ECONOMIC, ECOLOGICAL AND SOCIAL ASPECTS OF INDUSTRIAL TOURISM DEVELOPMENT IN TWO-TIERED ANTHROPOGENIC LANDSCAPES OF THE KRYVYI RIH LANDSCAPE TECHNICAL SYSTEM

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ABSTRACT

The article considers the prospects for the development of industrial tourism in the two-tiered anthropogenic landscapes of the Kryvyi Rih landscape-technical system. Five main features of industrial tourism in this region are highlighted. The presence of powerful mineral deposits, which contributes to the active development of the mining industry, is analysed, and as a result, the main locations for the development of industrial tourism are identified. The paper provides examples of such locations as the quarry of the Pivdenne Mining and Processing Plant, Zhovtnevyi Granite Quarry, Karachunivskyi Granite Quarry, Kochubiyivskyi Mine and Burshchytskyi Dump, which have the potential for industrial tourism development. It is characterised that the Kryvyi Rih landscape-technical system is a unique industrial region that has a two-tier structure, combining mining and settlement landscapes, which determine the emergence of industrial tourism sites. It is determined that the concept of two-tieredness is currently rather poorly studied, but it can be traced in anthropogenic landscapes. In mining landscapes, the surface tier is caused by the emergence of dumps, quarries, spoil heaps, and sludge pits. The underground tier of mining landscapes is divided into mines (shafts, quarries, drifts, geshenkas), adits and sinkholes. The article also discusses the main economic, environmental and social opportunities of the region, and develops a variant of a 'basic' tourist route that will facilitate the development of industrial tourism.

Keywords : industrial tourism, two-tiered anthropogenic landscapes, mining landscape complex, Kryvyi Rih landscape and technical system, ecology, environmental safety.

INTRODUCTION

Today, the tourism industry is one of the key sectors of the global economy, contributing to job creation, exports and economic growth on a global scale. It encompasses a wide range of industries whose main task is to service and support domestic and international tourism, as well as business and leisure travel. In Ukraine,

there is a growing need to strengthen domestic tourism based on the use of local resources, as each region of the country is rich in history, heritage, nature and people. In the highly competitive tourism sector, there is a need to find new sources and opportunities for tourism, as well as to introduce innovative tourism services. One of the most promising areas of development is the attraction of non-traditional tourism resources of the territory, which will contribute to the emergence of new types of travel. And industrial tourism, as a modern trend, has significant potential to create a unique tourist experience that combines informational, emotional and cognitive aspects. In Ukraine, this area remains under-researched, and its opportunities and attractiveness have not yet been sufficiently assessed.

MATERIALS AND METHODS

Research methods. In the process of work, general scientific and special research methods were used: analytical, comparative and statistical, generalization, historical, statistical and comparative methods and anthropogenic landscape forecasting.

RESULTS

Industrial tourism is a type of tourism activity involving visits to operating or abandoned industrial facilities, enterprises, quarries, mines, factories, man-made landscapes, etc. It allows you to immerse yourself in the history of industrial development, learn about production processes and see large-scale engineering structures from the inside. Like every type of tourism, it has its own peculiarities, which we propose to consider in more detail in Fig. 1 [5].

Educational Nature

- Industrial tourism is aimed not only at recreation but also at acquiring new knowledge about production, technology, and the history of enterprises and their role in regional development.

Variety of Objects

- Tourist routes may include operating factories, such as metallurgical, automotive, and textile enterprises. They may also feature abandoned objects, including quarries, mines, and industrial complexes. Additionally, museum workshops, production sites, industrial parks, and industrial zones can be part of the routes.

Combination with Other Types of Tourism

- Industrial tourism can integrate with other directions. It can be part of extreme tourism, which includes tours in mines and active industrial enterprises. It also connects with environmental tourism, where visitors observe nature in man-made landscapes. Moreover, it supports educational tourism, providing valuable experiences for students of technical specialties.

Popularity Among Different Tourist Groups

- This type of tourism attracts both general tourists interested in industrial heritage and professionals working in technology, science, and production.

Possibility of Economic Development of Regions

- The development of industrial tourism contributes to increasing the investment attractiveness of territories. It also promotes the creation of new jobs and ensures the preservation of industrial heritage sites.

Fig. 1. Features of industrial tourism*

* compiled by the authors based on sources [5-10].

Thus, industrial tourism is a promising area that combines educational, cultural and economic components. Its development can contribute to the preservation of the unique man-made heritage and attract tourists to industrial regions, which creates new opportunities for the local economy.

Ukraine is known worldwide for its abundance of natural resources, which make up the country's mineral resource base. The country produces coal (2% of global production), iron and manganese ores (4% and 10% respectively), graphite (4%), kaolin (18%), uranium (2%), titanium, zirconium ores, germanium, non-metallic raw materials, raw materials for construction materials, and others. A distinctive feature of Ukraine's mineral resource base is its comprehensiveness, as 117 of the 120 types of minerals consumed globally are found in Ukraine's subsoil. Ukraine is actively developing deposits of manganese, iron, titanium-zirconium and uranium ores. Ukraine also produces significant volumes of non-metallic minerals, including kaolin, refractory and bentonite clays, limestone, dolomite, potassium salts, sulphur, graphite, decorative stone, gypsum, and others [10]. Their deposits are located in different geological regions of Ukraine. Let us consider the most promising industrial facilities of the Kryvyi Rih landscape - technical system:

- The open pit at Pivdennyi Mining and Processing Plant is one of the of the largest in the world, almost the main place of iron ore production in Ukraine and the main attraction of industrial tourism. The open pit mine was founded in 1955. The depth is about 400 meters. Its length is 3 km. Its width is 2.5 km and it has a rounded shape. In terms of its productivity and depth, it is second only to the quarry of the Ingulets Mining and Processing Plant, which is 426 m deep [12].
- The Karachunivsky granite quarry is located within the Central City district of Dnipropetrovska oblast. The quarry covers an area of 26.9 km2. The Karachunivsky quarry is located on the floodplain terrace of the Ingulets River, the absolute height of which is 200-220 m. The current open pit is a hexagonal workings stretched from north to south. Its maximum width is 700 m and length is 1400 m. The height of the quarry site above the river level is 10-15 m [12].
- The Zhovtnevyi granite quarry is located in Pokrovske, Kryvyi Rih, east of the KRES village and 150 meters from the Saksahan River. Since 1990, granite mining operations have been suspended, and this, in turn, has led to rapid flooding of the quarry bowl by fissured groundwater. In 2003, the depth of the quarry was 28.5 meters, but by the end of 2018, the depth reached 40 meters [14].
- Kochubiyevsky mine is located in Ukraine, in the Kirovograd region, Petrikovsky district, north of the city of Kryvyi Rih, near the village of Annivka. Kochubiyivskyi mine is a mining and industrial landscape complex with an open pit, a dump and 5 adits; the transition between the surface and underground layers of the mining landscape is clearly visible on the mine's territory. Tourists can learn about the history of the mine and walk through the adits; the place is safe, but needs significant improvement [13].
- The Burshchytsia dump is located in the city of Kryvyi Rih, in the Ingulets district, near the villages of Hdantsivky and Shevchenkove, located above the Ingulets River. It belongs to the Novokryvyi Rih mining and processing plant. The height of the Burschitsky dump is 80 meters and the slopes are 35-45 degrees. The geological structure of the dump includes bulk layers - bands: lower accumulative, middle accumulative-denudation and upper denudation microbands. The intensity of vegetation development at the Burshchytske dump is due to the rocks that make up the dump; the entire city of Kryvyi Rih can be clearly seen from the Burshchytske dump, which is a good location

for industrial tourism [15].

It is worth noting that one of the key characteristics of anthropogenic landscapes is their two-element nature. This means that they consist of two main parts - natural and anthropogenic components. The natural component includes natural components such as soils, vegetation, hydrological systems, etc., while the built component is shaped by human activities, including development, agriculture, industry and other anthropogenic structures. The significance of the two-tiered nature of anthropogenic landscapes lies in the distinction between the surface and subsurface layers, where the surface layer includes all components located on the surface of the earth, and the subsurface layer includes all elements located underground [13].

It is possible to draw through lines between two-tiering and height differentiation, but these concepts are quite different. Altitudinal differentiation is based on the diversity and change with altitude of climatic factors and their impact on vegetation , while two-tieredness arises from the action of all landscape-forming factors, primarily lithogenic (geological structure of the territory, relief and their development), climatic, hydrological (functioning of surface water), hydrogeological (groundwater), soil, and plant factors [13].

A clear example of the two-tiered nature of anthropogenic landscapes can be seen in the Kryvyi Rih landscape - technical system (KRTS), namely in mining and settlement landscapes. Compared to other industrial landscapes, the mining landscapes of the KLTS have the most significant impact on the material composition, development, and structure of natural and anthropogenic landscapes. All components of the natural environment are fundamentally changed in the places of mineral extraction, and specific, impoverished and less stable mining landscapes with a more differentiated, contrasting and dynamic structure are formed compared to natural ones. Such complexes now exceed 40 thousand hectares of the KLTS territory [13].In mining landscapes, the surface layer is caused by the appearance of dumps, quarries, waste heaps, and sludge pits. Currently, the largest quarries operate on the territory of the KLTS - the quarry of the Southern Mining and Processing Plant (over 400 meters), one of the largest reclaimed dumps - Burshchytskyi (110 meters), flooded reclaimed quarries - Zhovtnevyi (110 meters), Karachunivskyi (over 250 meters), and the largest sludge dump - Voikivske. The underground tier of mining landscapes is divided into mines (shafts, querslags, drifts, gezenkas), adits and sinkholes. The deepest mines are Kozatska mine (1190 m) and Kryvorizka mine (1580 m) [12, 13].

Indeed, the KLTS is a unique region of Ukraine, known for its significant industrial resources, particularly in the metallurgy and mining sectors. Long-term operation of mining enterprises has formed special anthropogenic landscapes here, among which an important place is occupied by two-tiered territories - a combination of active and abandoned quarries, dumps, man-made reservoirs and reclaimed areas. These areas are promising for the development of industrial tourism, which can become an important factor in the region's economic growth, contribute to the ecological balance and increase the social significance of industrial heritage. Thus, the development of industrial tourism in the two-tiered anthropogenic landscapes of the Kryvyi Rih landscape - technical system opens up a number of economic, environmental and social opportunities.

Table 1. Analysis of economic, environmental and social opportunities in Kryvyi Rih*.
*compiled by the authors based on sources [7-10].

Economic aspects	Environmental aspects	Social aspects
• **Diversification of the local economy** – the creation of tourist infrastructure alongside the industrial sector contributes to attracting additional investments and creating new jobs. • **Formation of tourist clusters** – combining excursions to enterprises, visiting reclaimed areas, and technological heritage sites helps attract tourists with different interests (ecological, extreme, scientific tourism). • **Increased business profitability** – organizing tourist programs based on active or former industrial sites allows enterprises to generate additional revenue. • **Increase in tax revenues** – the activation of tourism businesses contributes to local budget replenishment, enabling funds to be allocated for infrastructure development and improving the region's socio-economic situation.	• **Revitalization of reclaimed lands** – the creation of tourist routes through abandoned quarries and technological heritage sites promotes land rehabilitation. • **Formation of ecological awareness** – introducing tourists to the industrial landscape and the consequences of human activities increases awareness of the importance of environmental conservation. • **Popularization of sustainable technologies** – industrial landscapes can demonstrate modern environmental practices, such as water purification, reclamation, and green solutions. • **Biodiversity conservation** – tourist routes can pass through areas where natural succession occurs, fostering the study of ecological adaptation processes.	• **Increased interest in regional history** – excursions to enterprises, mining quarries, and technological heritage sites deepen the understanding of industrial heritage. • **Engagement of local communities** – tourism development creates opportunities for small and medium-sized businesses, particularly in hospitality, food services, and retail. • **Educational potential** – excursions for students and schoolchildren enhance career orientation and stimulate interest in scientific and technical specialties. • **Enhancing regional prestige** – Kryvyi Rih can become not only a center of heavy industry but also an attractive tourist region with unique technological landscapes.

The development of industrial tourism in the two-tiered anthropogenic landscapes of the Kryvyi Rih landscape - technical system is a promising area that contributes to economic growth, improves the environmental situation and increases the social significance of industrial heritage. For the successful implementation of this area, it is necessary to attract government support, investors, local communities and enterprises, as well as to develop comprehensive tourist routes that combine educational, environmental and recreational components.

We propose to create a possible (basic) version of a tourist route and calculate its cost. We will take the perspective of a weekend tour as a basis to make it interesting first of all for local residents, all Ukrainians, and only then as one of the key travel destinations in Ukraine for foreigners. Thus, there are three key components of this route: visiting active and abandoned mining quarries, walking in various landscapes and lakes, and camping (Table 2).

Table 2. Calculation of the basic tourist route in the two-tiered anthropogenic landscapes of the KLTS

Duration of the Route:
It is optimal to plan for two to three days to fully enjoy all the components of the route.
Seasonality:
The best time to visit is spring and autumn, when the weather is ideal for comfortable walks and excursions.
Excursion Program:
Excursion "Technogenic Fantasy in Kryvyi Rih" – a tour of quarries, the underground tram, and other industrial sites. Approximate cost: 500 UAH per person. Eco-trail walk and visit to reclaimed areas – the cost may vary, but is approximately 300 UAH per person.
Accommodation:
Hotels in Kryvyi Rih – the price per room depends on the hotel class and accommodation conditions. Average cost per night: from 600 to 1500 UAH per room.
Food:
Restaurants and cafes – the average daily food cost is around 300 to 500 UAH per person.
Transport Expenses:
Local transport – use of public transport or renting a vehicle for group trips. Approximate cost: 100 to 200 UAH per person per day.
Estimated Total Cost for One Person for Two Days:
Total: from 2500 to 3000 UAH per person.

Considering the variant of the tourist route in the two-tiered anthropogenic landscapes of the KLTS presented by us, we draw attention to the fact that these are indicative prices, and the actual cost may vary depending on specific conditions, choice of services and seasonality.

DISCUSSION

Few scholars study various issues of tourism development in Ukraine and the world, including: Maximiliano E. Korstanje [1], Gregory Ashworth, Stephen J. Page [2], Mehtab Alam, Mudiarasan Kuppusamy, Puvaneswaran Kunasekaran [3], Trusova, N.V., Kyrylov, Y.Y., Hranovska, V.Hr. [4], Kasenkova, K. [5], Sorochan, V.O. [6], Prokopyshyn-Rashkevych, L., Shadurska, B., Petrovych, Y. [7], Kazakov V.L., Kazakova T.A., Zavalniuk O.Y. [8], Bondarenko M.P. [9], Kulesh V.G. [10].

However, in our opinion, it is relevant to analyse and characterise the economic, environmental and social aspects of industrial tourism development in the two-tiered anthropogenic landscapes of the Kryvyi Rih landscape-technical system.

CONCLUSION

Accordingly, the above analysis and proposals for the development of industrial tourism in the two-tiered anthropogenic landscapes of the KLTS can, in turn, contribute to the economic growth of the region, increase its tourist attractiveness and preserve its industrial heritage, as attracting tourists stimulates the development of local businesses, creates new jobs and increases budget revenues. The unique industrial landscapes of the Kryvyi Rih landscape-technical system can become a highlight of tourist offers, attracting both domestic and foreign tourists, which in turn contributes to the preservation and promotion of historical industrial sites and can become an important part of the region's cultural heritage. Accordingly, a significant amount of work will need to be done to implement such a set of measures, which will require cooperation between local authorities, businesses, and the community, as an integrated approach will ensure the sustainable development of the KLTS tourism potential and increase its competitiveness in the tourism market.

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