

Artificial Intelligence Tools for the Development of the Tourism Sector

Tinatin Mshvidobadze 

Abstract. It is worth noting that tourism is one of the first industries to start using digital technologies in business activities. This paper examines the role of artificial intelligence (AI) in facilitating the growth of sustainable tourism and its implications for the next technological and economic cycle. Focusing on the top ten global tourism destinations from 2013 to 2025, the paper examines the interaction between AI adoption, gross domestic product (GDP), foreign direct investment (FDI), inflation (INF), and urbanization (UB). Using a multi-method approach that combines artificial neural network (ANN) analysis with traditional econometric models, the findings highlight that AI is a critical driver of tourism efficiency and smart tourism capabilities, significantly improving tourism sustainability. The study also reveals the significant contribution of GDP, INF, FDI and UB. The role of artificial intelligence as a crucial technological catalyst in the development of sustainable tourism.

Keywords: artificial intelligence adoption, tourism growth, data analysis, neural networks

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Turizm sektorunun inkişafı üçün süni intellekt alətləri

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Xülasə. Turizm biznes fəaliyyətində rəqəmsal texnologiyalardan istifadə etməyə başlayan ilk sahələrdən biridir. Bu məqalədə süni intellektin (Sİ) dayanıqlı turizmin inkişafındakı rolu və bunun növbəti texnoloji və iqtisadi mərhələ üçün əhəmiyyəti araşdırılır. Tədqiqat 2013–2025-ci illər ərzində dünyanın ən çox turist qəbul edən on istiqamətinə yönəlir və Sİ-nin tətbiqi, ümumi daxili məhsul (ÜDM), birbaşa xarici investisiyalar (BXİ), inflyasiya (İNF) və urbanizasiya (URB) arasındakı əlaqəni təhlil edir. Süni neyron şəbəkəsi (ANN) təhlili ilə ənənəvi ekonometrik modelləri birləşdirən metodoloji yanaşmanın nəticələri göstərir ki, Sİ turizmdə səmərəliliyin və ağıllı turizm imkanlarının inkişafında mühüm rol oynayır, həmçinin turizmin dayanıqlılığına töhfə verir. Tədqiqat ÜDM, inflyasiya, BXİ və urbanizasiyanın da əhəmiyyətli rol oynadığını göstərir. Beləliklə, süni intellekt dayanıqlı turizmin inkişafında mühüm texnoloji amil kimi çıxış edir.

Açar sözlər: süni intellektin tətbiqi, turizmin böyüməsi, məlumatların təhlili, neyron şəbəkələri

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Introduction

Like other sectors of the economy, the introduction of digital technologies and the digitization of services have a significant impact on the development of the tourism sector. Given the growing role of digitalization in tourism, the development of the sector significantly depends on the effective management of this process. The integration of digital solutions into business processes contributes to increasing the competitiveness of the sector, diversifying tourism markets, and developing the industry.

These processes, in turn, are related to the introduction of digital technologies in tourism activities, the use of digital marketing and e-commerce, and the development of innovative tourism products. As a result of the development of online platforms, booking systems, electronic transfers, and mobile applications of tourism companies, the quality and quantity of services available to consumers are increasing, which simplifies the travel process. The introduction of digital technologies by companies contributes to the optimization of their activities, the reduction of costs, and a more accurate assessment of demand (Buhalis & Law, 2008, pp. 609–623). Among technological advancements, artificial intelligence (AI) has been a pivotal force, providing novel insights and operational efficiencies across industries, including tourism.

To assess the progress in the use of digital systems in the tourism sector, it is interesting to consider the Tourism and Travel Index. Given the positive relationship between the development of information and telecommunications technologies in a country and revenues from international tourism, one of the components of the World Economic Forum that is related to the Tourism and Travel Index is the digital readiness of the tourism sector.

In terms of digital infrastructure development, along with the introduction of a functional website and e-commerce system, tourist destinations in various developed countries of the world actively use the following types of digital technologies: digital check-in and check-out systems, digital hotel room keys, digital menus, digital management of infrastructure and devices, contactless portals for communication with service representatives, and virtual tours. In the case of Georgia, such technologies are mainly found only in large cities.

It is important that the EU projects supporting the digital transformation of tourism are mainly aimed at developing the skills of small and medium-sized enterprises in the tourism sector, integrating digital technologies into the development of tourism services, creating new products, initiating virtual and augmented reality or data-processing systems, as well as platforms supporting this process.

This study focuses on the role of AI adoption in driving tourism growth, specifically within the top ten tourist-receiving countries from 2010 to 2022. The tourism sector is not only a critical economic driver but also a catalyst for cultural exchange and global understanding (Alcalde-Giraudó et al., 2023, p. 123). Beyond technological advancements, tourism growth is influenced by economic indicators such as gross domestic product (GDP), inflation (INF), foreign direct investment (FDI), and urbanization (UB). The interplay of these variables offers rich insights into tourism growth

patterns, particularly in the world's most visited nations (Can & Gozgor, 2018, pp. 1157–1170). AI, as a transformative technology, plays a crucial role in integrating with these broader economic and environmental shifts to influence sustainable tourism growth. This research investigates the synergistic effects between AI adoption and key economic indicators, revealing how they enhance tourism efficiency and resilience.

Materials and Methods

This article uses descriptive, analytical, and explanatory methods, based on which important issues of the study are highlighted. To formulate the concept, we examined the views of various researchers, based on which we illustrated the reasoning and conclusions. All changes made to integrate the algorithms seamlessly are thoroughly described. The relevant data are obtained from experiments. To examine the multifaceted impact of AI adoption and economic indicators (GDP, FDI, investment infrastructure, and the city's domestic market) on tourism growth, this study uses panel data from 2013 to 2025. The selection of the sample and period is mainly driven by the availability of comprehensive data on the variables, with a particular focus on the emerging role of AI in the tourism sector.

This period also coincides with significant global developments in AI technologies and their increasing use in various industries, including tourism. The period from 2013 to 2025 witnessed rapid developments in AI, such as the development of machine learning and natural language processing, which directly impacted the efficiency and personalization of tourism services.

Results

The US and the UK have seen the most significant growth in AI startups, especially between 2015 and 2020, while some countries (e.g., Austria, Greece, and Mexico) have seen minimal changes. Spain, France, and Germany have seen moderate growth in AI startups over the same period, with minor fluctuations. Figure 1 shows the number of AI startups in the top ten tourism countries from 2013 to 2025.

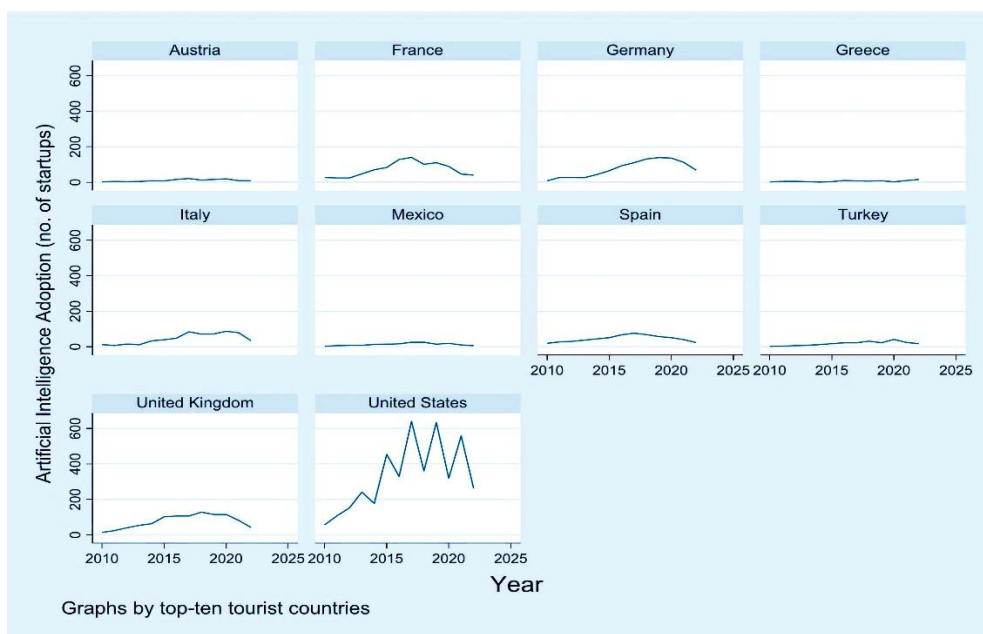


Figure 1
Trend of AI adoptions by country over the years

The dependent variable used in this study is tourism growth, as measured by the number of international arrivals reported by UNWTO and WDI. The main independent variable of the study is also the adoption of AI, as measured by Crunchbase as the number of AI startups per year (Figure 1). Crunchbase is a large database of publicly traded companies that provides detailed information about startups, including their founding dates, industry sectors, and investment rounds (Mungo et al., 2024, p. 233).

The empirical analysis is based on a study conducted by Hopfield et al., which aims to quantify the contribution of technological development, economic indicators, investment flows, price stability, and urban development to the growth of the tourism industry. In the initial phase, the use of artificial neural networks (ANN), a machine-learning technique known for its ability to model complex relationships and identify influential variables without making assumptions about their nature or interrelationships (Hopfield, 2000, pp. 2554–2558), is investigated. The study period is 2013–2025. A comprehensive multi-method approach is used to study the dynamics of tourism growth in the top ten countries, as well as to test the research hypotheses. The baseline model is defined by Equation (1).

$$TL_t = \delta_0 + \delta_1 AI_t + \delta_2 LG_t + \delta_3 LF_t + \delta_4 LI_t + \delta_5 LU_t + \varepsilon_t \quad (1)$$

where:

δ_0 is the intercept point indicating the expected level of tourism growth.

δ_1 through δ_5 are the coefficients capturing the marginal effects of the independent variables: AI (AI adoption), LG (logarithm of gross domestic product), LF (logarithm of foreign direct investment), LI (logarithm of inflation), and LU (logarithm of urbanization) on tourism growth.

ε_{it} includes unobserved factors and potential measurement errors, which may affect tourism growth but are not included in the model.

Discussion

In the modern world, taking into account the conditions of globalization, green investments play a crucial role in the sustainable development of tourism and the development and preservation of the ecosystem. There are many successful examples of sustainable tourism development and ecosystem preservation in the world, which can be used as examples by other states. Costa Rica is a pilot example of sustainable tourism development. The Costa Rican government has developed a strict environmental legislative package and has given priority to investments in the creation of environmentally friendly housing.

In international literature and various sources, the processes of advancing the tourism policy of the Estonian Tourist Board and implementing sustainable development strategies at the highest level are actively discussed; the practice of Slovenia served as a source of motivation for these processes (Tallinn City Tourist Office & Convention Bureau, 2023).

Green investment and environmental programs in Georgia are implemented by the European Bank for Reconstruction and Development, whose 2016–2021 report shows that the Bank financed programs worth 766 million euros in sustainable infrastructure during these years, including 297 million euros in municipal and environmental infrastructure (European Bank for Reconstruction and Development Report, 2016–2021).

The countries included in our analysis are Austria, France, Germany, Greece, Italy, Mexico, Spain, Turkey, the UK, and the US, as defined by the United Nations World Tourism Organization

(UNWTO) for 2022. Together, these countries account for approximately 46% of the global tourism industry.

Scholars (Leong et al., 2019a, pp. 146–160) advocate the use of artificial neural networks to study the determinants of tourism growth. The artificial neural network analysis includes variables such as AI use, GDP, FDI, investment infrastructure, and UB as input variables. Therefore, the use of a deep-learning approach helps to achieve more accurate results, which led our study to use a single-layer ANN configuration (Morales-Alonso, 2022, p. 174). Figure 2 shows the results of the ANN model for tourism growth forecasting (Hew et al., 2023, p. 75). In addition, the goodness of fit was assessed using the R^2 index according to Hew et al. to further confirm the forecasting accuracy. Goodness of Fit (R^2) = 1 – Mean AR during testing / Mean SSE during testing.

$$AR = \sqrt{\frac{1}{N}} * SSE \quad (2)$$

The model demonstrates remarkable predictive accuracy, as evidenced by low AR values during both training and testing phases.

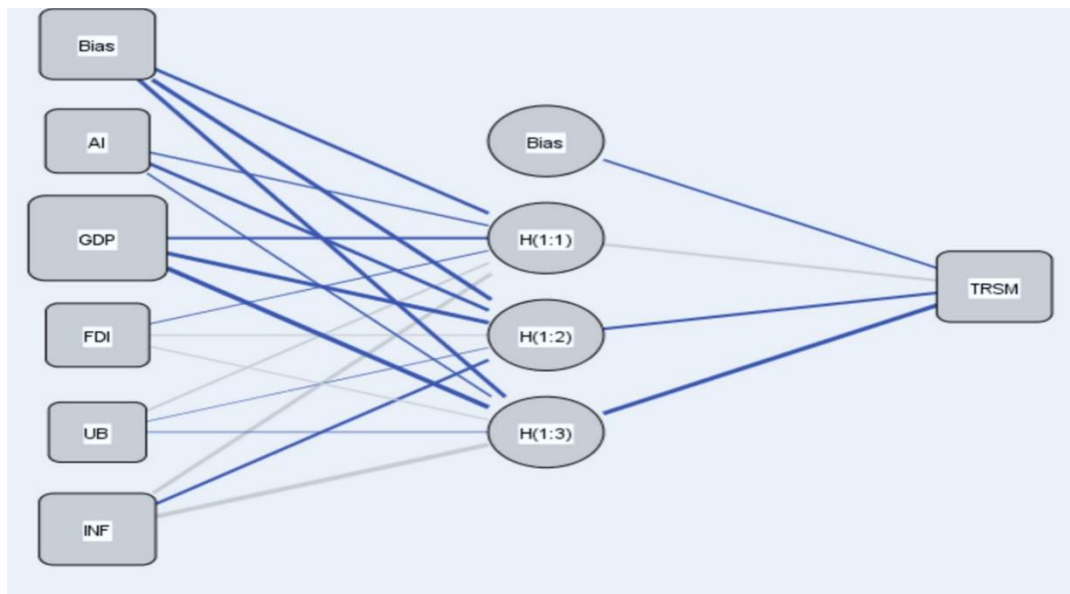


Figure 2
Outcomes of ANN model for predicting tourism growth

This analysis revealed GDP as the most influential input variable in tourism growth, followed by inflation, AI, FDI, and UB, underscoring the differential impact of these variables on the tourism sector's expansion.

Conclusion

As a result of the literature review carried out within the framework of this article, it was determined that, in the modern world, through state support for green investments, a diversified tourism product is created and the tourist season is prolonged. The results of the study confirm that, by encouraging the use and implementation of green investments, the tourism industry is developing dynamically and, at the same time, the negative impact of mass tourism on the environment is significantly reduced.

In this paper, we examine the impact of AI deployment on tourism growth in key global destinations from 2013 to 2025 using a novel blend of machine-learning and econometric models (Park, 2024, pp. 262–266).

We conclude that AI has a significant positive role in facilitating smart tourism and operational efficiency, highlighting its transformative potential. GDP growth, inflation, foreign direct investment, and urbanization also have significant impacts. Notably, the findings point to complex relationships between foreign direct investment, foreign investment, and tourism growth, with foreign investment negatively affecting tourism, while the impact of foreign direct investment is context-dependent.

These data have limitations that must be acknowledged in order to draw a more transparent and balanced conclusion. First, the study's time frame (2013–2025) may not fully capture the sustained impact of AI adoption on tourism growth. In addition, the data collected from Crunchbase for AI startups, while comprehensive, may have geographical limitations, as they may not fully capture new AI startups in less digitally literate regions or developing countries.

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