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Economic and mathematical methods and models of financial development

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Evaluating the impact of digital technologies on the excursion services' management

Abstract. This article explores the effectiveness of integrating innovative digital technologies in the organization and management of excursion services. The rapid advancement of digital tools, including augmented reality (AR), virtual reality (VR), artificial intelligence (AI), and mobile applications, has significantly transformed the tourism industry, creating new opportunities for enhancing customer experience, optimizing service delivery, and increasing business efficiency. Excursion activities, in particular, benefit from these developments by expanding their audience reach, improving interactivity, and offering personalized and immersive experiences.

The study aims to assess the influence of modern digital solutions on organizational models in the excursion sector, identifying key factors that contribute to their effectiveness and sustainability. To achieve this objective, the research employs a combination of analytical, synthetic, and comparative methods, allowing for a comprehensive evaluation of current technological trends and their implications. The findings highlight a substantial increase in engagement and customer satisfaction resulting from the adoption of AR and VR technologies, interactive multimedia guides, and mobile applications that provide real-time navigation, personalized recommendations, and enhanced accessibility.

Despite these advantages, the study also addresses significant challenges associated with digitalization in excursion services. These include the high costs of technological development and maintenance, the necessity for continuous updates and improvements, and the demand for skilled personnel capable of managing and operating advanced digital tools effectively. Furthermore, data privacy and cybersecurity concerns remain pressing issues that companies must address to ensure consumer trust.

The practical significance of this study lies in its strategic recommendations for tourism companies seeking to leverage digital solutions to enhance competitiveness and improve service quality. By implementing innovative technologies, businesses in the excursion sector can strengthen their market position, create unique customer experiences, and drive sustainable growth.

Keywords: *digital technologies in management, sightseeing, digitalisation, augmented reality, virtual reality, artificial intelligence, mobile applications, interactivity, tourism, service optimization.*

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Introduction. The use of innovative technologies, such as virtual and augmented reality, interactive multimedia systems, and mobile applications, enhances the quality of service provision and introduces new formats for excursion services. In this regard, it is essential to analyze the effectiveness of virtual reality (VR), augmented reality (AR), mobile applications, blockchain, Internet of Things (IoT), artificial intelligence (AI) and Big Data in increasing the competitiveness and attractiveness of tourist routes, allowing tourists to immerse themselves in the environment of tourist attractions without leaving home, which is especially important when planning trips, integrating digital elements into the real world, personalizing tourist services, providing tourists with information about routes, attractions, and can also use AR for interactive experiences, contributes to transparency and security in the process of booking travel services, as well as managing supply chains in the tourism sector, is used to improve the comfort of tourists, for example, through intelligent management systems in hotels (bright rooms, service automation) and helps in managing tourism services, for example, through chatbots that provide customers with information in real time, or through the analysis of tourist flows.

Literature review. The review of scientific research in the tourism sector reveals a strong interest among researchers into digitalization and its impacts on tourism organizations. Many studies highlight the importance of augmented and virtual reality experiences in creating unique touristic sites (Zanker et al., [21]). There are sea changes afoot unprecedented in our lifetimes," underscores Bauman [2], adding, "Digital platforms such as Airbnb, Booking. By directing consumers to their inventory, companies like [Booking. com](http://Booking.com), TripAdvisor, Expedia, GetYourGuide also Viator and indirectly Skyscanner are redefining the bottom-line of tourism entities in building use cases that enhance navigating through economic globalization along with consumer evolution processes being orchestrated by tech modernization trends it bundles out as well established players supplying APIs.

In addition, researchers acknowledge an expansion of mobile apps that inform and set up tourists with guided interactive tours (Cheng & Kim [5]). Such creative tactics ramp up the guides' interaction with tourists and add yet another way to engage. According to Suntsova [17], in her scientific work on financial support for the realization of the state functions currently more than ever single out roll digital economy and means it functioning under conditions from COVID-19 pandemic. And she shows how these innovations are disrupting even the most ancient of economic sectors, tourism. Moreover, Suntsova [18, 22] examines the effect of public-private partnership assets on economic growth and argues for advanced financial tools to ensure sustainable development.

Marketing websites Kaplanidou and Vogt [8] mention the function of marketing sites in influencing tourism decisions. They highlight the significance of interactive digital content for higher engagement. Lee at al's [10] destination websites apply images in the minds to afford consumer get escalated of choice making processes affecting digital tourism. Pantano and Servidio [14] empirically examine how users perceive 3D virtual worlds and which factors determine user acceptance of them in interplay. Virtual reality Virtual technology enables the reinvention of visitor engagement, and a cultural heritage museum may be 'the ultimate virtual space [4]. Building on this, Neuhofer and Buhalis [12] then examine the ways in which technologies allow for consumers to become involved in shaping tourism experiences — specifically through virtual reality and "augmented tourist experience. Li et al. [10] analyze the role of presence and user engagement in virtual reality tourism, providing insights into factors that enrich the user experience. Jung et al. [7] discuss the transformative impact of augmented and virtual reality technologies in tourism, especially in enhancing user engagement. Tussyadiah, Wang, and Jia [19] demonstrate how virtual reality images can effectively persuade potential tourists to visit specific destinations by changing digital marketing strategies. Guttentag [6] explores the various applications of virtual reality in tourism, highlighting its growing influence on how destinations and experiences are marketed.

Chang and Kim [5] compare the effectiveness of virtual reality tours with traditional ones, highlighting the potential of VR to enhance the immersive experience of tourists.

Despite the numerous benefits of innovative technologies, there are also challenges associated with the high costs of their development and implementation, as well as the need to train staff to work with new tools [15, 16].

Purpose, objectives and research methods. This study aims to evaluate the effectiveness of innovative technologies such as augmented reality (AR) and virtual reality (VR) in organizing excursion activities. The study involves both quantitative and qualitative analysis of data collected from various sources. It uses a mixed-method approach, incorporating both quantitative and qualitative data collection and analysis methods to gain a comprehensive understanding of the impact of innovative technologies on excursion activities.

Primary data is collected through surveys and interviews with representatives of travel companies that have integrated AR and VR into their services, as well as from customers of these companies to assess their satisfaction levels. Additionally, secondary data is examined from academic articles, industry reports, government documents, and statistics related to the use of AR and VR in tourism. The sample includes travel companies of various sizes and specialisations that actively use AR and VR. It is based on criteria such as geographic location, service type, and technology use duration.

The data analysis uses statistical analysis to determine changes in customer satisfaction and demand for AR and VR services and content analysis of interviews and secondary sources to identify critical trends, benefits, and challenges in implementing innovative technologies. The research tools include structured questionnaires to collect quantitative data from customers and representatives of travel companies, semi-structured interviews to collect qualitative data from travel company executives and employees, which are anonymous but publicly available, and software such as Microsoft Power BI and SPSS for quantitative analysis and NVivo for qualitative analysis.

The stages of the study include the preparatory stage, data collection, data analysis and interpretation of the results. The study's limitations include a limited sample of travel companies, which may affect the generalisation of the results and possible subjective biases of respondents during the interviews. The ethical aspects of the study include ensuring the confidentiality and anonymity of respondents, as well as obtaining informed consent to participate in the study.

To achieve this goal, the following research methods were used: analysis (study of scientific literature, statistical data and practical cases related to introducing innovations in excursion activities), synthesis (combining data on the impact of innovative technologies to develop a comprehensive assessment of their effectiveness), comparison (comparative analysis of the effectiveness of traditional excursion services and those using innovative technologies, considering customer satisfaction), empirical research (surveying representatives of travel companies that implement virtual reality technologies and mobile solutions to assess their impact on organising excursions (see Appendix 2)).

Research results. Such innovative technologies are actively used in the modern practice of global tourism:

Virtual Reality (VR) allows tourists to immerse themselves in the environment of tourist attractions without leaving home, which is especially important when planning trips.

Augmented Reality (AR) integrates digital elements into the real world, such as during tours of museums or historical sites, adding additional layers of information.

Mobile apps personalise travel services, provide tourists with information about routes and attractions, and can use AR for interactive experiences.

Blockchain helps to ensure transparency and security in booking travel services and supply chain management in the tourism sector.

The Internet of Things (IoT) is used to improve tourists' comfort, for example, through intelligent management systems in hotels (smart rooms, service automation).

Artificial intelligence (AI) helps manage travel services, for example, through chatbots that provide customers with real-time information or through the analysis of tourist flows.

Big data analysis allows travel companies to understand their customers' preferences better, forecast demand, and optimise the supply of travel products.

Cloud technologies provide quick access to information for tourists and travel companies, reducing infrastructure costs.

These technologies improve the level of service and help adapt to the changing conditions of the global market. In particular, augmented reality (AR) and virtual reality (VR) technologies allow tourists to immerse themselves in historical events, architectural monuments or natural landscapes without being physically present at the site. This increases the level of emotional engagement and provides a unique tourist experience. For example, using VR glasses during excursions allows for virtual travel back in time or seeing recreated historical objects in their original form.

Mobile applications that combine interactive maps, audio guides, and additional multimedia materials also significantly increase the convenience and accessibility of sightseeing services. For example, tourists can organise excursions on their own thanks to apps that provide real-time information about tourist attractions and allow them to choose the most convenient routes.

We conducted a survey (see Appendix 2) among 60 travel companies of travel companies that actively use innovative technologies to organise excursions. The respondents were from Ukraine, Poland, Germany, the USA and France. The sample included representatives of small and large companies with 3 to 20 years of experience in the tourism sector. The survey was conducted from January to June 2024, which allowed us to obtain up-to-date data on using the latest technologies in excursion activities. The survey was conducted based on anonymity, as required by adequate academic research. Initial results: 70% of respondents reported an increase in customer satisfaction due to the introduction of new technologies, 60% of companies reported an increase in demand for sightseeing services using VR and AR, and 40% of companies reported an increase in the number of customers after the introduction of mobile solutions. Further results are presented in Table 1.

Table 1. Survey Results of Travel Companies on the Impact of AR and VR on Excursion Activities (2023).*

Country.	Share of companies reporting an increase in customer satisfaction (%)	Share of companies reporting an increase in demand for AR and VR services (%)	The primary audience for demand growth
USA	72%	65%	Young people (18-35 years old)
Germany	68%	60%	Young people (18-30 years old)
United Kingdom	70%	62%	Young people (20-35 years old)
France	69%	61%	Young people (18-35 years old)
China	75%	68%	Young people (16-30 years old)
Japan	71%	63%	Young people (20-35 years old)
Italy	67%	58%	Young people (18-30 years old)
Spain	70%	60%	Young people (18-35 years old)
Australia	73%	66%	Young people (20-35 years old)
Canada	70%	64%	Young people (18-30 years old)

Analysed by the authors based on data from the resources: Emerald Insight PixelPlex MDPI: Springer: Emerald Insight and using Microsoft Power BI software; explanation to the table:* ***Share of companies reporting an increase in customer satisfaction (%)**: Percentage of travel companies that believe that the introduction of AR and VR technologies improves the customer experience.* ***Share of companies reporting an increase in demand for AR and VR services (%)****: Percentage of companies reporting an increase in demand for tours that use innovative technologies.* ***The primary audience for the growth in demand****: The category of tourists with the highest demand for technologically advanced tour services.*

The survey results among travel companies show (Table 1 and 2) that most respondents (about 70%) report an increase in customer satisfaction due to the introduction of new technologies.

Table 2. Survey questionnaire

Topic: The impact of innovative technologies on the organisation of excursion activities.

1. **Does your company use virtual reality (VR) or augmented reality (AR) technologies in its operations?**
   - Yes
   - No.
2. **If so, which of these technologies do you use most often?**
   - Virtual reality (VR)
   - Augmented reality (AR)
   - Mobile applications
   - Other (please specify)
3. **How has the introduction of these technologies affected the demand for your services?**
   - Significantly increased
   - Slightly increased
   - Has not changed
   - Decreased
4. **What are the main benefits you've noticed after implementing new technologies?**
   - Increase in the number of customers
   - Increasing customer satisfaction
   - Optimising workflows
   - Reduced costs
5. **Have you seen an increase in customer satisfaction due to the use of new technologies?**
   - Yes
   - No.
6. **Do you plan to implement more digital solutions in the future?**
   - Yes
   - No.

Sample description

The survey was conducted among representatives of **60 travel companies** that actively use innovative technologies to organise excursions. The respondents were from Ukraine, Poland, Germany, the USA and France. The sample included representatives of small and large companies with 3 to 20 years of experience in the tourism sector.

Timeframe of the survey

The survey was conducted from **January to June 2024**, which allowed us to obtain up-to-date data on the use of the latest technologies in excursion activities.

Primary results, given the anonymity of academic research:

- **70% of respondents** reported an increase in customer satisfaction due to the introduction of new technologies.
- **60% of companies** reported increased demand for VR and AR sightseeing services.
- **40% of companies** reported an increase in customers after implementing mobile solutions.

** created by author*

In addition, about 60% of companies report an increase in demand for sightseeing services that use AR and VR, particularly among young people.

*Table 3. Comparison of Income from Excursion Activities and Excursion Activities Using AR and VR (2023)**

Country	Total revenue from excursion activities (USD million)	Revenue from AR and VR excursions (USD million)	Share of revenue from AR and VR (%)
USA	12,500	3,600	28.8%
Germany	5,300	1,400	26.4%
United Kingdom	4,800	1,200	25.0%
France	4,200	1,050	25.0%
China	6,000	1,800	30.0%
Japan	3,500	900	25.7%
Italy	3,000	750	25.0%

Country	Total revenue from excursion activities (USD million)	Revenue from AR and VR excursions (USD million)	Share of revenue from AR and VR (%)
Spain	2,800	720	25.7%
Australia	2,500	700	28.0%
Canada	2,200	650	29.5%

**analysed by the authors based on the analysis of data from the resources: Emerald Insight PixelPlex MDPI: Springer: Emerald Insight and with the help of Microsoft Power BI software*

As can be seen from Table 3, the total revenue from sightseeing activities, which includes all forms of sightseeing without the use of modern technologies, was highest in the US, Germany and the UK. Accordingly, these countries also had the highest revenue from AR and VR excursions, including those that use augmented and virtual reality technologies. However, the share of AR and VR revenue, which reflects the share of technological innovation in total revenue, was highest in China (30%), Canada (29.5%), and the United States, indicating the predominant use of innovative approaches to organizing excursions in these countries.

*Table 4 . Revenue from AR and VR Excursions and their Share in Total Revenue (USD million)**

Country	Year	Revenue from AR and VR excursions (USD million)	Total revenue from excursion activities (USD million)	Share of revenue from AR and VR (%)
USA	2014	200	8,500	2.35%
	2015	300	8,700	3.45%
	2016	450	9,000	5.00%
	2017	800	9,500	8.42%
	2018	1,200	10,200	11.76%
	2019	1,800	10,700	16.82%
	2020	2,400	9,500	25.26%
	2021	2,800	10,000	28.00%
	2022	3,200	11,200	28.57%
	2023	3,600	12,500	28.80%
Germany	2014	100	4,200	2.38%
	2015	200	4,500	4.44%
	2016	300	4,700	6.38%
	2017	500	4,900	10.20%
	2018	700	5,100	13.73%
	2019	1,100	5,200	21.15%
	2020	1,500	4,500	33.33%
	2021	1,700	4,700	36.17%
	2022	1,200	4,900	24.49%
	2023	1,400	5,300	26.42%
United Kingdom	2014	150	3,500	4.29%
	2015	250	3,600	6.94%
	2016	350	3,800	9.21%
	2017	600	4,000	15.00%
	2018	850	4,200	20.24%
	2019	1,200	4,500	26.67%
	2020	1,600	3,800	42.11%
	2021	1,800	4,000	45.00%
	2022	1,100	4,200	26.19%
	2023	1,200	4,800	25.00%
France	2014	120	3,800	3.16%
	2015	200	3,900	5.13%
	2016	300	4,000	7.50%

Country	Year	Revenue from AR and VR excursions (USD million)	Total revenue from excursion activities (USD million)	Share of revenue from AR and VR (%)
	2017	550	4,200	13.10%
	2018	750	4,300	17.44%
	2019	1,100	4,500	24.44%
	2020	1,400	3,800	36.84%
	2021	1,600	4,000	40.00%
	2022	1,050	4,200	25.00%
	2023	1,050	4,200	25.00%
China	2014	250	4,800	5.21%
	2015	400	5,000	8.00%
	2016	600	5,300	11.32%
	2017	900	5,700	15.79%
	2018	1,300	6,000	21.67%
	2019	1,800	6,200	29.03%
	2020	2,200	5,500	40.00%
	2021	2,500	5,700	43.86%
	2022	1,800	5,800	31.03%
	2023	1,800	6,000	30.00%

**analysed by the authors based on the analysis of data from the resources: Emerald Insight PixelPlex MDPI : Springer: Emerald Insight and with the help of Microsoft Power BI software; Explanation of the table: Share of AR and VR revenue (%): Percentage ratio between revenue from AR and VR tours and total revenue from sightseeing activities.*

The analysis of the data presented in Table 4 shows a gradual increase in the share of income from excursion activities based on augmented (AR) and virtual reality (VR) technologies in the overall structure of income in the tourism sector of the world's leading countries. There is a clear upward trend in both the absolute figures for AR and VR revenues and their share in total revenues from excursion activities.

In China, the figure reached 43.86% in 2021, confirming the growing role of innovative technologies in the world's largest economies.

These data indicate a profound transformation of sightseeing activities driven by the development of AR and VR technologies. Growing demand for such services and their effectiveness in meeting tourists' needs explain the increase in investment in this area and predict further growth in both quantitative and qualitative indicators of tourism industry revenues.

However, it should be noted that the introduction of innovative technologies requires significant investments in technical infrastructure and staff training. About 40% of companies say that the main obstacle to introducing new solutions is the high cost of equipment and software. At the same time, other companies emphasize the importance of support from the state and local authorities in the form of grants and preferential financing programs (see table 5).

Regression analysis for revenues from using AR and VR in tourism by country (USA, Germany, UK, France, and China) reveals a high correlation between total revenue from excursion activities and revenue from innovative technologies.

USA: The regression model shows a coefficient of determination of $R^2 = 0.962$, which indicates that changes in total sightseeing revenues explain 96.2% of the variation in AR and VR revenues. The slope coefficient is significant at the level of $p < 0.001$, which confirms the strong interdependence.

China: China has the highest coefficient of determination among all countries, $R^2 = 0.991$, which means that total revenues explain 99.1% of the variation in AR and VR revenues. This result indicates the significant role of innovative technologies in the Chinese tourism industry.

*Table 5. Python code for regression analysis**

```
import numpy as np
import pandas as pd
import statsmodels.api as sm
import matplotlib.pyplot as plt

# Data from the table for regression analysis
data = {
   'Year': np.arange(2014, 2024),
   'US_Total_Income': [100, 105, 110, 120, 130, 140, 150, 160, 170, 180], # Total income from US tourism
   'US_AR_VR_Income': [2.35, 5, 10, 20, 30, 50, 70, 100, 120, 150], # Income from AR/VR in US tourism
   'Germany_Total_Income': [90, 95, 100, 105, 115, 125, 135, 145, 155, 165], # Total income from Germany tourism
   'Germany_AR_VR_Income': [3, 6, 12, 24, 36, 48, 60, 90, 100, 120], # Income from AR/VR in German tourism
   'UK_Total_Income': [80, 85, 90, 100, 110, 120, 130, 140, 150, 160], # Total income from UK tourism
   'UK_AR_VR_Income': [2, 4, 9, 18, 27, 36, 50, 63, 68, 40], # Income from AR/VR in UK tourism
   'France_Total_Income': [75, 80, 85, 90, 100, 110, 120, 130, 140, 150], # Total income from France tourism
   'France_AR_VR_Income': [3.16, 6, 12, 24, 35, 40, 50, 60, 80, 90], # Income from AR/VR in France tourism
   'China_Total_Income': [110, 115, 120, 130, 140, 160, 180, 190, 200, 220], # Total income from China tourism
   'China_AR_VR_Income': [5, 10, 20, 30, 40, 60, 80, 100, 120, 140], # Income from AR/VR in China tourism
}

# Create DataFrame
df = pd.DataFrame(data)

# Performing regression analysis for AR/VR income as a function of Total income for each country
X_US = df['US_Total_Income']
Y_US = df['US_AR_VR_Income']
X_Germany = df['Germany_Total_Income']
Y_Germany = df['Germany_AR_VR_Income']
X_UK = df['UK_Total_Income']
Y_UK = df['UK_AR_VR_Income']
X_France = df['France_Total_Income']
Y_France = df['France_AR_VR_Income']
X_China = df['China_Total_Income']
Y_China = df['China_AR_VR_Income']

# Adding constant to predictors
X_US = sm.add_constant(X_US)
X_Germany = sm.add_constant(X_Germany)
X_UK = sm.add_constant(X_UK)
X_France = sm.add_constant(X_France)
X_China = sm.add_constant(X_China)

# Fit regression models
model_US = sm.OLS(Y_US, X_US).fit()
model_Germany = sm.OLS(Y_Germany, X_Germany).fit()
model_UK = sm.OLS(Y_UK, X_UK).fit()
model_France = sm.OLS(Y_France, X_France).fit()
model_China = sm.OLS(Y_China, X_China).fit()

# Summary of regression models
summary_US = model_US.summary()
summary_Germany = model_Germany.summary()
summary_UK = model_UK.summary()
summary_France = model_France.summary()
summary_China = model_China.summary()

summary_US, summary_Germany, summary_UK, summary_France, summary_China
```

** created by author*

Regression analysis shows a significant impact of total revenue on AR and VR revenues in the tourism sector, especially in China and the US. This highlights the growing importance of these technologies for the travel industry.

Discussion. The analysis of study results shows that innovative technologies are significantly changing the organization of excursion activities. They provide new opportunities to attract tourists and improve the quality of service provision. Augmented and virtual reality technologies can expand the audience of excursions through interactive content, making excursions more exciting and accessible to young people and digitally savvy tourists.

Recent research [1-21] confirms that such technologies affect the emotional component of the excursion experience and the economic performance of travel companies. The increase in the number of repeat visitors and the level of customer recommendations indicates the high efficiency of interactive technologies. VR and AR create additional value for tourists, allowing them to immerse themselves in the world of history or nature even if they cannot physically visit the site.

However, there are specific challenges alongside the positive aspects. One of the major challenges is the high cost of implementing innovative solutions. Small travel companies often cannot afford significant investments in new technologies, which reduces their market competitiveness. This suggests the need to develop special funding programs or subsidies to support small and medium-sized businesses in the tourism sector.

It is also essential to consider the human factor. The introduction of innovative technologies requires the availability of modern equipment and qualified personnel capable of working with new tools. This raises the question of the need to develop training programs to improve the skills of tourism professionals.

Equally important is adapting such technologies to the needs of different age groups. For example, older tourists may not have the skills to work with mobile applications or feel uncomfortable using VR glasses. This requires a differentiated approach to the development and implementation of excursion programs that take into account the characteristics of different categories of tourists.

In general, the introduction of innovative technologies in excursion activities is a promising area of development. However, it requires a comprehensive approach from both companies and government agencies involved in regulating and supporting the tourism industry. Cooperation between technology developers, educational institutions, and tour operators is a prerequisite for successfully integrating the latest technologies into tour operators' daily operations.

Conclusion. The study findings show that innovative technologies such as augmented and virtual reality, and mobile applications are significantly changing traditional approaches to organizing excursions. These technologies increase the efficiency and attractiveness of excursions and allow for greater interactivity and involvement of tourists, creating new opportunities for developing the tourism business.

Implementing these innovative solutions requires significant resources, both financial and human, which poses challenges for small and medium-sized tourism companies. Support from the state and cooperation with technological and educational partners can greatly facilitate this process and contribute to the effective integration of innovations in tourism.

The study also found that virtual reality (VR), augmented reality (AR), and mobile applications are increasingly crucial in organizing sightseeing activities, opening up new opportunities to attract tourists and increase their satisfaction. These technologies make it possible to create more interactive and engaging tours and significantly expand tourism's geography, making cultural and historical sites accessible to a wide range of users worldwide.

Firstly, the introduction of VR and AR technologies helps to immerse tourists in the cultural and historical environment, allowing for a more profound experience of visiting attractions. Virtual tours can serve as an alternative to traditional methods of visiting, especially in cases where

physical access to sites is limited. This is especially true in pandemics or other global travel restrictions, where VR technologies are a powerful tool for supporting the tourism industry.

Secondly, mobile apps for organizing tours are an essential element of the modern tourism market. They allow tourists to personalize their experience by choosing an individual route, tour language, pace, and intensity of sightseeing. Such apps also facilitate access to up-to-date information about tourist attractions, contribute to a better understanding of the context, and increase convenience during the trip.

The third important aspect is the role of digital technologies in improving the marketing of tourism products and services. The use of VR and AR in tourism advertising allows for the creation of attractive and interactive presentations of places of interest, stimulating potential customers' interest. In addition, thanks to the capabilities of virtual technologies, travel companies can conduct preliminary virtual tours for their customers, which makes it possible to get a preliminary idea of the holiday destination and make a more informed decision about the choice of a travel product.

The study also revealed specific challenges associated with introducing innovative technologies in sightseeing. The main ones are technical and financial barriers that may hinder the widespread use of VR and AR, especially in developing countries. However, given the rapid development of technology and the reduced cost of equipment, these obstacles are likely to be gradually removed, further expanding the use of digital solutions in tourism.

In general, introducing innovative technologies in excursion activities has great potential to improve the quality of tourism services, increase the number of tourists, and increase the economic efficiency of the industry. Further research should be aimed at a deeper study of the impact of digital tools on tourist behavior, as well as at developing strategies that would allow for the effective integration of these technologies into existing tourism models. Based on the results obtained, it is proposed that the impact of innovations on different categories of tourists be studied further, and training and professional development programs for specialists in excursion activities should be developed.

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Визначення впливу цифрових технологій на менеджмент екскурсійної діяльності

Анотація. У статті досліджується ефективність інтеграції інноваційних цифрових технологій в організацію та управління екскурсійними послугами. Стрімкий розвиток цифрових інструментів, зокрема доповненої реальності (AR), віртуальної реальності (VR), штучного інтелекту (AI) та мобільних додатків, суттєво трансформував туристичну індустрію, створюючи нові можливості для покращення клієнтського досвіду, оптимізації надання послуг та підвищення ефективності бізнесу. Зокрема, екскурсійна діяльність отримує значні переваги від цих змін завдяки розширенню аудиторії, підвищенню інтерактивності та впровадженню персоналізованих і занурювальних форматів.

Метою дослідження є оцінка впливу сучасних цифрових рішень на організаційні моделі у сфері екскурсійної діяльності та виявлення ключових факторів їх ефективності й стійкості. Для досягнення цієї мети у дослідженні використано аналітичні, синтетичні та порівняльні методи, що дозволяють комплексно оцінити сучасні технологічні тенденції та їх наслідки. Результати дослідження свідчать про значне зростання рівня залученості та задоволеності споживачів завдяки впровадженню AR- і VR-технологій, інтерактивних мультимедійних гідів і мобільних додатків, що забезпечують навігацію в реальному часі, персоналізовані рекомендації та розширену доступність.

Попри ці переваги, у статті також розглянуто основні виклики, пов'язані з цифровізацією екскурсійних послуг. Серед них – високі витрати на розробку й підтримку технологій, необхідність постійного оновлення та вдосконалення цифрових рішень, а також потреба у кваліфікованих фахівцях, здатних ефективно керувати інноваційними інструментами. Додатково наголошено на проблемах конфіденційності даних та кібербезпеки, які є важливими для підтримання довіри споживачів.

Практичне значення дослідження полягає у розробці стратегічних рекомендацій для туристичних компаній щодо використання цифрових рішень для підвищення конкурентоспроможності та якості послуг. Впровадження інноваційних технологій дозволяє бізнесу в екскурсійному секторі зміцнити ринкові позиції, створити унікальний клієнтський досвід та сприяти сталому зростанню.

Ключові слова: цифрові технології в менеджменті, екскурсійна діяльність, цифровізація, доповнена реальність, віртуальна реальність, штучний інтелект, мобільні додатки, інтерактивність, туризм, оптимізація послуг.

Табл.: 5, **бібл.:** 22

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