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MODERN TRENDS AND INNOVATIONS IN TOURISM INFORMATION TECHNOLOGIES

Z. Prykhodko, K. Kolomiyets, N. Nefedova, S. Kudelina

Odesa I. I. Mechnikov National University

Abstract

The article summarizes the theoretical foundations and practical aspects of the digitalization of the global and national tourism industries. It establishes that the rapid growth of online bookings and the transformation of consumer behavior have turned information technologies into a fundamental basis for the industry's development. Leading innovative trends are systematized, with a particular emphasis on the roles of artificial intelligence (AI) and generative models in enabling the hyper-personalization of tourism products, intelligent route planning, and communication automation. Big Data tools for forecasting tourism flows and dynamic pricing are analyzed. The impact of immersive technologies and the Metaverse concept is examined in the context of destination marketing and the creation of a "sense of presence." The role of Geographic Information Systems (GIS) in spatial analysis, interactive map design, and the support of sustainable development principles is highlighted. Solutions for hotel business automation are reviewed, and key challenges associated with digital transformation are outlined.

Keywords: information technologies in tourism; artificial intelligence; Big Data;

immersive technologies; GIS technologies; digital marketing; blockchain; smart destinations; hotel automation.

СУЧАСНІ ТРЕНДИ ТА ІННОВАЦІЇ В ІНФОРМАЦІЙНИХ ТЕХНОЛОГІЯХ ТУРИЗМУ

З. Приходько, В. Соколовський, К. Коломієць, Н. Нефедова

Одеський національний університет імені І. І. Мечникова

Анотація

У статті узагальнено теоретичні засади та практичні аспекти цифровізації глобальної й національної туристичної індустрії. Визначено, що стрімке зростання обсягів онлайн-бронювань та трансформація споживчої поведінки перетворили інформаційні технології на фундаментальну основу розвитку галузі. Систематизовано провідні інноваційні тренди, серед яких особливу роль відіграють штучний інтелект (ШІ) та генеративні моделі, що забезпечують гіперперсоналізацію туристичного продукту, інтелектуальне планування маршрутів та автоматизацію комунікацій. Проаналізовано інструментарій Big Data для прогнозування туристичних потоків та динамічного ціноутворення. Досліджено ефект застосування імерсивних технологій і концепції Метавсесвіту в контексті маркетингу дестинацій та формування «ефекту присутності». Висвітлено роль геоінформаційних систем (ГІС) у просторовому аналізі, проектуванні інтерактивних карт і забезпеченні засад сталого розвитку. Розглянуто рішення з автоматизації готельного бізнесу. Окреслено ключові виклики цифрової трансформації.

Ключові слова: інформаційні технології в туризмі; штучний інтелект; Big Data; імерсивні технології; ГІС-технології; digital-маркетинг; блокчейн; розумні дестинації; автоматизація готелів.

Introduction. The modern world is undergoing a global digital transformation in which information technology (IT) plays a pivotal role in the functioning of international business. Tourism, as one of the most dynamic and significant sectors of the global economy, is characterized by a high level of information intensity. The evolution of technology in

tourism has progressed from paper catalogs, brochures, and telephone calls to the creation of complex digital ecosystems, online platforms, and mobile services.

According to data from the analytics agency Statista, global online sales of tourism services reached \$748 billion in 2023 and are projected to surpass the \$1 trillion mark by 2025 [9]. More than 70% of tourists worldwide regularly use the Internet to search for information, compare prices, and book travel. This shift in consumer behavior necessitates the adoption of cutting-edge tools—such as artificial intelligence, immersive technologies, Big Data, and GIS—that enhance business process efficiency and create high-quality tourism experiences.

The growth dynamics of the online booking market and the increasing information intensity of the environment are driving a move away from traditional planning and management methods. Manual comparison of dozens of web resources and subjective analysis of disparate reviews are giving way to algorithmic solutions. The modern consumer prioritizes instant data verification, driving a shift toward the "Smart Tourism" model, in which a destination's digital ecosystem becomes its primary competitive advantage. Establishing the theoretical basis for these processes makes it possible to uncover the underlying patterns of technological evolution within the tourism sector.

Analysis of recent research and publications. The theoretical significance of studying digital tools stems from their role in shaping the integrated competitiveness of tourism enterprises and destinations. Recently, scholarly discourse has shifted from a descriptive analysis of information technologies and basic digital marketing toward the synthesis of intelligent management systems based on artificial intelligence (AI). At the same time, researchers emphasize that digital transformation is a non-linear process requiring the systematic training of highly qualified personnel [8].

The theoretical and practical foundations of applying information technologies in tourism have been addressed in the works of numerous domestic and international scholars. General issues regarding the development of IT infrastructure and the use of management and automation systems in tourism enterprises are covered in studies by S. V. Melnychenko, A. A. Mazaraki, H. I. Mykhailichenko, H. V. Bilohurova, N. M. Vlashchenko, and M. V. Tonkoshkur. Research into Global Distribution Systems (GDS) and the practical implementation of computer reservation systems is the focus of works by V. V. Dzhindzhoian and S. V. Melnychenko.

The National Tourism Organization of Ukraine (NTO.UA) is actively addressing the implementation of artificial intelligence, Big Data, and innovative digital marketing through

specialized educational courses for industry professionals [6]. Meanwhile, the rapid emergence of generative AI models and the development of the Metaverse necessitate a continuous re-evaluation and comprehensive systematization of their impact on the tourism industry. The aim of the article is to provide a comprehensive analysis, systematization, and assessment of the effectiveness of modern trends and innovative information technologies in the tourism sector, as well as to identify the strategic prospects and challenges associated with their implementation for enhancing the competitiveness of tourism enterprises and destinations.

Presentation of the main material. Key vectors of technological innovation in the tourism industry include artificial intelligence (AI), Big Data, the use of immersive technologies, digital marketing tools, blockchain technology, and more.

In the modern paradigm of tourism management, artificial intelligence is viewed as a highly effective system for analyzing consumer behavior. The application of AI has become a key driver in the transformation of tourism services. Traditional machine learning algorithms (collaborative and content-based filtering) are widely used by platforms such as Booking.com and Airbnb to generate personalized accommodation recommendations based on a user's search history and budget.

The emergence of generative AI has ushered in an era of automated creation of unique travel content and personalized itineraries. Generative AI has facilitated a shift from reactive interaction to proactive trip design, where the creation of a custom itinerary relies on a six-parameter neural network: budget, duration, specific interests, trip type, seasonality, and departure location.

The implementation of artificial intelligence (AI), machine learning (ML), and natural language processing (NLP) algorithms is transforming the tourism business from passive information provision to interactive, hyper-personalized service. Practical applications of AI in tourism span several key areas:

1. Generative AI assistants and intelligent itinerary planning. Examples include the following services:

- GuideGeek (Matador Network). An innovative service based on generative AI that functions as a digital personal consultant via popular messaging apps (Instagram, WhatsApp, Facebook Messenger). The service analyzes free-form user queries and instantly generates comprehensive, detailed itineraries, while recommending locations and dining venues.
- Tripadvisor AI Itinerary Generator. An integrated generative AI tool that

automatically creates personalized daily travel plans based on geography, the traveler's interests, budget, trip type, and more.

- TUI ("Holiday Heroes"). TUI's marketing system employs AI algorithms to analyze customer preferences and automatically select ideal travel packages.

2. Price forecasting and dynamic pricing.

- Hopper. A mobile app that analyzes billions of historical and current records regarding flights and hotel rates. Machine learning algorithms predict fare fluctuations down to specific dates and send push notifications to users about the optimal time to book.

- Google Flights. Uses price trend forecasting models to assess the likelihood of airfare increases or decreases and suggests alternative, more cost-effective itinerary options.

3. Customer service automation and messenger bots.

- Airline travel bots (KLM Royal Dutch Airlines, Qatar Airways' "Fenna," SkyUp, MAU). AI chatbots handle requests regarding bookings, flight status checks, the issuance of electronic boarding passes, and 24/7 FAQ support across Messenger, WhatsApp, and WeChat. Implementing such assistants allows for the automation of over 50% of initial customer inquiries, reduces the workload on call centers, and ensures round-the-clock support.

- Local city assistants (such as Ukraine's Visit Kyiv and Lviv Tourist Bot). These interactive bots offer tourists curated city itineraries and announcements of events and cultural activities, featuring direct integration with Google Maps and tour booking systems.

4. Personalization and recommendation systems.

- Airbnb and Booking.com. These platforms employ hybrid recommendation models (combining collaborative and content-based filtering) to analyze search history, geolocation, budget, and user reviews. This enables the selection of the most relevant private accommodation or hotel room options, thereby increasing booking conversion rates.

Big Data analytics and review analysis. The tourism industry generates vast amounts of data, including search queries, transactions, geolocation data, reviews, and social media activity. Big Data technologies enable the forecasting of tourist flows, the analysis of seasonal fluctuations, and the optimization of infrastructure loads. The economic value of Big Data in tourism is realized through the "3V" concept (Volume, Velocity, Variety), which allows for real-time monitoring of tourist flows. Analyzing large datasets serves as the foundation for predictive analytics, enabling demand forecasting and the optimization of pricing strategies.

User-generated content (UGC) analysis is becoming increasingly important. AI systems process large volumes of reviews to identify areas critical to satisfaction or potential

reputational risks. In the Ukrainian tourism sector, the "Tourism Barometer of Ukraine" by NTO.UA serves as a strategic tool. Consolidating data on arrivals, expenditures, and investments via the barometer allows government authorities to optimize the network of destinations and develop well-founded proposals to attract regional investment. In the context of the digital transformation of tourism, immersive technologies—which create an effect of partial or full user immersion in a virtual or hybrid environment—are gaining particular importance. They transform the concept of tourism content consumption from passive viewing into interactive engagement with the destination. By creating an immersive digital experience, these technologies serve as a powerful marketing tool under the slogan "Try Before You Fly." Key components of this class of innovations include:

- Virtual Reality (VR): creates a fully artificially generated 3D space using specialized VR headsets or glasses, completely replacing the real world and providing a profound "sense of presence." Examples include the Ukrainian VR Travel project (360° tours of Ukraine's national parks); international booking kiosks by Thomas Cook and Marriott (the "Teleporter"); and Airbnb, which utilized VR technology in its "Live There" campaign to virtually familiarize guests with accommodations and local infrastructure.

- Augmented Reality (AR): overlays virtual objects (3D models, text, audio cues, graphics) onto the real world via smartphone cameras or AR glasses. It is used, for instance, in mobile applications such as Kyiv City Guide AR (3D models of landmarks), the Japan National Tourism Organization (AR-based samurai armor try-ons), and South Australia Tourism (an AR experience involving great white sharks for thrill-seekers).

- Mixed Reality (MR) and the Metaverse: these technologies merge the physical and digital worlds, enabling real-time interaction between virtual and real-world objects. The Metaverse is a network of interconnected 3D spaces where users—represented by 3D avatars—can visit travel trade shows, cultural events, concept hotels, and virtual destinations from the comfort of their homes.

Implementing VR, AR, and MR in tourism marketing offers several strategic advantages:

- Increased conversion rates and travel intent: By offering virtual site visits, businesses reduce buyer uncertainty and encourage the purchase of actual travel products;
- Accessibility and heritage preservation: Immersive technologies allow for the showcasing of hard-to-reach, physically restricted, or fragile ecological and cultural sites without causing them harm;
- Content virality: The use of 360° video and AR filters generates viral content

for social media platforms (TikTok, Instagram Reels, YouTube Shorts), thereby expanding reach among younger audiences.

Geographic Information Systems (GIS). GIS technologies facilitate the collection, storage, spatial analysis, and visualization of geographic data. In tourism, GIS is used to design interactive maps and develop and visualize tour routes (e.g., via Google My Maps and Google Earth); monitor visitor impact on environmental and cultural sites (ecotourism); maintain the State Cadastre of Tourism Resources and relevant databases; and create "smart" urban routes (such as Vodafone's interactive "First Time in Lviv" route), among other applications.

Cutting-edge technologies in the hotel industry. The implementation of automated hotel management systems (PMS)—such as OPERA Enterprise Solution, HRS Back Office, Shotel, and Parus-Hotel—optimizes the management of room inventory, pricing, and finances. The modern hotel industry is adopting the "smart room" concept (controlling lighting, climate, and multimedia via smartphone or voice commands) and integrating service robots for guest check-in, housekeeping, and luggage delivery.

Automating hotel operations through PMS, IoT (smart rooms), and robot concierges aims to optimize operating costs. However, the strategic goal extends beyond mere cost reduction to the transformation of human capital. Relieving staff of routine tasks allows them to focus on delivering highly personalized, emotionally engaging service. In the long run, this boosts customer Lifetime Value (LTV), as it is empathy and personalization—complemented by technology—that foster loyalty. Robots (such as those found in hotels in Japan or the UAE) serve as both an attraction and a source of technical support, reinforcing the establishment's overall digital ecosystem.

Digital marketing strategies in tourism. The effectiveness of promoting a tourism product relies on a combination of short-form video content (TikTok, Instagram Reels, YouTube Shorts), SEO-optimized multimedia storytelling (Ukrainer, Visit Ukraine, Visit Scotland), performance advertising, and the leveraging of user-generated content (UGC). The modern sales funnel is driven by the dominance of visual content (Reels, TikTok) and SEO optimization for voice queries (Siri, Alexa). Global tourism leaders like Visit Dubai and Visit Scotland demonstrate high levels of effectiveness through performance campaigns, where every advertising effort targets a specific, measurable action (such as a booking) [7].

Blockchain. Blockchain is a digital technology that records every transaction in a distributed database, ensuring data security, transparency, and immutability. In the tourism sector, blockchain technology can be employed to enhance the security and transparency of

operations. For instance, it can be used to store travel vouchers and tickets, thereby making forgery impossible. Implementing blockchain in the tourism industry fosters both secure transactions and greater transparency in loyalty programs.

Conclusions. In the current landscape, information technologies have evolved from a mere support tool into the strategic foundation upon which the entire tourism industry operates. The implementation of digital tools accelerates business processes, ensures end-to-end automation, and reduces operational costs, serving as a crucial factor in maintaining the competitiveness of tourism enterprises in both global and national markets.

The growth of e-commerce and online booking platforms has provided travelers with round-the-clock access to up-to-date information and the ability to book services directly within minutes. The adoption of artificial intelligence algorithms, generative AI assistants, and chatbots has enabled the automation of over 50% of customer inquiries, ensuring instant responses and a high level of personalization in tourism products.

Artificial intelligence and Big Data facilitate the in-depth analysis of vast datasets—including search queries, reviews, and consumer behavior—to accurately forecast tourism flows, implement dynamic pricing, and optimize pricing and marketing strategies. Immersive technologies (VR, AR, MR, the Metaverse) create a sense of presence, boost tourist engagement, enable the presentation of inaccessible or fragile sites, and generate viral content for digital promotion channels.

GIS technologies serve as powerful tools for spatial visualization, the development of interactive tourist routes, the monitoring of visitor loads at sites, and the promotion of sustainable tourism practices.

Implementing modern technologies in the hotel industry—such as Property Management Systems (PMS), "smart room" technologies, and robotic services—optimizes internal resource management and enhances the overall guest experience.

Despite numerous benefits, the active adoption of IT in tourism entails significant challenges. These include high initial investment costs for IT infrastructure, an urgent need for a workforce skilled in digital technologies, concerns regarding cybersecurity and user data protection, and ethical issues surrounding the use of AI algorithms.

The future of the tourism sector lies in the continued development of the "Smart Destinations" concept. Promising areas for further research and practical application include expanding the use of the Internet of Things (IoT) in smart hotels, employing blockchain technology to secure transactions and loyalty programs, and fostering interdisciplinary education to train a new generation of professionals.

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