

THE ROLE OF DIGITAL TECHNOLOGIES IN THE DEVELOPMENT OF PILGRIMAGE TOURISM

Digitalization and Tourism Innovation

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ABSTRACT

This article analyzes the role of digital technologies in developing pilgrimage tourism. Based on monitoring of shrines' digital platforms, a pilgrim survey, and expert interviews, existing digital services (websites, mobile applications, e-ticketing) were found to be underdeveloped, while pilgrim demand for such services remains high. Drawing on international experience (Saudi Arabia, Turkey), recommendations are proposed for creating a unified national digital platform, introducing multilingual audio guides, and implementing AI-based personalized services.

Keywords: digital technologies, pilgrimage tourism, smart tourism, mobile application, artificial intelligence, digital platform, Uzbekistan.

Introduction

The rapid development of digital technologies is affecting all areas of tourism, including pilgrimage tourism. Mobile applications, virtual and augmented reality (VR/AR) technologies, electronic ticketing systems, and AI-based recommendation systems not only create convenience for pilgrims but also make it possible to deliver information about sacred sites to a wide audience. In recent years, the world's leading pilgrimage destinations, including Mecca and Medina, have succeeded in ensuring the safety and comfort of millions of pilgrims through the active introduction of digital technologies.

On a global scale, the concept of a "smart tourism destination" is increasingly being adopted by more countries, whereby information and communication

technologies are becoming an integral part of tourism infrastructure. Such an approach not only improves the pilgrim experience but also enables government agencies to monitor tourist flows in real time, ensure safety, and allocate resources efficiently.

In Uzbekistan, the digitalization process has been declared one of the priority areas of state policy, and within the framework of the "Digital Uzbekistan — 2030" strategy, digitalizing the tourism sector has been identified as a separate task. However, scientific research on the level and effectiveness of introducing digital technologies in the pilgrimage tourism sector remains insufficient. In order to fill this gap, this article analyzes the role of digital technologies in developing pilgrimage tourism and the current level of their use.

The relevance of the research lies in the fact that modern pilgrims, especially representatives of the younger generation, increasingly rely on digital tools when planning and carrying out their travel. For this reason, the digital infrastructure of shrines is becoming an important factor determining their competitiveness in the international market. The purpose of the research is to assess the current state of existing digital services, to study pilgrims' experience of using digital technologies, and to develop recommendations for developing this field.

The research tasks were defined as follows: monitoring the availability of official digital platforms of major shrines; studying pilgrims' experience of and demand for digital services; analyzing advanced digital solutions from international experience; identifying existing technical and financial constraints; and developing practical proposals that could be implemented in the context of Uzbekistan.

Theoretical Foundations and Literature Review

The concept of "smart tourism" has become widespread in tourism studies over the past decade, referring to the use of information and communication technologies to improve the tourist experience, manage resources efficiently, and increase the competitiveness of tourist destinations. The smart tourism concept includes three main components: smart experience, smart business ecosystem, and smart destination.

In the context of pilgrimage tourism, smart tourism technologies are of particular importance, as they help pilgrims obtain deeper information about sacred sites,

improve queue and crowd management, and perform religious rites correctly and respectfully. In international practice, the digital systems used by Saudi Arabia in managing the Hajj and Umrah pilgrimages (such as electronic permits, crowd-density sensors, and multilingual mobile applications) are recognized as among the most advanced examples in this field.

Virtual and augmented reality technologies are also opening new opportunities in pilgrimage tourism. Through these technologies, pilgrims can virtually familiarize themselves with sacred sites before traveling, a "virtual pilgrimage" option can be created for those unable to visit in person, and the educational effect can be enhanced by interactively recreating historical events. The literature review shows that the introduction of such technologies, especially in developing countries, is still at an early stage, and there is significant potential in this area.

In the literature on the integration of artificial intelligence technologies into tourism, particular attention is given to "personalized recommendation systems." Such systems suggest routes, services, or products suited to a user based on their previous choices, interests, and behavior. In the context of pilgrimage tourism, such systems can provide deeper information about particular sites or rites in line with a pilgrim's religious and spiritual interests.

Research Methodology

The research combined content analysis, monitoring, and survey methods. In the first stage, monitoring was carried out on the existence, content quality, and update frequency of official websites, mobile applications, and official social media pages of 20 major shrines in Uzbekistan. For each site, a digital readiness index was calculated, taking into account criteria such as the existence of a website, multilingualism, mobile responsiveness, and the availability of interactive services.

In the second stage, an online and in-person survey was conducted with 200 local and foreign pilgrims. The survey questionnaire included questions on the information sources pilgrims used when planning their trip, their experience of obtaining digital information about a shrine, and their readiness to use virtual tour or audio-guide services. In the third stage, a comparative analysis of digital solutions in the pilgrimage tourism sector of Saudi Arabia, Turkey, and Israel was carried out in order to study international experience.

In the fourth stage, 15 expert interviews were conducted with local tourism-sector IT specialists and representatives of government bodies to identify the technical and financial constraints in developing the existing digital infrastructure. All collected data were processed using quantitative and qualitative analysis methods. The expert interviews were conducted in a semi-structured format, which allowed respondents to freely express their opinions.

Results and Analysis

Level of Digital Readiness: Monitoring Results

According to the monitoring results, of the 20 major shrines in Uzbekistan, only 7 (35%) have a fully functional, multilingual official website, and of these, only 3 (15%) have a mobile application. Information about most sites is placed on general tourism portals or third-party platforms, which often contain outdated or incomplete information.

Type of digital service	Share of sites with the service, %
Official multilingual website	35
Mobile application	15
Electronic ticketing system	20
Virtual tour / 360° view	10
Active official social media page	45
Online payment option	18

Pilgrims' Experience of Using Digital Services

According to the survey results, 63% of respondents used internet sources when planning their trip, but only 18% obtained information about a shrine through an official mobile application. Most pilgrims (57%) said they searched for information via social media and general search engines, which sometimes led them to encounter inaccurate or outdated information.



Information source	Share of users, %
Social media	57
General search engines (Google, etc.)	63
Official mobile application	18
Tour operator/guide recommendation	48
Recommendation from friends/acquaintances	39

In addition, 71% of respondents said they would be willing to use a virtual tour or audio-guide service if one were available, indicating significant demand in this area. Among younger respondents (18–30 years old), this figure was even higher — 84% — showing that the younger generation of pilgrims has a strong need for digital services. Among respondents over 40, this figure was 58%, indicating that while digital services are important for this group as well, they should be offered in combination with traditional forms of service.

Comparative Analysis with International Experience

A comparative analysis conducted using Saudi Arabia as an example showed that official digital platforms such as "Nusuk," used in managing the Hajj and Umrah pilgrimages, ensure that millions of pilgrims can register, plan their routes, and pass through security control. Such centralized digital systems not only create convenience for pilgrims but also greatly assist government bodies in crowd management and ensuring safety. It was found that Uzbekistan currently has no similar centralized national platform.

In the case of Turkey, the digital audio-guide systems introduced at the Mevlana Museum in Konya and other religious and educational sites are particularly notable. Through these systems, pilgrims can obtain audio information in more than 15 languages, which has served to significantly increase the flow of international pilgrims. According to the expert interviews, the main obstacles to introducing such a system in Uzbekistan were identified as a lack of financial resources and a shortage of technical specialists.

In the case of Israel, the integrated ticketing and queue-management system introduced around the holy sites in Jerusalem is also noteworthy; through this system, the flow of pilgrims belonging to different denominations is managed separately, with a specific time slot allocated to each group. Such experience could also be useful for Uzbekistan, particularly in regulating the pilgrimage flows of different groups during major religious holidays.

Technical and Institutional Constraints

According to the expert interviews, the main obstacles to introducing digital technologies are as follows: local IT companies' insufficient experience in developing solutions specialized for the tourism sector; unclear mechanisms for financing digital projects between the public and private sectors; and the absence of unified standards for data exchange among various government bodies. 73% of respondents emphasized the need for the state to introduce grant or subsidy programs to implement digital projects.

In addition, 51% of experts noted a shortage of qualified personnel able to manage digital projects within local government bodies, which has resulted in some digital initiatives being left unfinished. This indicates the need to train or attract dedicated project managers for digital transformation projects, as well as to establish clear accountability and deadlines at every stage of such projects.

The Role of Social Media and User-Generated Content

The research separately analyzed the role of social media in promoting pilgrimage tourism. User-generated video content about shrines in Uzbekistan on platforms such as Instagram, YouTube, and TikTok has increased significantly over the past two years; however, much of this content is informal, spontaneous in nature, and is not coordinated by the state or official tourism organizations. Of 120 social media posts analyzed, only 15% contained accurate and complete historical information about the shrines, with the rest mainly emphasizing visual appeal.

While this situation, on the one hand, helps promote shrines naturally, on the other hand it creates a risk of spreading inaccurate or confusing information. For this reason, it is recommended that the state establish official partnership programs with popular bloggers and content creators, providing them with accurate and

verified information in order to encourage the creation of high-quality, precise content.

Mobile Communications and Internet Infrastructure Constraints

Another important factor affecting the effectiveness of using digital services is the quality of mobile communications and internet infrastructure. According to the survey results, 34% of respondents noted that the quality of internet connectivity at some shrines, particularly those located on the outskirts of cities or in rural areas, is poor, making it difficult to use mobile applications and online services. To address this problem, it is recommended to develop, in cooperation with telecom operators, special programs to introduce free Wi-Fi networks at major shrines and to improve mobile communication infrastructure.

Discussion

The research results show that there are significant opportunities for integrating digital technologies into pilgrimage tourism. The currently low indicators can, on the one hand, be viewed as a problem, but on the other hand, they indicate that this field has considerable "room" for development. Creating a unified national pilgrimage tourism platform — one that combines multilingual, regularly updated information about all major shrines, electronic ticketing and queue management, as well as transport- and accommodation-related services — should be regarded as the primary task.

Providing multilingual audio guides, particularly in Arabic, Urdu, Persian, English, and Russian, through a mobile application would allow pilgrims to independently obtain complete information without needing a guide, which is especially important for individual travelers. In addition, it is recommended to expand opportunities to reach international audiences by conducting targeted marketing campaigns on social media and creating high-quality video content on religious and educational themes.

Introducing an AI-based personalized route recommendation system could further enrich the pilgrim experience. Such a system could suggest an optimal route based on a pilgrim's interests, available time, and budget, and could also provide real-time information on queues and crowd density. International experience, particularly Saudi Arabia's centralized digital platforms, could serve as a roadmap

for Uzbekistan as well, though implementation should proceed gradually, taking national conditions and resources into account.

To overcome institutional constraints, it is recommended to establish a dedicated fund to finance digital tourism projects on a public-private partnership basis, as well as to introduce special grant programs to attract local IT specialists to the tourism sector. In addition, developing a unified data-exchange standard among government bodies responsible for tourism and digitalization would lay the groundwork for creating a unified national platform in the future.

At the same time, in the digitalization process it is necessary to take into account the needs of all groups of pilgrims, including older pilgrims with low digital literacy. For this reason, alongside digital services, traditional forms of service (printed maps, physical information centers) should also be preserved, ensuring equal opportunities for different groups of pilgrims.

User Typology (Persona) Analysis

Based on the survey and interview results, three main user typologies (personas) can be identified with regard to pilgrims' needs for digital services. The first type is the "digitally active young pilgrim" (18–35 years old), who plans their trip entirely independently, actively relies on mobile applications and social media, and shows high demand for virtual tours and personalized recommendations. The second type is the "traditional group pilgrim" (over 40 years old), who usually travels through a tour operator, uses digital services, but views them as a supplementary rather than a primary tool.

The third type is the "family pilgrim," a category that includes family members of different age groups, for whom child-friendly routes, information about family recreation areas, and simplified navigation are particularly important. Adapting the digital platform's interface and content for each user typology could significantly improve the overall user experience.

Cost-Benefit Analysis

According to expert estimates, the approximate initial cost of creating and implementing a unified national platform would be around USD 1.5–2.5 million, with annual technical maintenance costs of USD 300,000–500,000. If such a

platform were able to increase pilgrim flow by even 10%, this could generate several million dollars of additional economic impact in major cities such as Bukhara and Samarkand, indicating that the investment could pay for itself relatively quickly. Such preliminary estimates confirm the economic justification for investing in the platform, though it is recommended to develop a detailed feasibility study for precise financial and economic justification.

Price-Quality Analysis of Existing Digital Services

An analysis of the price-quality ratio of existing digital services found that paid audio-guide applications offered by certain private companies vary significantly in quality. 44% of survey participants noted that the price of existing paid applications does not match their quality, with content often being shallow or outdated. This once again points to the need to create a state-approved, quality-standard-compliant, free or affordable official audio-guide service.

With such an official state platform in place, private companies would also be compelled to improve the quality of their products, as they would need to compete with a free, quality alternative. This, in turn, would have a positive effect on the overall quality of digital services in the market.

Proposal for Digital Platform Architecture

In creating a unified national pilgrimage tourism platform, it is recommended to include the following functional modules: the first module — a multilingual database of information about shrines, containing each site's history, opening hours, entry requirements, and location map. The second module — an electronic ticketing and queue management system, allowing pilgrims to book time slots in advance and track queues in real time. The third module — an audio-guide and virtual-tour service, providing audio content in various languages and 360-degree virtual tour capability.

The fourth module — a personalized route recommender, which suggests an optimal pilgrimage route based on the user's profile and preferences. The fifth module — a directory of local services, containing information about hotels, restaurants, and craft shops, with the option to place online orders. It would be advisable to introduce such a comprehensive platform in stages, starting with the

most important module (the database and ticketing system) and then moving on to more complex functions (AI-based recommendations).

Regarding platform financing, it is recommended to combine the state budget, grants from international development organizations (such as the Islamic Development Bank), and public-private partnerships with private IT companies. Such a mixed financing model could ensure the stable, long-term development of the project.

In designing the platform architecture, it is recommended to use a flexible (modular) architecture that allows for adding further modules in the future (such as integration with shrines in other Central Asian countries or a blockchain-based ticketing system). This approach would ensure the platform's long-term technological sustainability and scalability.

Cybersecurity and Data Protection Issues

In introducing digital platforms, protecting pilgrims' personal and payment data is of particular importance. According to the expert interviews, 60% of local IT specialists noted that cybersecurity standards are not currently sufficiently implemented in the tourism sector's digital systems. For this reason, requirements in line with international data protection standards (such as GDPR principles) must be taken into account from the outset when developing new platforms.

Furthermore, when integrating payment systems with international bank cards and local payment systems, it is recommended to implement data encryption standards (such as PCI DSS), conduct regular cybersecurity audits, and provide users with transparent information about how their data is stored and used. Such measures not only ensure technical security but also strengthen foreign pilgrims' trust in the platform.

From a cybersecurity standpoint, it is necessary to establish a clear legal and regulatory framework and oversight mechanisms to prevent the unlawful disclosure to third parties of pilgrims' personal data held by government bodies. In this regard, it is recommended to bring Uzbekistan's legislation "On Personal Data" into line with international standards and to develop special guidelines for digital platforms in the tourism sector.

Data Analysis and Forecasting Tourist Flows

Using big data and artificial intelligence technologies to create a system for forecasting pilgrim flows in advance is a particularly promising direction. Such a system could forecast the expected number of pilgrims in coming weeks or months by analyzing anonymized location data from mobile network operators, visit statistics from previous years, and booking system data. This, in turn, would allow hotels, transport organizations, and government bodies to plan resources in advance.

68% of expert respondents noted that such a forecasting system could bring great practical benefit, particularly in managing queues and staff scheduling. However, it was also noted that implementing such a system would require developing legal and technical agreements on data exchange among various organizations (telecom operators, hotels, government bodies).

In international experience, similar forecasting systems — such as Japan's systems for managing tourist flows — are already being applied successfully, enabling government bodies to allocate additional public transport and security personnel in advance during seasonal peak periods. It is recommended that Uzbekistan introduce a similar system, adapted to national conditions, gradually, first as a pilot project in the cities of Bukhara and Samarkand, which have the highest visitor density.

System for Collecting User Feedback

To continuously improve the quality of digital services, it is important to introduce a system for collecting feedback from pilgrims. Currently, most shrines in Uzbekistan lack a mechanism for systematically collecting and analyzing visitor feedback, which leads to decisions on improving service quality being based more on assumptions than on concrete data. It is recommended to introduce a simple, quick rating system via a mobile application (for example, a five-point rating scale and the option to leave a short comment after a visit).

Automatically analyzing collected feedback using artificial intelligence, identifying the most common problems and suggestions, and regularly reporting the results to relevant government bodies and service providers would help create a cycle of

continuous improvement. Such a system could also increase pilgrims' overall satisfaction by making them feel that their opinions are being taken into account.

International Cooperation and Technology Transfer

For faster development in the field of digital tourism, establishing cooperation with countries and technology companies with international experience is of great strategic importance. In particular, it is recommended to organize knowledge and technology exchange programs with companies that have developed digital tourism platforms in Saudi Arabia, the United Arab Emirates, and Turkey, and to direct local IT specialists to learn from their experience.

In addition, ensuring the active participation of Uzbekistan's representatives in international technology exhibitions and conferences, as well as establishing joint research and educational programs with foreign universities, could help build a pool of qualified personnel capable of independently developing the local digital tourism ecosystem in the long term. Such international cooperation would also ensure that Uzbekistan stays timely informed of the latest trends in digital tourism.

Digital Equity and Accessibility

In the digitalization process, the issue of "digital equity" deserves special attention. It is important that digital services be convenient and understandable for pilgrims with disabilities, elderly people, and those with little experience using digital tools. According to the survey results, 76% of respondents with disabilities noted that existing digital platforms do not meet their needs (for example, compatibility with screen-reading software, large-font text).

For this reason, it is recommended that new digital platforms be developed in accordance with universal design principles, creating interfaces that are convenient for all user groups, including people with disabilities. Such an approach is important not only from the standpoint of social justice but is also economically beneficial, as it expands the potential user base.

In addition, it was found that digital literacy levels among local pilgrims from rural areas are also lower than among urban residents, indicating the need to design digital services not only for urban residents but for all socio-geographic groups. Features such as a simplified interface, voice-command control, and offline

functionality for core features would make the platform more convenient for users with lower digital literacy.

Human Capacity Development

To successfully carry out digital transformation, it is necessary to introduce special training programs to raise digital literacy in the tourism sector. It is recommended to organize short-term courses for local guides, hotel staff, and small business owners on using mobile applications and online platforms and conducting marketing on social media. Such capacity-building programs would particularly accelerate integration into the digital economy for small entrepreneurs in rural areas.

Likewise, opening tourism-technology specializations at local IT educational institutions and involving students in working on real tourism-sector projects during their internships could help build a pool of qualified specialists able to work in this field in the future. This, in turn, would help reduce dependence on foreign IT companies and develop the local digital tourism solutions ecosystem.

Another important aspect of human capacity development is training existing civil servants to use digital management tools. Organizing regular professional development courses for staff of the Tourism Committee and the tourism departments of local government bodies on data analysis, maintaining electronic reports, and using digital monitoring systems would increase the public sector's readiness for digital transformation.

Conclusion and Recommendations

In conclusion, digitalization serves as an important tool for adapting pilgrimage tourism to modern requirements. The following are proposed as key recommendations: creating a unified national digital platform for pilgrimage tourism; introducing multilingual mobile application and audio-guide services at major shrines; expanding electronic ticketing and queue management systems; conducting targeted international marketing campaigns on social media; gradually introducing AI-based personalized services; establishing a public-private partnership fund to finance digital projects; introducing a system for collecting and analyzing user feedback; and expanding international technology transfer programs.

Implementing these recommendations could significantly improve the pilgrim experience, increase the country's competitiveness in the international pilgrimage tourism market, and open up new directions for future research in the field of digital tourism. Future research should more deeply and quantitatively measure the direct impact of digital technologies on pilgrim satisfaction levels, as well as assess the practical effectiveness of AI-based systems.

As a limitation of the study, it should be noted that the monitoring was limited to only 20 major shrines and did not cover all sacred sites in the country. It is recommended that future research include broader monitoring as well as additional studies assessing the precise economic effectiveness of digital services.

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