# Innovative technologies for tourism development in the Carpathian region

**Hanna Mashika**[*]

Doctor of Geography, Professor
Uzhhorod National University
88000, 3 Narodna Sq., Uzhhorod, Ukraine
https://orcid.org/0000-0001-6063-5823

**Mykhailo Klymenko**

Postgraduate Student, Assistant
Uzhhorod National University
88000, 3 Narodna Sq., Uzhhorod, Ukraine
https://orcid.org/0000-0002-6938-4941

**Nataliia Shumylo**

Senior Lecturer
Uzhhorod National University
88000, 3 Narodna Sq., Uzhhorod, Ukraine
https://orcid.org/0000-0002-4463-8132

**Abstract.** The relevance of the study is due to the sharp increase in interest in the field of travel in the context of the development of modern technologies and the need to create innovative approaches to improve the service and safety of tourists. The purpose of this study is to analyse the concept of a "smart region" and identify strategies for integrating information technology in the travel industry to improve the service and safety of tourists in the region of Zakarpattia. The study used the methods of analysis, synthesis, generalization, deduction, and systematization to assess the needs of tourists and develop optimal solutions. The potential for integrating information technology into tourism in the "smart region" of Zakarpattia was studied. It is established that the creation of a tourist information platform with personalized recommendations and support for different languages and cultures can help increase the attractiveness of the region for tourists. In addition, the use of cross-platform solutions for the development of mobile applications will ensure that the platform is accessible to a diverse audience, regardless of their devices. An important aspect is the storage of information on the user's device and automatic synchronization with the server, which ensures continuous availability of the platform. The use of voice assistants and an inclusive interface will ensure convenient use of the platform for people with disabilities. The results of the study indicate the potential of information technology to improve the tourism industry and improve the quality of tourist services. The study confirms the importance of integrating technology to achieve strategic goals in tourism development and increase the competitiveness of Zakarpattia as a tourist destination. The introduction of innovative technological solutions can be a key factor in creating a "smart tourist space" that will provide convenience, safety, and pleasure for tourists. The practical significance of the study lies in the possibility of using its results to further improve the information and technological infrastructure of the tourism industry in the "smart region", as well as the possibility of improving tourist services and increasing the competitiveness of the "smart region" by introducing an information technology platform

**Keywords:** recommendation system; pandemic; "smart region"; COVID-19; Zakarpattia

**Suggested Citation:**

Mashika, H., Klymenko, M., & Shumylo, N. (2024). Innovative technologies for tourism development in the Carpathian region. *Bulletin of Cherkasy State Technological University*, 29(1), 43-51. doi: 10.62660/bcstu/1.2024.43.

*Corresponding author

## INTRODUCTION

The rapid development of information technology necessitates the transformation of the tourism industry towards "smart regions". One of the important aspects of this transformation is the creation and implementation of information technology platforms aimed at addressing the challenges and tasks that arise in the context of modern tourism. This issue has become especially relevant in the context of the global COVID-19 pandemic, when the tourism industry has witnessed significant changes in the demand and structure of services. The problem of this study is the insufficient integration of information technology tools in the tourism industry of the "smart region" of Zakarpattia, which hinders the development and efficiency of the tourism sector. In addition, in the context of the COVID-19 pandemic, new challenges arise that require innovative solutions in the field of tourism, such as an effective management system and tourist safety.

The publication by S. Kalinichenko *et al.* (2023) examined the impact of information technology on tourism development. The paper emphasizes the importance of integrating innovations into the tourism sector to ensure the comfort, safety, and speed of tourist services. The relevance of implementing digital solutions in the context of competition and changes in consumer demand in the tourism industry is highlighted. The paper by A.V. Avryata (2023) highlights the key trends in the international tourism market and the impact of changes related to integration and globalization on the tourism industry. The article identifies the importance of information technology, in particular its role in addressing the consequences of the COVID-19 pandemic, and highlights the opportunities to expand the infrastructure of the tourism industry through innovative technologies. This paper calls for the competent use of information technology in tourism to improve the tourism market and economic development of the country.

The article by A. Mokryi (2023) investigated the impact of innovations on marketing technologies in tourism, identifying their main role in the development of the tourism business. The author analysed the latest trends, such as the use of artificial intelligence, bots, social media marketing, and location-based technologies. The study analyses the problem of assessing the relevance of marketing technologies for enterprises and proposes a scoring method for selecting the most relevant technologies in the tourism industry. The authors I. Kulyniak & Yu. Bondarenko (2022) analysed in their work the classification of factors influencing the development of tourism. They identified economic, political, social, technical, cultural, and natural factors, revealing the main elements that determine the strength of influence of each group. The study by T. Lysiuk *et al.* (2021) examined the impact of innovative digital technologies, including contactless payment, face recognition systems, online monitoring, and artificial intelligence, on the functioning of tourism enterprises such as TUI,

Coral Travel, Tez Tour, Feyeria Mandriv, and Poikhaly z namy. It is noted that these technological advances improve management and quality of service. Examples of successful use of such technologies by Ukrainian tourism enterprises are provided.

Given the analysis of previous studies, several unresolved problems related to innovations in the tourism industry can be identified. The shortcomings in the integration of information technology tools in the travel sector and the lack of comprehensive solutions to optimize and improve tourist services remain relevant issues. In addition, the impact of the COVID-19 pandemic on the tourism industry and the development of effective solutions to overcome these challenges have not received full scientific coverage. Therefore, the purpose of this study was to consider the concepts of a "smart region" and identify strategies for integrating information technology in the tourism sector to improve tourist services and safety in the Zakarpattia region.

## MATERIALS AND METHODS

The deduction method used in this study involves drawing specific conclusions based on general principles and assumptions. It was used to study the main principles and concepts underlying the development of an information technology platform for the tourism industry of a "smart region". The key aspects to be taken into account when developing the platform, such as user interaction, integration with other services, and consideration of data security and confidentiality requirements, were identified. The deductive method allowed to draw logical conclusions and formulate the basic principles of developing an information technology platform to support tourism in a "smart region".

To conduct a study of the latest trends in the field of tourism and information technology, the analysis method was used. This method involved the systematic study, classification, and interpretation of information, which allowed to understand the current state and trends in this industry. The main difficulties and challenges faced by the tourism industry in the context of a "smart region" were identified. The advantages and limitations of different approaches to integrating digital technologies into travel were also analysed, as well as existing practices of using technology in the tourism sector in other regions and countries. In addition, the needs, and requirements of tourists for information technology solutions in the field of tourism were identified, and the impact of the COVID-19 pandemic on the tourism industry and the possibilities of using technology to overcome its consequences were analysed. In addition, the possibilities of using information technology to improve the safety and comfort of tourists in the region were explored.

The synthesis method used in this study was a systematic combination of different ideas, concepts, and requirements to create a new concept. Using this

method, the concept of an information technology platform for the tourism sector of a "smart region" was developed. The requirements for the functionality and efficiency of such a platform included, in particular, the ability to quickly and easily search for and book tourist services, an interactive map of the region with the marking of interesting objects and routes, personalized recommendations on routes and excursions, information resources about tourist sites and cultural events, a mobile application with additional functions such as reminders about planned trips, support for different languages and cultures, organization of transport and events, user feedback and evaluation, and so on. The conceptual architecture and functionalities of the platform were developed taking into account the requirements for its usability and accessibility. In addition, a synthesis of strategies for interacting with other tourism services and systems was carried out. Recommendations for the implementation and support of the platform were synthesized to ensure its successful implementation in practice. Also, a general concept of integrating information technology into the region's tourism infrastructure was developed to achieve the main goals of "smart tourism" development.

The systematization method consisted of organizing and classifying information, which allowed identifying the main aspects and functions and describing them systematically. The systematization method was used to identify the main functionalities that a platform should include to provide a full range of travel services and to describe the requirements for the security and confidentiality of data processed on the platform to ensure a high level of information protection. In addition, the main methods of interaction between the platform and other systems and services to ensure its integration into the tourism market ecosystem were summarized.

The requirements for mobility and accessibility of the platform for users on different devices and at different Internet access points are also systematized.

The method of generalization included the analysis of specific data and phenomena to identify general patterns, which allowed to move from individual cases to general conclusions and establish the basic principles of the information technology platform. Using the method of generalization, the main trends were identified and conclusions were drawn based on the research results. The general principles of the functioning of the information technology platform for the tourism industry of a "smart region" were also established, and the key requirements and needs of users regarding the platform's functionality were summarized to ensure their satisfaction and ease of use. The basic principles of the platform's interaction with other systems and services were summarized to ensure its integration into the tourism ecosystem.

## RESULTS

A "smart region" is a concept that uses digital technologies, communication tools, and data analytics to create an efficient and effective service environment aimed at improving the living standards of residents and strengthening the resilience of the region (Gracias *et al.*, 2023). A "smart region" is defined not only by the use of modern technologies but also by the integration of these technologies into all areas of economic and socio-cultural development.

There are different methodological approaches to characterizing the components of a "smart city". The most universal synthetic method is to identify six key components, namely: "smart economy", "smart environment", "smart citizens", "smart living", "smart mobility", and "smart governance" (Fig. 1).
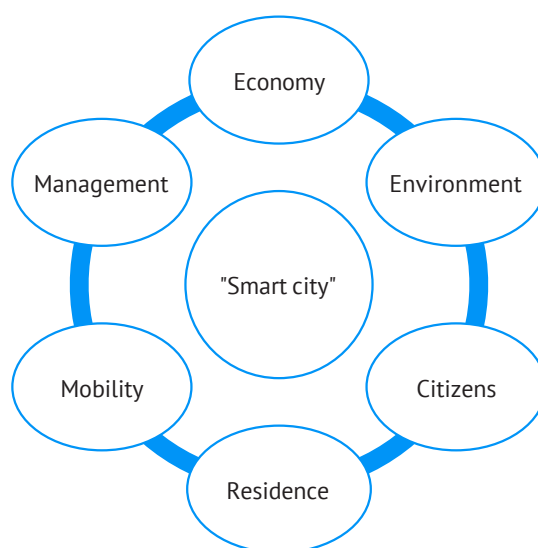


**Figure 1.** Components of a "smart city"

**Source:** R. Lozynskyy *et al.* (2021)

To ensure that entrepreneurship thrives and develops, it is key to create an active economy that promotes the efficient use of resources and fosters innovation. An active economy is defined as a key driver of prosperity and attracts entrepreneurship by supporting innovation and a start-up culture. By involving citizens in local governance and decision-making, the basis for "smart civic participation" is created, which is one of the key components of a "smart city". Citizens play an important role in restoring democracy in local governance by actively participating in decision-making and promoting citizen participation. The "smart environment" is aimed at preserving nature and creating a sustainable urban environment. "Smart mobility" uses advanced technologies to improve transport infrastructure and solve parking and traffic congestion problems. "Smart living" improves the quality of life by optimizing infrastructure and facilitating social interaction. "Smart governance" emphasizes a systematic approach to civic participation and access to e-governance, which promotes openness and restores trust in government (Sharma *et al.*, 2023).

The integration of information technology in the tourism sector of Zakarpattia is an important strategic step to improve and optimize the tourism industry in this location. It involves the development and implementation of advanced information systems aimed at improving tourist services. Recommendation systems are becoming an essential element, providing individualized recommendations and information for travellers. An important component is the creation of information models to assist in management and planning. Special attention should be paid to the booking system to ensure an efficient and convenient mechanism for tour-

ists and businesses in the industry. This may include the introduction of online platforms that simplify the booking process and provide access to up-to-date information on hotels, restaurants, tourist routes, etc.

In light of the challenges posed by the COVID-19 pandemic, it is important to integrate information technology to ensure safety and meet health requirements. This may include the development of applications to track the epidemiological situation, e-ticketing systems to avoid physical contact, and other innovations aimed at improving the safety and health of tourists. This integration of technologies aims not only to create an attractive environment for tourists but also to create a "smart tourist space" that responds to the needs and expectations of the modern traveller (Casado-Aranda *et al.*, 2021; Gavurova *et al.*, 2022). According to 2021 data, Ukraine's gross domestic product (GDP) in the tourism sector was 11.82%, highlighting the importance of this industry for the country's economy (Tourist barometer..., 2023). These statistics show that the development and implementation of information technology innovations in tourism can significantly increase the competitiveness and attractiveness of the region for tourists, which, in turn, is important for ensuring sustainable economic development.

The main objectives for the development of the "smart region" of Zakarpattia are focused on increasing the attractiveness of the region, optimizing the tourism business, ensuring the safety and health of tourists, creating "smart infrastructure", increasing competitiveness, and promoting sustainable development. Table 1 provides a specific description of each goal and its relationship to the implementation of "smart tourism" in Zakarpattia.

**Table 1.** Goals for the development of the "smart region" of Zakarpattia

| Objective | Description |
|---|---|
| Increasing tourist attractiveness | To make the territory of Zakarpattia more attractive to tourists by using information technology to improve services and provide innovative tourist offers. |
| Optimization of the travel business | Ensure the efficiency of the tourism business through the introduction of information technologies that facilitate booking management, marketing, and customer interaction. |
| Ensuring the safety and health of tourists | Respond to challenges related to the pandemic and other potential hazards by using technology to monitor the epidemiological situation, contactless services, and compliance with sanitary standards. |
| Creating a "smart infrastructure" | Development of infrastructure that uses information technology to optimize transport routes, provide access to up-to-date information and improve the overall tourist environment. |
| Increasing competitiveness | Ensure the region's competitiveness by using information technology to create innovative tourism products and improve marketing strategies. |
| Promoting sustainable development | Interest in developing tourism that promotes environmental sustainability supports local culture and considers the social aspects of the territory. |

**Source:** created by the authors

To optimize the tourism business, it is necessary to create a travel information platform that should be guided by the principles of "privacy by design" and "privacy by default", which ensures the minimum amount of collection and processing of personal data of travellers by the destination state to fulfil the requirements of entry. "Privacy by design" involves a proactive approach

to preventing privacy violations, while "privacy by default" guarantees automatic protection of personal data without the traveller's involvement. It is also important to comply with international standards, such as ISO 29100 for IT system design, ISO 17975 for health information consent and ISO 27799 for health data security. Effective measures should be implemented to

protect and secure data, including encryption protocols, secure data storage and regular security checks. Access to traveller data should be restricted to authorized individuals only, with strict authentication and authorization mechanisms in place to prevent unauthorized access. Compliance with international standards such as ISO 27001 and 27701, which set out requirements for information security management systems, is also recommended (Culot *et al.*, 2021; Taherdoost, 2022).

A tourism information platform that integrates with other systems and services in the tourism industry should provide convenience and efficiency for all stakeholders. This means that the platform should interact with other tourism resources, such as hotel reservations, routing and itinerary planning, online services, and others, to provide a comprehensive service to tourists. Accessibility and mobility are key characteristics of such a platform, as it should be accessible from any device with an Internet connection, as well as mobile applications for smartphones and other devices. This will ensure that tourists can access the information and services they need anywhere and anytime, which will greatly increase user convenience and satisfaction.

The platform should also provide personalized information and recommendations to users based on their individual needs, preferences, and travel history. This will help to make travel more comfortable and enjoyable for each tourist, and increase the likelihood of repeat visits to the region. Additionally, it is necessary to take into account the different languages and cultural backgrounds of users to ensure convenience and accessibility. For example, the platform should be able to translate information into different languages and provide cultural information and advice for tourists from different backgrounds (Sarji *et al.*, 2023; Ivars-Baidal *et al.*, 2023). The tourist information platform for the "smart region" of Zakarpattia should meet the needs of modern tourists. The main functionalities of such a platform are described in Table 2.

**Table 2.** Main functions of the tourism information platform

| Functionality | Description |
|---|---|
| Search and book services | A system for searching and booking hotels, restaurants, excursions, transport, and other tourist services in the region. |
| Interactive map of the region | A detailed and interactive map showing tourist attractions, routes and interesting places to visit. Use of GPS to determine the user's location. |
| Personalized recommendations | A system for analysing users' preferences and travel history to provide personalized recommendations for routes, excursions, and restaurants. |
| Information resources | Presentation of information about tourist attractions, the history, and culture of the region, national parks, museums, and other objects in the form of text descriptions, photos, videos, and audio guides. |
| Mobile application | Developing a mobile application for easy access to the platform from mobile devices. Providing additional features such as reminders of planned trips, offline maps and navigation. |
| Feedback and assessments | Allowing users to leave feedback, ratings, and reviews of tourism services and facilities. Help other users make informed decisions and improve the quality of service in the region. |
| Support for languages and cultures | The ability to translate information into different languages and provide specific recommendations for different cultural groups. |
| Organization of transport | Providing information on public transport, taxis, car rental and other transport services. Assist tourists in getting around the region with ease. |
| Event organization | Possibility to view and register for tourist events, festivals, and excursions taking place in the region. |

**Source:** created by the authors

The development of the platform involves the creation of a responsive design that automatically adapts to screen sizes and is optimized for playback on various gadgets, ensuring optimal visual display and correct functioning of functions on different types of devices. This approach ensures optimal visualization and functionality of the interface on any device, regardless of its type and size. The use of cross-platform solutions such as Flutter or React Native will allow developers to create applications that run on different operating systems (Android and iOS) using a single code. This approach will simplify the development and maintenance of applications, ensuring high efficiency and productivity on different devices (Biørn-Hansen *et al.*, 2020).

To ensure convenient and efficient use of the platform without the need for an Internet connection, it should be possible to save a certain part of information and functions on the user's device. This will allow users to use certain functions of the application offline and ensure the uninterrupted operation of the platform even in the absence of a connection to the server. Data synchronization with the server should occur automatically when there is a connection, which will allow for storing up-to-date information and regularly updating the data. In addition, the platform should have support for special needs, including the development of an inclusive interface with the ability to change font sizes, colour schemes and other parameters for users with disabilities. This will help to improve the accessibility of the platform for different categories of users and ensure their comfortable use of the services. The introduction of text-reading functions with the help

of voice assistants will allow users with disabilities to access information through audio presentation, making the platform more accessible and convenient.

Information technology plays a key role in creating innovative solutions aimed at improving the quality of service and ensuring the safety and comfort of tourists. Firstly, the introduction of a tourist information platform allows tourists to access all the necessary information from a single source. Thanks to the search and booking of services, an interactive map of the region, personalized recommendations and other features, tourists can easily find the information they need and plan their trips. The mobile app makes this process even more convenient, allowing users to access the platform from anywhere and at any time.

Security and data protection is also an important aspect in the development of a travel platform. The use of the principles of "privacy by design" and "privacy by default", as well as compliance with international data protection standards, ensures that users' personal information is safely stored and processed. In addition, information technology contributes to the creation of "smart infrastructure" and optimization of transport routes, which increases accessibility and ease of travel for tourists. They also help to organize tourism events and festivals, ensuring their effective coordination and promotion. Overall, the integration of information technology into tourism in Zakarpattia is an important step towards increasing the region's competitiveness and providing high-quality and convenient services for tourists. This allows to implement the concept of "smart tourism", which contributes to the sustainable development of the region and meets the needs of the modern traveller.

## DISCUSSION

A "smart region" is a concept that uses digital technologies, communication tools and data analysis to improve the lives of residents and increase the region's resilience to the negative impacts of external factors such as natural disasters, economic fluctuations, or epidemiological threats. This concept envisages the integration of modern technologies into all areas of economic and socio-cultural development. The most universal approach to characterizing a "smart region" is to define six key components: "smart economy", "smart environment", "smart citizens", "smart residence", "smart mobility", and "smart governance".

The introduction of information technology in the tourism industry in Zakarpattia is a strategic step to improve and optimize the tourism industry in this location. This involves the creation and use of advanced information systems, recommendation systems and information models for better management and planning. The booking system is an important component that provides an efficient and convenient mechanism for tourists and businesses in the industry. This may include the introduction of online platforms to simplify the booking process and provide access to up-to-date information.

In the context of the COVID-19 pandemic, the introduction of information technology has become important to ensure safety and compliance with sanitary standards in tourism. This includes the development of apps to track the epidemiological situation and e-ticketing systems to avoid physical contact. Such innovations are aimed at ensuring the safety and health of tourists and creating a "smart tourist space". The main objectives of the development of the "smart region" of Zakarpattia include increasing the attractiveness of the region, optimizing the tourism business, ensuring the safety and health of tourists, creating "smart infrastructure", increasing competitiveness, and promoting sustainable development. To achieve these goals, it is important to introduce information technology, such as booking systems and recommendation systems, which will simplify the travel service process and improve service. It is also necessary to ensure the security of travellers' data by implementing encryption measures and strict access control.

The Tourism Information Platform for the Zakarpattia Smart Region aims to provide a user-friendly and efficient experience for all stakeholders. Its main functions include search and booking of services, an interactive map of the region, personalized recommendations, information resources, a mobile application, feedback and ratings, support for languages and cultures, transport, and event organization. The platform should be accessible from any device with Internet access and have mobile applications for smartphones and other devices. Providing personalized recommendations and support for different languages and cultures are key aspects of responding to the needs of modern tourists.

Using cross-platform solutions, such as Flutter or React Native, will allow the developing of applications that run on different operating systems using a single code. The platform should also provide users with the ability to use certain functions offline without an Internet connection, while keeping some information and functions on the user's device. This will ensure that the platform continues to operate smoothly even when there is no connection to the server. In addition, the platform should support the special needs of users, such as an inclusive interface for users with disabilities and text reading functions with the help of voice assistants to improve accessibility and comfort of use of the platform.

The research by I.Y. Dir (2021) describes the current level of development of the "smart city" concept around the world, analysing the strategies of different cities and rankings of leading institutions that study this topic. The author examined policies adopted in different regions of the world, including Europe, Asia, North America, Latin America, and the Caribbean, and identified the various goals pursued by these regions in the development of "smart cities". The study also looked at the benefits that "smart cities" can bring to their residents. In comparison, the current study focuses on the concept of a "smart region", in particular, on the

implementation of this concept in the tourism sector in the Zakarpattia region. This study analysed specific goals and strategies for the development of the tourism industry in a particular region, in particular, paying attention to the integration of information technology and ensuring the safety and health of tourists through the implementation of "smart solutions". While the researchers' work is focused on analysing the strategies of cities within the framework of the "smart cities" concept in the world, this study aims to analyse specific measures to increase the attractiveness of a tourist region through the use of information technology and "smart approaches".

The study by N. Chung *et al.* (2021) examines the concept of "smart tourism cities" and highlights the need to integrate innovation and technology into tourism applications and urban infrastructure. They emphasize that "smart tourist cities" open up opportunities for everyday life and travel and are the result of the merging of the tourism business with everyday life. The authors propose to consider the concept of "smart tourist cities" and the role of urban centres in creating value for residents and travellers, in particular, through the development of an index for assessing the competitiveness of cities in the field of tourism. Compared to the current study, which focuses on a specific region of Zakarpattia and the application of "smart solutions" in the tourism sector to increase its attractiveness and safety, the researchers' work has a more general focus on creating competitive "smart tourist cities" as a concept.

A study by J.C. Cepeda-Pacheco & M.C. Domingo (2022) proposes the use of a deep learning-based tourist recommendation system that uses the Internet of Things to enhance the tourist experience in a "smart city". Tourists provide information about their travels and personal preferences through a city's app or website, and a deep learning-based recommendation system analyses this data to provide recommendations for the most appropriate tourist activities. In addition, the system can react in real-time to information about places already visited and contextual information such as location and weather conditions to suggest additional activities. Compared to this study, which focuses on the implementation of "smart technologies" to improve the safety and comfort of tourists in a specific region, the researchers' work aims to develop personalized recommendation systems to improve the overall tourist experience in a "smart city" using deep learning and the Internet of Things.

The study by P. Martinovich (2023) is devoted to the theoretical aspects of the development of the concept of "smart specialization" at the regional level, including the search for strategies and the dissemination of relevant processes to ensure the sustainable development of regions. The author systematized the main postulates of "smart specialization" development, pointing out the importance of technological progress for economic growth and competitiveness of the country. The main stages of the development and spread of "smart specialization" in the market space are highlighted, and its role as an innovative tool that contributes to the progressive development of the regional economy with strategic approaches to the regional environment is identified. Compared to this study, which focuses on the use of "smart technologies" to improve the tourist experience in a particular region, the researcher's work considered the theoretical and strategic aspects of introducing "smart specialization" for the development of the regional economy.

The study by P.P. Fedorka *et al.* (2023) examined the key methods and prerequisites for creating "smart cities" both in Ukraine and abroad, to implement them in the Zakarpattia region using advanced technologies. The study included an analysis of existing theories, practical solutions, and a comparative analysis of approaches to the formation of "smart cities" and "smart regions". The authors have developed criteria for determining the ways of development of Zakarpattia region to turn it into a "smart region". They propose a project of an information technology platform to improve decision-making efficiency and develop scientific models for the development of a "smart living environment" for the region's residents. Both studies are important for the development of the region and propose strategies to improve the quality of life of residents and the region's attractiveness to investors and tourists.

The concept of a "smart region" involves the integration of digital technologies and data analytics to improve the quality of life of residents and ensure the sustainability of the region. In the Zakarpattia region, this is manifested through the development of the tourism industry, including information systems and security measures for tourists. Integrating "smart solutions" into tourism not only improves service but also ensures the safety and health of travellers. Planning, booking, and information are becoming more convenient thanks to the use of information technology, which contributes to the region's competitiveness and attractiveness to tourists from other regions and countries.

## CONCLUSIONS

The study found that the integration of information technology into the tourism industry of the "smart region" of Zakarpattia has great potential to increase the attractiveness of the region for tourists and ensure their safety. The development of a tourist information platform with personalized recommendations and support for different languages and cultures can contribute to the growth of the tourism potential of Zakarpattia. Cross-platform solutions for mobile application development can ensure that the platform is accessible to the entire audience of users, regardless of their devices. The use of voice assistants and an inclusive interface can greatly facilitate the use of the platform for people with disabilities. Saving information on the user's device and automatic synchronization with the server

allows for continuous availability of the platform even when there is no Internet connection.

The integration of information technologies into tourism in Zakarpattia will help to improve the level of tourist services, create safer conditions, and promote the development of the tourism industry in the region. The study confirms the importance of technology integration for achieving strategic goals in tourism development and increasing the competitiveness of Zakarpattia as a tourist destination. The results of the study demonstrate the potential of information technology to improve the tourism industry and the quality of tourist services in the region. To summarize, the integration of information technologies into tourism in Zakarpattia has the potential to increase the attractiveness and efficiency of tourist services, contributing to the sustainable development of the region. Recommendations arising from the study include the development of an information technology platform that takes into account the needs of tourists to the maximum extent possible and integrates with other services of the tourism industry, such as booking systems and interactive maps, to ensure convenient and efficient use for all stakeholders. Areas for further research could include analysing the impact of information technology innovations on tourism development, studying the wishes and needs of users regarding the functionality and interface of the platform, and improving security and data protection systems in the context of the tourism industry.

## ACKNOWLEDGEMENTS

None.

## CONFLICT OF INTEREST

None.

## REFERENCES

[1] Avryata, A.V. (2023). Development of the international market of tourist services in the modern conditions of globalisation and informatisation of the world economy. *Current Issues in Modern Science*, 3(9), 12-25. doi: 10.52058/2786-6300-2023-3(9)-12-25.

[2] Biørn-Hansen, A., Rieger, C., Grønli, T.M., Majchrzak, T.A., & Ghinea, G. (2020). An empirical investigation of performance overhead in cross-platform mobile development frameworks. *Empirical Software Engineering*, 25, 2997-3040. doi: 10.1007/s10664-020-09827-6.

[3] Casado-Aranda, L., Sánchez-Fernández, J., & Bastidas-Manzano, A. (2021). Tourism research after the COVID-19 outbreak: Insights for more sustainable, local and smart cities. *Sustainable Cities and Society*, 73, article number 103126. doi: 10.1016/j.scs.2021.103126.

[4] Cepeda-Pacheco, J.C., & Domingo, M.C. (2022). Deep learning and Internet of Things for tourist attraction recommendations in smart cities. *Neural Computing and Applications*, 34, 7691-7709. doi: 10.1007/s00521-021-06872-0.

[5] Chung, N., Lee, H., Ham, J., & Koo, C. (2021). Smart tourism cities' competitiveness index: A conceptual model. In W. Wörndl, C. Koo & J.L. Stienmetz (Eds.), *Information and communication technologies in tourism 2021: Proceedings of the ENTER 2021 etourism conference* (pp. 433-438). Cham: Springer. doi: 10.1007/978-3-030-65785-7_42.

[6] Culot, G., Nassimbeni, G., Podrecca, M., & Sartor, M. (2021). The ISO/IEC 27001 information security management standard: Literature review and theory-based research agenda. *The TQM Journal*, 33(7), 76-105. doi: 10.1108/TQM-09-2020-0202.

[7] Dir, I.Y. (2021). "Smart cities" in the processes of innovative development of the global economic system. *Economic Studies*, 31(1), 44-49.

[8] Fedorka, P.P., Kunanets, N.E., Kut, V.I., & Klymenko, M.V. (2023). "Smart region of Transcarpathia" and criteria for its formation. *Scientific Bulletin of UNFU*, 33(1), 60-70. doi: 10.36930/40330109.

[9] Gavurova, B., Kelemen, M., & Polishchuk, V. (2022). Expert model of risk assessment for the selected components of smart city concept: From safe time to pandemics as COVID-19. *Socio-Economic Planning Sciences*, 82(B), article number 101253. doi: 10.1016/j.seps.2022.101253.

[10] Gracias, J.S., Parnell, G.S., Specking, E., Pohl, E.A., & Buchanan, R. (2023). Smart cities - a structured literature review. *Smart Cities*, 6(4), 1719-1743. doi: 10.3390/smartcities6040080.

[11] Ivars-Baidal, J.A., Vera-Rebollo, J.F., Perles-Ribes, J., Femenia-Serra, F., & Celdrán-Bernabeu, M.A. (2023). Sustainable tourism indicators: What's new within the smart city/destination approach? *Journal of Sustainable Tourism*, 31(7), 1556-1582. doi: 10.1080/09669582.2021.1876075.

[12] Kalinichenko, S., Gribnyk, A., & Avriata, A. (2023). The effect of digitalisation of the tourist infrastructure on the development of regional tourism. *Modelling the Development of the Economic Systems*, 1, 133-138. doi: 10.31891/mdes/2023-7-19.

[13] Kulyniak, I., & Bondarenko, Yu. (2022). Typology of factors influencing the tourism industry development. *Entrepreneurship and Innovation*, 25, 21-27. doi: 10.32782/2415-3583/25.3.

[14] Lozynskyy, R., Pantyley, V., & Sawicka, A. (2021). Smart city concept in Poland and Ukraine: Implementation tools, problems and successes of cities. *Bulletin of Geography. Socio-Economic Series*, 52, 95-109. doi: 10.2478/bog-2021-0016.

[15] Lysiuk, T., Matviichuk, L., & Lepkyi, M. (2021). Innovative information technologies of tourist enterprises. *Economic Forum*, 1(3), 78-87.

[16] Martinovich, P. (2023). Smart specialisation of the region: Fundamentals of formation, development and dissemination. *Economic Bulletin of Cherkasy State Technological University*, 67, 43-50. doi: 10.24025/2306-4420.67.2022.278783.

[17] Mokryi, A. (2023). Innovative marketing technologies in the tourism sphere. *Innovations and Technologies in the Service Sphere and Food Industry*, 3(9), 55-59. doi: 10.32782/2708-4949.3(9).2023.9.

[18] Sarji, Chakim, M.H.R., Hatta, M., Himki, A., Az Zahra, A.R., & Azizah, N.N. (2023). The relationship between smart cities and smart tourism: Using a systematic review. *ADI Journal on Recent Innovation*, 5(1), 33-44. doi: 10.34306/ajri.v5i1sp.914.

[19] Sharma, C., Sharma, S.K., & Gill, D. (2023). Reassessing smart city components: An overview of the dynamic nature of smart city concept. *IOP Conference Series: Earth and Environmental Science*, 1186, article number 012017. doi: 10.1088/1755-1315/1186/1/012017.

[20] Taherdoost, H. (2022). Understanding cybersecurity frameworks and information security standards - a review and comprehensive overview. *Electronics*, 11(14), article number 2181. doi: 10.3390/electronics11142181.

[21] Tourist barometer of Ukraine 2021-2022. (2023). Retrieved from http://surl.li/tsngm.

# Інноваційні технології розвитку туризму в Карпатському регіоні

**Ганна Машіка**

Доктор географічних наук, професор
Ужгородський національний університет
88000, пл. Народна, 3, м. Ужгород, Україна
https://orcid.org/0000-0001-6063-5823

**Михайло Клименко**

Аспірант, асистент
Ужгородський національний університет
88000, пл. Народна, 3, м. Ужгород, Україна
https://orcid.org/0000-0002-6938-4941

**Наталія Шумило**

Старший викладач
Ужгородський національний університет
88000, пл. Народна, 3, м. Ужгород, Україна
https://orcid.org/0000-0002-4463-8132

**Анотація.** Актуальність дослідження обумовлена різким зростанням зацікавленості у сфері подорожей в умовах розвитку сучасних технологій та необхідністю створення інноваційних підходів для покращення обслуговування та безпеки туристів. Метою даного дослідження є проведення аналізу концепції «розумного регіону» та визначення стратегій інтеграції інформаційних технологій у галузі подорожей для поліпшення обслуговування та безпеки туристів у регіоні Закарпаття. Під час дослідження застосовувалися методи аналізу, синтезу, узагальнення, дедукції та систематизації для оцінки потреб туристів та розробки оптимальних рішень. Було вивчено потенціал інтеграції інформаційних технологій у туризм «розумного регіону» Закарпаття. Встановлено, що створення туристичної інформаційної платформи з персоналізованими рекомендаціями та підтримкою різних мов та культур може допомогти зростанню привабливості регіону для туристів. Крім того, використання крос-платформених рішень для розробки мобільних додатків дозволить забезпечити доступність платформи для різноманітної аудиторії, незалежно від їхніх пристроїв. Важливим аспектом є збереження інформації на пристрої користувача та автоматична синхронізація з сервером, що забезпечує неперервну доступність платформи. Застосування голосових асистентів та інклюзивного інтерфейсу забезпечить зручне використання платформи для осіб з інвалідністю. Результати дослідження вказують на можливості інформаційних технологій у вдосконаленні туристичної індустрії та покращенні якості обслуговування туристів. Дослідження підтверджує важливість інтеграції технологій для досягнення стратегічних цілей у розвитку туризму та підвищенні конкурентоспроможності Закарпаття як туристичного напрямку. Впровадження інноваційних технологічних рішень може стати ключовим чинником у створенні «розумного туристичного простору», який забезпечить зручність, безпеку та задоволення для туристів. Практичне значення дослідження полягає в можливості використання його результатів для подальшого вдосконалення інформаційно-технологічної інфраструктури туристичної галузі в «розумному регіоні», а також в можливості покращення обслуговування туристів та збільшення конкурентоспроможності «розумного регіону» шляхом впровадження інформаційно-технологічної платформи

**Ключові слова:** рекомендаційна система; пандемія; «розумний регіон»; COVID-19; Закарпаття