Brief information about the project

Name of the project	AP23490620 “Implementation of Sustainable Tourism Management in the Imantau-Shalkar Resort Area Based on the Application of Smart Technologies”
Relevance	The modern development of tourism requires the introduction of innovative approaches to the management of tourist-recreational areas, particularly in the context of sustainable development and digitalization. Amid global environmental challenges, increasing tourist flows, and the need for the rational use of natural resources, Smart technologies are becoming a key tool for balanced management, ensuring harmony between the economic, social, and environmental aspects of tourism development. The Imantau-Shalkar resort zone (ISRZ) has significant tourism and recreational potential; however, its effective utilization is constrained by the absence of an integrated management system, insufficient digitalization of tourism services, and the lack of comprehensive monitoring based on sustainability indicators. In this context, implementing a management system based on Smart technologies and sustainable development indicators is essential. This will help minimize anthropogenic impact, optimize the use of natural resources, and enhance the competitiveness of the resort zone. According to the Environmental Performance Index (2022), Kazakhstan ranks 93rd out of 180 countries, highlighting the need for innovative solutions to achieve sustainable development. Tourism, as one of the country’s strategically significant economic sectors, requires effective mechanisms for regulating tourist flows, digitalizing tourism services, and creating a favorable ecological environment. Leading global tourism destinations actively employ Smart technologies for monitoring and managing natural and recreational resources; however, this approach remains underdeveloped in Kazakhstan. In this context, the project aimed at developing a balanced system of integrated management for the development of ISRZ, utilizing Smart technologies and sustainability indicators, is highly relevant and in demand. Its implementation will not only improve the efficiency of resort area management but also create a foundation for replicating successful experiences in other tourist regions of Kazakhstan. The integration of digital solutions, including 3D tourism routes, GIS analysis, and mobile applications, will modernize tourism infrastructure, increase the attractiveness of the region, and enhance the quality of tourism services.
Purpose	Development of a Balanced Integrated Management System Model for the Development of the Imantau-Shalkar Resort Zone (ISRZ), Based on Sustainable Development Indicators (SDIs) and Smart Technologies.
Objectives	– Develop a catalog of Smart technologies and sustainable development indicators (SDIs), based on studied international best practices, national research experience, and monitoring data. – Identify visitor preferences for the use of Smart technologies in the resort zone. – Examine the applicability of global best practices in the use of Smart technologies and SDIs in the conditions of the ISRZ. – Assess the attractiveness of ISRZ landscapes using GIS technologies, expert evaluations, and factor analysis to identify unique landscape features. – Conduct water sampling for hydrochemical and toxicological analysis of the resort destination's water bodies.

	– Study the geoecological situation in ISRZ to assess landscape resilience to tourist impacts and determine optimization measures. – Evaluate the ISRZ territory by creating a digital zoning map based on SDIs and the application of GIS technologies. – Design 3D-format tourist routes within the ISRZ. – Create a database (information package) of developed 3D tourist routes and integrate them into the "TourismKaz" mobile application for commercial promotion and sustainable tourism stimulation. – Develop a system of digital labels for ISRZ, integrated with informational passports on an online platform and supported by an audio guide. – Develop verbal and conceptual models of an intelligent integrated management system for ISRZ development, incorporating Smart technologies, infrastructure planning, and SDI-based monitoring. – Formulate recommendations for the application of Smart technologies in ISRZ, focusing on sustainable natural resource use, expansion of eco-education, development of ecological culture, and sustainable development of resort zones.
Expected and achieved results	***Achieved Results:*** *For the Year 2024:* – An assessment of Kazakhstanis' awareness of sacred sites in the ISRZ was conducted using primary data collection methods. – A selection of methodologies for assessing the sustainable development of resort zones was carried out, and a system for planning and managing tourism and recreational resources was developed, incorporating best practices from both domestic and international experience. A set of Smart technologies and sustainable development indicators (SDIs) was developed and adapted specifically for the ISRZ. – In-depth interviews and/or surveys of stakeholders were conducted to identify attractive Smart technologies for visitors to the resort zone among Kazakhstanis. An assessment of Kazakhstanis' level of information awareness and preferences regarding Smart technologies used in resort zones was carried out. – A comprehensive analysis of water samples was conducted, including hydro-physical and hydrochemical parameters, as well as the presence of heavy metals. At least 20 parameters were determined for each water body, and bathymetric surveys of water bodies were performed using a motorboat and modern echo sounder-chart plotters to create depth maps of the lakes (Imantau, Shalkar). – A catalog of Smart technologies and SDIs for resort zones was developed. – As a result of the research, two intellectual property protection documents were obtained. ***Expected Results:*** *For the Year 2025:* – A digital cartographic model of landscape attractiveness in the ISRZ is being created, and the geo-ecological situation in this area is being studied. – Digital cartographic models of the geo-ecological situation in the ISRZ are being developed, along with recommendations for optimizing the geo-ecological conditions within the resort zone. – A comprehensive analysis of water samples will be conducted, including hydro-physical and hydro-chemical parameters, as well as the presence

	of heavy metals. At least 20 parameters will be determined for each water body, and a bathymetric survey of the water bodies will be carried out using a motorboat and modern echo sounder chart plotters to create depth maps of the lakes (Imantau, Shalkar). – 3D tourist routes will be developed in the ISRZ to promote unique historical, cultural, and natural heritage sites, as well as to support a healthy lifestyle and the principles of sustainable development. *For the Year 2026:* – Authorial 3D tourist routes will be developed and integrated into the "TourismKaz" mobile application for commercial promotion and support of sustainable tourism development, along with informational passports for the tourist routes. – A labeling system with QR codes will be implemented at tourist sites in the ISRZ, along with an audio guide for tourists. – A verbal and substantive model of an intelligent management system for the balanced development of the ISRZ will be developed, integrating Smart technologies, infrastructure development, and sustainable development monitoring indicators. This model will serve as a fundamental step toward ensuring effective territorial management. – Recommendations will be developed to enhance and strengthen the role of the local population (local communities) in the development of tourism activities in the ISRZ. Additionally, methodological guidelines will be proposed based on the results of assessments and the determination of recreational load norms in this area, as well as recommendations for regulating visitor flow.
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List of publications with links to them	*Published Articles / Presented Papers at International Conferences:* 1) Kambarova, A., & Nuruly, Y. (2024). The Role of Metaverse Technologies in the Digital Transformation of the Tourism Industry. In *Sustainable Development of Tourism in Central Asia: Challenges, Opportunities and Prospects. Collection of Materials of the International Scientific and Practical Conference* (pp. 31–38). Almaty:

	Al-Farabi Kazakh National University. ISBN 978-601-04-6902-0. https://tourismforum.ecokazwest.kz/index.php/documentation/ 2) Nuruly, Y., & Sembayeva, A. (2024). Blockchain-Based Consensus Solutions for Managing and Protecting Hotel Guest Information. In *Sustainable Development of Tourism in Central Asia: Challenges, Opportunities and Prospects. Collection of Materials of the International Scientific and Practical Conference* (pp. 146–153). Almaty: Al-Farabi Kazakh National University. ISBN 978-601-04-6902-0. https://tourismforum.ecokazwest.kz/index.php/documentation/ *3)* Karim, A., Nuruly, Y. (2024). R-Keeper: From Classical Automation to Modern Integration with Online Services // In *Sustainable Development of Tourism in Central Asia: Challenges, Opportunities and Prospects. Collection of Materials of the International Scientific and Practical Conference* (pp. 292–300). Almaty: Al-Farabi Kazakh National University. ISBN 978-601-04-6902-0. https://tourismforum.ecokazwest.kz/index.php/documentation/ *(in Russian).* 4) Serikbol, A., Aliyeva, Zh., & Nuruly, Y. (2024). The Role of Neural Network Technologies in Optimizing Processes in the Tourism Industry. In *Sustainable Development of Tourism in Central Asia: Challenges, Opportunities and Prospects. Collection of Materials of the International Scientific and Practical Conference* (pp. 263–271). Almaty: Al-Farabi Kazakh National University. ISBN 978-601-04-6902-0. https://tourismforum.ecokazwest.kz/index.php/documentation/ 5) Shyryntay, A.Z. (2025). Assessing Smart Tourism Readiness Through Key Technologies and Indicators in Urban Destination Management: A Case Study of Almaty. In *Materials of the International Scientific Conference of Students and Young Scientists «Farabi Alemi»* (pp. 161–162). Almaty: Qazaq University. *(Supervised by Y. Nuruly).* 6) Sembayeva, A. (2025). Enhancing Hotel Data Security with Blockchain: A Hybrid POS-PBFT Approach. In *Materials of the International Scientific Conference of Students and Young Scientists «Farabi Alemi»* (pp. 167–168). Almaty: Qazaq University. *(Supervised by Y. Nuruly).* 7) Kambarova, A. (2025). The Role of Metaverse Technologies in the Digital Evolution of Tourism. In *Materials of the International Scientific Conference of Students and Young Scientists «Farabi Alemi»* (pp. 151–152). Almaty: Qazaq University. *(Supervised by Y. Nuruly).* 8) Serikbol, A.M. (2025). The Role of Neural Network Technologies in Optimizing Processes in the Tourism Industry. In *Materials of the International Scientific Conference of Students and Young Scientists «Farabi Alemi»* (pp. 158–159). Almaty: Qazaq University. *(Supervised by Zh.N. Aliyeva).* 9) Karim, A. B. (2025). The Resilience of R-Keeper in the Transition Toward Hybrid Service Models: Challenges and Solutions. In *Materials of the International Scientific Conference of Students and Young Scientists «Farabi Alemi»* (pp. 164–165). Almaty: Qazaq University. *(Supervised by Y. Nuruly).* 10) Kaliyeva, A.B. (2025). The Impact of Integration of Green Innovations on Increasing the Environmental Efficiency of Hotel Enterprises. In *Materials of the International Scientific Conference of Students and Young Scientists «Farabi Alemi»* (pp. 183–184). Almaty: Qazaq University *(Supervisor: Aktymbayeva A.S.). (in Kazakh).*
Patents	*Copyright Certificates:*

	1) Shyryntay, A.Z., Nuruly, Y. Regulation of Overtourism through the Application of Smart Technologies for Optimizing Tourist Flows // Certificate of registration in the State Register of Rights to Objects Protected by Copyright (scientific work) / No. 59246 dated June 4, 2025. *(in Kazakh).* 2) Sembayeva, A.E., Nuruly, Y. Ensuring Data Security in Hotels through the Use of Blockchain Technology // Certificate of registration in the State Register of Rights to Objects Protected by Copyright (scientific work) / No. 59285 dated June 5, 2025. *(in Kazakh).* 3) Shyryntay, A.Z., Nuruly, Y. Almaty's Smart Tourism Readiness: Towards Sustainable City Transformation // Certificate of registration in the State Register of Rights to Objects Protected by Copyright (scientific work) / No. 56346 dated April 2, 2025. 4) Dauletkhanova, Y.R., Aktymbayeva, A.S., Sapiyeva, A.Zh., Nuruly, Y., Kaliyeva, A.B. "MAZE" Ecopark // Certificate of registration in the State Register of Rights to Objects Protected by Copyright (literary work) / No. 49043 dated August 14, 2024. *(in Kazakh).* *5)* Dauletkhanova, Y.R., Sapiyeva, A.Zh., Nuruly, Y., Kaliyeva, A.B. KazGlamping – Under the Open Sky! // Certificate of registration in the State Register of Rights to Objects Protected by Copyright (literary work) / No. 48856 dated August 6, 2024. *(in Russian).*