be used to create cartographic products, such as: maps, series of maps, atlas, 3D models, and virtual tours. They will help to study in detail the tourist objects of the region; promote management decision – making and further development and promotion of tourism.

The database created during the study can be used to form other types of tourism products. The proposed method of using spatial analysis in the projection of the tour can be useful for expanding the scope of GIS technologies.

### Summary

The use of GIS in public administration significantly increases the transparency of local

decision-making processes. The boom in interactive tourist maps and geoportals with them in Ukraine in general and in the Chernihiv region in particular is widespread. The developing of information systems will increase the number of potential users.

The use of geoportals for tourism professionals has obvious advantages:

- on geoportals we can get official data provided by public authorities, local governments or specific organizations;
- each set of spatial data has metadata with information about the persons responsible for the accuracy of the data;
- constant updating of data;
- ease using of data sets due to their geovisualization.

Using of GIS technologies` products to increase tourist attractiveness in Chernihiv region has begun in recent years. The geoportal of the urban cadastre of the Chernihiv region is a bright example of application of GIS-technologies at the regional level both for use by managers, citizens, and for scientific workers. It is the basic platform for creating the GIS environment of Chernihiv region and helps to form the national infrastructure of geospatial data.

### Perspectives

Geoportals as innovative applications of GIS technologies in tourism can help to extend the life cycle of a tourist destination by providing free access to information about attractions and elements of tourist infrastructure.

In the future, over time, we can expect the emergence of geoportals with increased functionality, new features. For tourism it can be a geoportal with a virtual globe, which allows to expand the expressiveness of the data, is a more realistic and intuitive environment for the user.

Creating databases related to tourism and expanding the tool capabilities of GIS programs, improving the interface of interactive maps will significantly improve the attractiveness of the use of GIS technologies for the tourism industry. These questions are promising ways for further research in this area. In the future, it is also planned to improve the proposed method of data processing by involving better statistical methods.

### REFERENCES

- Artemenko, O. I., Kunanets, N. Ye., Pasichnyk, V. V., & Savchuk, V. V. Systemni osoblyvosti suchasnykh informatsiinykh tekhnolohii u haluzi turyzmu. URL: [http://nbuv.gov.ua/UJRN/nvnlto\\_2015\\_25](http://nbuv.gov.ua/UJRN/nvnlto_2015_25).
- Artemenko, O. I., Pasichnyk, V. V., & Yehorova, V. V. Informatsiini tekhnolohii v haluzi turyzmu. Analiz zastosovan ta rezultatyv doslidzhen. URL: [http://nbuv.gov.ua/UJRN/VNULPICM\\_2015\\_814\\_3](http://nbuv.gov.ua/UJRN/VNULPICM_2015_814_3)
- Chernihiv Regional Council. URL: <https://chor.gov.ua/>.
- Cherniaha, P., Lahodniuk, O., & Romaniuk, O. (2010). Principles of formation infrastructure of geospatial data for sustainable development of tourism. *Geodesy, cartography and aerial photography*, 73, 115–121.
- Crompvoets, J. (2017). Geoportals. Retrieved from <https://doi.org/10.1002/9781118786352.wbieg0315>.
- Danil'chuk, V. F., Kudokocev, N. S., Semichastnyj, I. L. (2008). Methods for identifying priority development of tourist and recreational areas based on GIS technologies. *Visnyk DITB*, 12, 25–29. (in Russian)
- Datsenko, L. M., Ostroukh V. I. (2007). Creating travel maps based on the latest computer technology. *Geography and tourism. Heohrafiia ta turyzm*, 1, 45–50 (in Ukrainian)
- Hliebova, A. O. Innovative technologies in the tourism industry. *Economy. Management. Innovation*, 2 (8). (in Ukrainian). URL: [https://tourlib.net/statti\\_ukr/glebova2.htm](https://tourlib.net/statti_ukr/glebova2.htm)
- Hotynian, V. S., Tomchenko, O. V., & Semenenko, A. V. Travel geoinformation websites. *Geography and Tourism*, (8), 137–140. (in Ukrainian). URL: [http://nbuv.gov.ua/UJRN/gt\\_2010\\_8\\_32](http://nbuv.gov.ua/UJRN/gt_2010_8_32).
- Kamenieva, T. Formation of the National Infrastructure of Geospatial Data in Ukraine and its legal regulation. (in Ukrainian). URL: <http://nbuviap.gov.ua/images/dumka/2020/9.pdf>.
- Karpinskiy, Yu. O., & Liashchenko, A. A. (2006). Strategy for the formation of the national infrastructure of geospatial data in Ukraine. Kyiv: NDIHK, 108 p. (in Ukrainian).
- Koshkarev, A. V. (2008). Geoportal as a tool for managing spatial data and geoservices. *Spatial data*, (2), 6–14. (in Russian). URL: <http://gisa.ru/45968.html>.
- Koshkarev, A. V., & Rotanova, I. N. (2014). Russian scientific, educational and industry geoportals as elements of spatial data infrastructure. *Vestnik Novosib. gos. un-ta*, 12 (4), S. 38–52. (in Russian).
- Kulyk, V., & Sossa, R. (2018). Determining the tourist attractive regions by GIS analysis using heatmaps. Retrieved from <https://journals.vgtu.lt/index.php/GAC/article/view/882>.
- Kupach, T. H. (2015). Information technologies and systems in tourism: textbook. Kyiv: Kyiv. nats. un-t im. T. Shevchenka, 2015. 97 p. (in Ukrainian).

- Lutai, A. P. Information technologies in the tourism industry. Coll. mate. scientific-practical conf. DonNUET. 2012. p. 241–247 (in Ukrainian).
- Medolińska, K., Gołębiowska, I., & Karsznia, I. (2017). Local GIS: development and assessment of the geoportal for local governments and local communities. Case study of a small town in Poland. Retrieved from <https://doi.org/10.1515/mgrsd-2017-0031>.
- Melnychenko, S. V. (2008). Information technologies in tourism: theory, methodology, practice: monograph. Kyiv: Kyiv. nats. torh.-ekon. un-t, 2008. 493 p. (in Ukrainian).
- Melnychenko, S. V (2010). Information technologies in the management of tourism entities. *Visnyk KNTEU*. 2010. № 2. S.131–143. (in Ukrainian).
- Melnyk, A. V. Introduction and improvement of geographic information technologies in tourism. Scientific Bulletin Uzh. NU.-2009.-Series “Economics”, 28, 43–44. (in Ukrainian). URL: [http://tourlib.net/statti\\_ukr/melnyk3.htm](http://tourlib.net/statti_ukr/melnyk3.htm).
- Mikhieiev, I. A., Noskova, V. V., Chudakolov, A. Iu. Geoinformation modeling of the regional sphere of tourism. *Systemy obrobky informatsii*. 2015. S. 74–77. (in Ukrainian).
- Ministry of Development of Communities and Territories of Ukraine. (in Ukrainian). URL: <https://www.minregion.gov.ua/wp-content/uploads/2019/12/PROTOKOL-14-Dodatok-1.pdf>.
- Mykhailichenko, H. I. (2012). Innovative development of tourism: monograph. Kyiv: Kyiv. nats. torh.-ekon. un-t, 2012. 608 p. (in Ukrainian).
- Onyshchenko, M. H. (2019). Tourist mapping: successful experience, successful result. *Chasopys kartohrafii : zbirn. nauk. pr.* Kyiv: KNU im. Tarasa Shevchenka, 20. p.26–38. (in Ukrainian).
- Peresadko, V. A., & Shpurik, K. V. (2010). Application of the cartographic method in the process of research of natural and historical-cultural heritage in Kharkiv region. *Problemy bezperervnoi heohrafichnoi osvity i kartohrafii: zbirn. nauk. pr. Kharkiv* : KhNU im. V.N. Karazina. 11. p.129–135. (in Ukrainian).
- Polyvach, K. A. Cultural heritage and its impact on the development of the regions of Ukraine. (in Ukrainian). URL: [https://igu.org.ua/sites/default/files/pdf-text/PolyvachK\\_Heritage.pdf](https://igu.org.ua/sites/default/files/pdf-text/PolyvachK_Heritage.pdf).
- Prasul, Yu. I. (2004). Scientific bases of systematic mapping of regions of Ukraine for the needs of tourism (on the example of Kharkiv region): avtoref. dys. ... kand. heohr. nauk. Kharkiv, 20 p. (in Ukrainian).
- On the national infrastructure of geospatial data: Law of Ukraine 13.04.2020 № 554-IX. (in Ukrainian). URL: <https://zakon.rada.gov.ua/laws/show/554-20#Text>
- Shakhovska, N. B., & Uhryn, D. I. (2008). Analysis of information systems for data processing in the tourism sector. *Naukovyi visnyk NLTU Ukrainy*. 18.10. 258–263 (in Ukrainian).
- Shevin, A. V. (2016). Geoportals as basic elements of spatial data infrastructure: analysis of the current state of affairs in Russia.. *Vestnik SGUGiT*. 3(35). S.102–110.
- Sigala, M. (2009) Geoportals and Geocollaborative Portals: Functionality and Impacts on Travellers' Trip Planning and Decision Making Processes. Retrieved from [https://scholarworks.umass.edu/refereed/Session\\_s/Friday/28](https://scholarworks.umass.edu/refereed/Session_s/Friday/28).
- Strategy of the steel development of the Chernigiv region for the period until 2027. URL: [http://cg.gov.ua/web\\_docs/1/2019/04/docs/%D0%A1%D1%82%D1%80%D0%B0%D1%82%D0%B5%D0%B3%D1%96%D1%8F\\_%D1%80%D0%BE%D0%B7%D0%B2%D0%B8%D1%82%D0%BA%D1%83\\_2027\\_der\\_f.pdf](http://cg.gov.ua/web_docs/1/2019/04/docs/%D0%A1%D1%82%D1%80%D0%B0%D1%82%D0%B5%D0%B3%D1%96%D1%8F_%D1%80%D0%BE%D0%B7%D0%B2%D0%B8%D1%82%D0%BA%D1%83_2027_der_f.pdf). (in Ukrainian).
- Management of the mistobuduvannya and architecture of the Chernigiv ODA. (in Ukrainian). URL: [http://chernigiv\\_dma.local.softpro.ua/](http://chernigiv_dma.local.softpro.ua/).
- Yamashkin, A. A., Yamashkin, S. A., Aksonova, M. Yu., Cimbaljević, M., Demirović, D., Vuksanović, N., & Milentijević, N. (2020). Cultural landscapes space-temporal systematization of information in geoportals for the purposes of region tourist and recreational development. Retrieved from <https://doi.org/10.30892/gtg.29205-480>.

В. Б. ЛЕПЕТЮК

Кафедра геоінформатики та фотограмметрії. Київський національний університет будівництва і архітектури, Повітрофлотський просп., 31, Київ, 03037, Україна, lepetiuk.vb@knuba.edu.ua, <https://orcid.org/0000-0002-2066-4424>. Scopus Author ID: 57202079704

### ПРОДУКТИ ГІС-ТЕХНОЛОГІЙ ДЛЯ ПІДВИЩЕННЯ ТУРИСТИЧНОЇ ПРИВАБЛИВОСТІ ДЕСТИНАЦІЇ (НА ПРИКЛАДІ ЧЕРНІГІВСЬКОЇ ОБЛАСТІ)

**Мета** цієї роботи – аналіз продуктів ГІС-технологій, покликаних підвищувати туристичну привабливість дестинації, дослідження можливостей ГІС-технологій при формуванні туристичного продукту. Актуальність даного дослідження полягає у необхідності застосування інноваційних підходів до використання ГІС-технологій при розробленні національних туристичних продуктів. **Методика** дослідження ґрунтується на застосуванні статистичного методу обробки даних, картографічного методу дослідження з застосуванням ГІС та методу просторового аналізу. Також використані загальнонаукові, системний та інформаційний підходи. **Результатами** дослідження є аналіз існуючих продуктів ГІС-технологій та стану їхнього впровадження в туризмі, вивчення інтерактивних карт та геопорталів як інструментів для успішного рішення проблем в сучасній туристичній сфері. З'ясовано, що геопортали значно допомагають формуванню національної інфраструктури геопросторових даних. В публікації розглянуто два рівні впровадження ГІС: національний та регіональний, наведені яскраві приклади новостворених національних геопорталів та туристичних геопорталів регіонів України, інтерактивних карт туристів-аматорів. Детальніше розглянуто розвиток продуктів ГІС-технологій такої туристичної дестинації, як Чернігівська область, зокрема один з найбільш потужних в Україні за функціоналом Геопортал містобудівного кадастру Чернігівської області. З допомогою ГІС спроекційовано тематичний тур Чернігівщиною. **Наукова новизна** даного дослідження полягає у виявленні особливостей використання картографічного методу дослідження в цілому та ГІС-технологій зокрема для вивчення туристичних ресурсів території, створення нових регіональних туристичних продуктів. Пропонується використовувати методику просторового аналізу при проєкціюванні туру. **Практична значущість** полягає у тому, що виявлені продукти ГІС-технологій можуть бути застосованими для створення картографічних творів, таких як: карта, серії карт, атлас, 3D моделі, віртуальні тури, що допомагають детально вивчати туристичні об'єкти регіону, сприяють прийняттю управлінських рішень та подальшому розвитку та популяризації туризму. Створена в ході дослідження база даних може бути використана для формування інших видів туристичних продуктів. Запропонована методика використання просторового аналізу при проєкціюванні туру може бути корисною для розширення сфери використання ГІС-технологій.

*Ключові слова:* ГІС-технології; геопортал; інтерактивна карта; набір геопросторових даних; база даних; туристичний продукт; туристична привабливість; продукт ГІС-технологій; туризм; туристична дестинація.

Received 16.09.2020