Forecasting Tourism Services Exports for Sustainable Development: A Case Study of Uzbekistan

Kozimbek Tuxtabekov[1], Makhina Buzrukova[2], Habibullo Hasanov[3(✉)], and Elena Salnikova[4]

[1] Oriental University, Shota Rustaveli Street. 154/a, Tashkent 100121, Uzbekistan
[2] Sharof Rashidov Samarkand State University, Boulevard, 15, Samarkand 140100, Uzbekistan
[3] Samarkand Institute of Economics and Service, A.Temur Street. 9, Samarkand 140105, Uzbekistan
khabibulloeco@gmail.com
[4] "Silk Road" International University of Tourism and Cultural Heritage, Boulevard 17, Samarkand 140100, Uzbekistan

Abstract. Tourism service exports play an important role in the economic growth and sustainable development of many countries. This study aims to forecast Uzbekistan's tourism services exports and identify the main economic factors affecting them. The analysis was conducted using log-log and semi-log regression models based on official statistical data for 2010–2023. The results show that the number of inbound tourist and hotel beds is the main driver of services exports, and their growth has a significant positive impact. Passenger transport, trade and accommodation services also have a positive impact on the growth of tourism exports. The forecast was made based on the semi-logarithmic model ($R2 = 0.785$), which has the highest accuracy among the models studied, and it was determined that Uzbekistan's tourism services exports could reach 2.85 billion USD by 2028. The results of the study confirm that the development of tourism infrastructure and increasing the flow of foreign tourists are important factors for sustainable development. These results serve as a scientific basis for the formulation of Uzbekistan's tourism policy, investment decisions and long-term strategic planning.

Keywords: Tourism Services Export · Forecasting · Regression Analysis · Foreign Tourist Flows · Hotel Capacity · Sustainable Development

1 Introduction

Tourism is one of the most important sectors of the world economy today, playing an important role in ensuring economic growth, employment and foreign exchange earnings in many countries [1]. Especially for developing countries, the tourism sector is one of the main factors in increasing national income, developing infrastructure and deepening international integration [2–4]. Uzbekistan is also strengthening its position in the international tourism market due to its rich historical and cultural heritage, natural beauty and convenient geographical location [4, 5].

© The Author(s), under exclusive license to Springer Nature Switzerland AG 2026
O. Gervasi et al. (Eds.): ICCSA 2025 Workshops, LNCS 15899, pp. 176–186, 2026.
https://doi.org/10.1007/978-3-031-97663-6_15

In recent years, the tourism sector in Uzbekistan has been developing rapidly, and the government is implementing comprehensive reforms aimed at supporting this sector. In particular, the simplification of visa procedures, the expansion of the hotel network and the improvement of logistics infrastructure are contributing to a significant increase in the flow of international tourists [6]. At the same time, the development of the export of tourism services and its forecasting remain one of the urgent issues today.

Tourism services exports are foreign exchange earnings that a country earns through services provided to foreign tourists, which contribute to the sustainable development of the country's economy. Accurate forecasting of such earnings is of great importance for national economic planning, investment decision-making, and tourism strategy development. Therefore, there is an increasing need to predict the future volume of tourism services exports using scientifically based methods.

This study aims to forecast tourism services exports and assess the impact of key economic indicators on tourism services exports using regression analysis and time series models. The results of the study serve as a scientific basis for developing effective strategies in the tourism sector, improving the investment climate, and ensuring sustainable development.

2 Literature Review

The issue of forecasting tourism revenues is one of the most relevant topics for economists and researchers today. In recent years, a lot of research has been conducted on the development of forecasting models in the tourism sector and their practical application. Most of this research is aimed at assessing the impact of tourism on economic development, forecasting tourist flows, and improving the methods used in formulating tourism policy.

As posited by Dwyer and Forsyth [7], local consumers have been identified as a primary catalyst for tourism. In their study, Allaberganov and Preko [8] demonstrated a positive correlation between tourists' travel motivations and the frequency of their visits. The researchers administered a questionnaire to 563 international tourists, though it should be noted that the study's findings are based on a single moment in time. The impact of ownership forms and management efficiency on economic growth and tourism development has also been studied previously [9], where the balance between the public and private sectors is shown as an important factor in sustainable development. Safarov et al. [10] utilized the ARDL and ARIMA methods, which are dynamic statistical techniques, to forecast the volume of tourist services in Uzbekistan, with the number of incoming tourists serving as the primary variable. Witt [11] asserts that three distinct methods are employed in the field of tourism forecasting: cause-and-effect models, time series models, and qualitative models. Goh and Law [12] identify three main types of quantitative forecasting models: time series models, econometric models and artificial intelligence (AI) based models. In time series models, future values are usually predicted based on changes in data in past periods. Although time series models are widely used in practice, they are often difficult to explain in economic theory. Time series models can be categorized into two broad types: simple models (e.g. simple moving averages, one-way exponential smoothing) and complex models (e.g. two-way exponential smoothing, autoregressive moving averages, simple structural time series). Peng et al. [13] employed

econometric models in their research to identify cause-and-effect relationships between factors affecting tourism demand. In essence, econometric models do not function as mere extrapolation methods, rather, they are designed to identify influential factors. Common types of econometric models include simple linear regression, gravity models, vector autoregression, error correction models, cointegration, and autoregressive distributed lag models.

Since the early 2000s, the utilization of AI for forecasting purposes has gained significant traction within the tourism industry [14]. It has become evident that AI-based models, such as artificial neural networks, support vector machines, random time series, genetic algorithms, and expert systems, have proven to be more efficacious than conventional forecasting methodologies [15]. While AI-based models yield more accurate forecast values, the rationale behind the selection of weights during the learning process remains opaque [14]. Consequently, the employment of artificial intelligence-based models is predominantly observed in scenarios involving classification or identification challenges posed by voluminous data sets. In contemporary research practices, a prevalent approach entails the concurrent utilization of diverse forecasting methods to calculate forecast values [15].

Milenkovski et al. [16] conducted a study on the impact of road infrastructure on inbound tourism in the Republic of Macedonia, finding that environmental conditions and safety had a significant impact on inbound tourism. Breda et al. [17] also studied the impact of safety measures on inbound tourism in China, finding that political and social stability and fashion trends had a significant impact on inbound tourism demand. However, Biagi et al. [18] found that tourism development led to an increase in crime. Sunlu's [12] study found that when the number of tourists visiting a destination exceeds its capacity, it hurts the environment of that destination.

The factors influencing the development of tourism vary from country to country. Some studies have found that transport infrastructure [19], safety [16] and environmental conditions [20–22] have a direct impact on tourist flows. In the case of Uzbekistan, tourism infrastructure, hotel capacity and the flow of foreign tourists are considered to be the main drivers of the export of tourism services.

3 Materials and Methods

The study used official statistical data from the Agency for Statistics of the Republic of Uzbekistan from 2010–2023. This data covers various aspects of the tourism sector and allows us to identify key important variables for the study. Table 1 describes these variables.

The main object of the study was chosen as the export of tourism services (TourExp), as it reflects the economic potential of the country in the tourism sector and its position in the international market. This indicator serves as a key indicator for assessing the development of the tourism sector.

The study used economic and statistical analysis methods. Correlation analysis was conducted to determine the relationship between factors, the results of which are presented in (Fig. 1).

According to the results of the correlation analysis, there is a strong relationship between the factors CollAccPlaces, HotelPlaces, PassTrans, AccFoodServ, TradeServ

Table 1. Description of variables used in the analysis.

Symbol	Variable name	Unit of measure
TourExp	Volume of tourism services export	Million USD
TourFirms	Number of operating travel companies and organizations (tour operators, travel agents)	Units
InbTourism	Inbound tourism	Persons
CollAccPlaces	Number of places in collective accommodation facilities (total)	Thousand units
HotelPlaces	Number of places in hotels	Thousand units
PassTrans	Number of passengers transported (total)	Million persons
AccFoodServ	Volume of accommodation and food services	Billion UZS
TradeServ	Volume of trade services	Billion UZS
TranspServ	Volume of transport services	Billion UZS
TourClients	Number of people served by tourist companies and organizations	Thousand units
MuseumVisits	Number of visits to museums	Thousand units

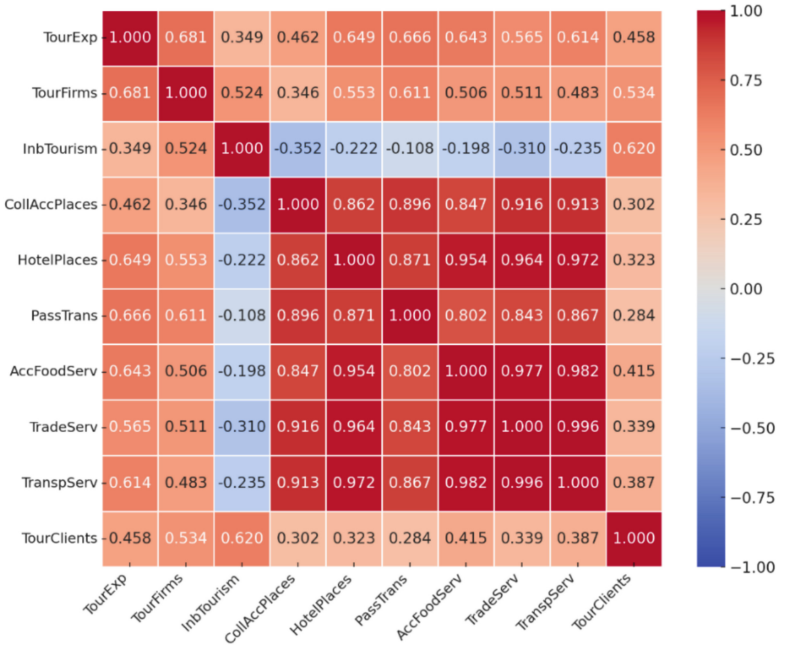

Fig. 1. Correlation matrix of variables.

and TranspServ, which may cause the problem of multicollinearity. To eliminate these problems, each variable is expressed in separate regression equations.

In addition, since the relationship between factors was found to be nonlinear during the study, all variables were log-transformed and a log-log regression model was constructed. The log-log regression model was expressed as follows:

$$log(TourExp) = \beta_0 + \beta_1\ log(X_1) + \beta_2\ log(X_2) + \ldots + \beta_n\ log(X_n) + \varepsilon \qquad (1)$$

where: *log(TourExp)* – the logarithmic value of tourism services exports; *X1, X2,…, Xn* – independent variables affecting tourism services exports; β_0 – the regression model intercept (constant term); β_1,…, β_n – elasticity coefficients of the independent variables; ε – random error term.

As a result of applying the log-log model, the elasticity coefficients of the factors are determined, that is, they show how much a 1% change in each independent variable affects the export of tourism services.

4 Results and Discussion

According to the results of the study, a log-log regression model was used to identify the main factors affecting the export of tourism services (Table 2).

This model allowed us to estimate their elasticity coefficients, taking into account nonlinear relationships between factors. The results presented in Table 2 demonstrate that factors such as InbTourism, HotelPlaces, PassTrans, TradeServ and TradeServ exert a significant positive influence on the export of tourism services ($p < 0.01$). In a similar vein, the CollAccPlaces factor proved to be statistically significant at the 95 percent confidence interval ($p < 0.05$), while AccFoodServ demonstrated statistical significance at the 90 percent confidence interval ($p < 0.1$).

Also, factors such as TourFirms and TourClients were not statistically significant in the model. This may indicate that these factors do not directly affect tourism exports or that their effect is manifested through other mediating factors. The results showed that none of the variables exceeded the threshold value of VIF < 5, which means that multicollinearity is not a serious problem.

Of all the regression models analyzed, model 2 had the highest accuracy ($R2 = 0.78$). The R2 value indicates that this model explains 78% of the variability in tourism services exports, indicating a good fit of the model. In addition, $Prob > F = 0.004$ confirms that the model is statistically significant overall. The results show that a 1% increase in the number of foreign tourists increases the export of tourism services by an average of 1.048%, and a 1% increase in the number of hotel beds can increase the export of tourism services by 2.402%.

The results of Table 2 show that the main driving forces of exporting tourism services are Inbound Tourism and Hotel Places. Therefore, the factors of Inbound Tourism and Hotel Places were selected to forecast the export of tourism services. Although the log-log model is suitable for analyzing elasticity, the semi-log model is more convenient for directly expressing the quantitative change in the export of tourism services. This allows us to express the forecast results more accurately in quantitative terms and bring

Table 2. Estimation results of log-log regression models.

	I	II	III	IV	V	VI
TourFirms	0.080 (0.09)	−1.357 (−1.32)	−0.585 (−0.64)	−0.620 (−0.49)	−0.882 (−0.91)	−0.826 (−0.85)
InbTourism	0.814** (2.65)	1.048*** (3.53)	0.659** (2.83)	0.868** (2.29)	1.042*** (3.38)	0.983*** (3.25)
CollAccPlaces	2.306** (2.75)					
HotelPlaces		2.402*** (3.63)				
PassTrans			4.453*** (3.35)			
AccFoodServ				0.428* (2.24)		
TradeServ					0.828*** (3.45)	
TradeServ						1.007*** (3.35)
TourClients	−0.380 (−0.97)	−0.317 (−0.98)	−0.091 (−0.28)	−0.201 (−0.50)	−0.340 (−1.01)	−0.378 (−1.09)
Constant	−12.260** (−0.97)	−4.986 (−1.66)	−35.562*** (−3.82)	−2.346 (−0.56)	−7.402** (−2.36)	−8.861** (−2.72)
Prob > F	0.017**	0.004***	0.007***	0.034**	0.006***	0.007***
R-squared	0.71	0.78	0.76	0.65	0.77	0.76
Mean VIF	2.52	3.49	2.32	3.48	3.24	3.13

*Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$*

Table 3. The results of (TourExp | log(InbTourism), log(HotelPlaces)) semi-log regression model.

TourExp	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
log(InbTourism)	501.812	110.639	4.54	0.001	258.296	745.327	***
log(HotelPlaces)	1464.44	256.628	5.71	0.000	899.606	2029.274	***
Constant	−10386.733	1859.294	−5.59	0.000	−14479.01	−6294.455	***
Mean dependent var		937.064	SD dependent var		560.107		
R-squared		0.785	Number of obs		14		
F-test		20.129	Prob > F		0.000		
Akaike crit. (AIC)		200.335	Bayesian crit. (BIC)		202.252		

*Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$*

them into a format convenient for use in economic decisions. Therefore, this model was developed to forecast TourExp until 2028 (Table 3).

According to the results in Table 3, the semi-log model has high reliability for forecasting tourism services exports. The factors of Inbound Tourism and Hotel Places are statistically significant ($p < 0.01$), which have a significant impact on tourism services exports. The model shows that in general, it can generally explain 78.5% of the variability in tourism services exports ($R2 = 0.785$). The overall statistical significance of the model is (Prob > F = 0.000), and the results indicate that the model is reliable for forecasting until 2028 and can be used to predict the future development of the tourism sector.

Based on the results in Table 3, TourExp can be forecasted using the following regression Eq. (2):

$$TourExp = 501.812 \times log(InbTourism) + 1464.44 \times ln(HotelPlaces) - 10386.733 \quad (2)$$

To forecast the future values of TourExp, the forecast of InbTourism and HotelPlaces was determined by identifying the trend line of their values. As shown in Fig. 2, the 14-year dynamic of InbTourism shows fluctuations that make it difficult to identify the trend line. However, it was hypothesized that this variable is more suitable for a third-order trend and the trend Eq. (3) is given below:

$$InbTourism = 385.96 \times t^3 - 8992.8 \times t^2 + 51431 \times t + 146787 \quad (3)$$

$$HotelPlaces = 0.1552 \times t^2 + 0.6875 \times t + 23,588 \quad (4)$$

Here t is the number of years (time) since the calculation period.

We have also constructed the above trend Eq. (4) assuming that HotelPlaces changes according to the trend as shown in Fig. 3.

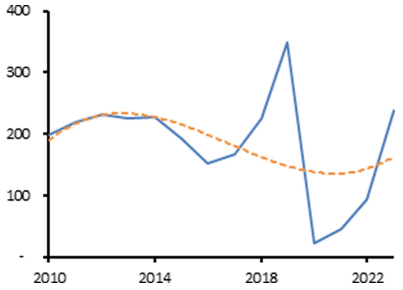

Fig. 2. Trend of InbTourism (thousand people) in Uzbekistan

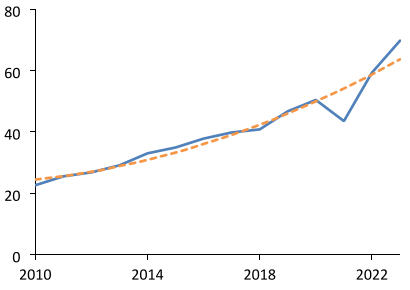

Fig. 3. Trend of HotelPlaces (thousand units) in Uzbekistan

Based on the above analysis, we calculated the forecast values for the variables TourExp, InbTourism, and HotelPlaces until 2028 using Eqs. (2), (3) and (4) (Table 4).

The semi-log model with the highest accuracy was used to calculate forecast values for the factor TourExp until 2028. According to the results, if tourist flows and hotel infrastructure continue to grow, tourism services exports could reach 2.85 billion USD

Table 4. Forecast values for TourExp, InbTourism and HotelPlaces (2024–2028).

Years	Inbound tourism, persons	Number of places in hotels, thousand units	Volume of tourism services export, million USD
2024	197 487.00	68.82	1 928.84
2025	248 418.36	74.32	2 156.57
2026	318 416.28	80.13	2 391.37
2027	409 796.52	86.25	2 625.76
2028	524 874.84	92.68	2 855.26

by 2028 (Table 4). These forecasts serve as a scientific basis for formulating Uzbekistan's tourism strategy and making investment decisions.

The results of the analysis show that the forecast values are in line with historical trends, which confirms the accuracy and reliability of the model created. The forecast results, which are within the 95% confidence interval, increase the likelihood that exports of tourism services will have a stable growth trend until 2028 (Fig. 4). This indicates that the modeling process was chosen correctly and that the forecasts developed based on the model are reliable for strategic planning.

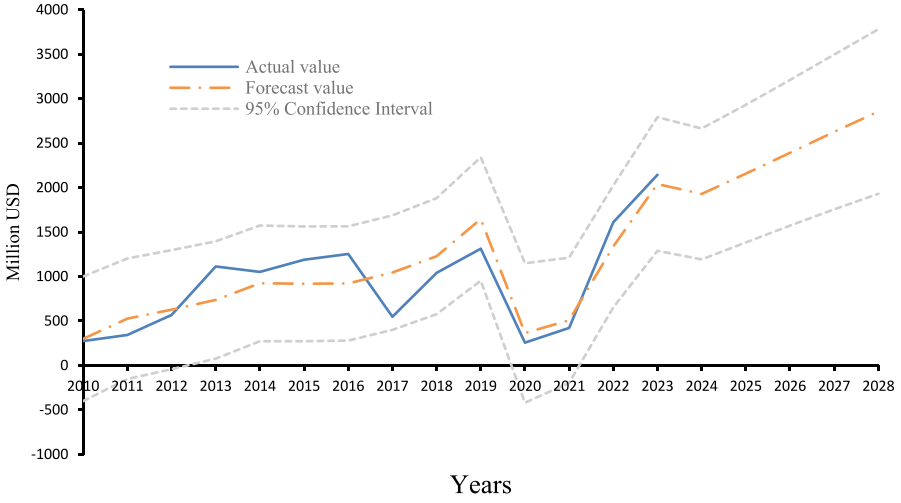

Fig. 4. Actual and forecasted values of tourism services export (2010–2028) with 95% confidence interval.

The results show that the growth of tourism services exports is mainly related to factors such as InbTourism and HotelPlaces. Analyses based on log-log and semi-log regression models confirmed that these factors have a significant impact on tourism services exports. These results are in line with previous studies. For example, a study by Safarov et al. [4] on the tourism sector in Uzbekistan also found that tourist flows and

the development of tourism infrastructure have a significant impact on tourism receipts. While Endo [23] confirmed the role of the tourism sector in foreign investment and service exports, the results of this study provide a detailed explanation of the internal effects of tourism infrastructure.

In addition, Table 2 shows that the variables PassTrans, AccFoodServ, TradeServ and TranspServ also have a positive impact on the export of tourism services. These results are in line with Kevin Li [1] theory of the relationship between tourism development and economic growth. However, the variables TourFirms (number of tourism firms operating) and TourClients (number of people served by tourism firms) were found to be statistically insignificant, which means that these factors have an indirect rather than a direct effect on export volumes.

5 Conclusion

This study aims to forecast Uzbekistan's tourism services exports and identify the main factors influencing them. Official statistical data for 2010–2023 were analyzed and log-log and semi-log regression models were used. The results of the study showed that inbound tourism and the number of hotel beds are the most important factors in the export of tourism services, and their growth significantly increases tourism exports. It was also found that passenger transport, accommodation and food services and trade and transport services also have a positive impact on the growth of tourism exports.

According to the forecast results, if tourist flows and hotel infrastructure continue to grow, the volume of tourism services exports could reach 2.85 billion USD by 2028. The model results are within the 95% confidence interval, confirming the reliability of the forecasts. These results serve as a scientific basis for formulating Uzbekistan's tourism policy, making investment decisions and ensuring the sustainable development of the tourism sector.

We believe that future research could explore the impact of digital technologies on tourism exports and regional differences. It could also be useful to examine the impact of government policies and private sector participation on tourism services export performance.

Acknowledgments. The research undertaken was made possible by the equal scientific involvement of all the authors concerned.

Disclosure of Interests. The authors have no competing interests to declare that are relevant to the content of this article.

References

1. Li, K.X., Jin, M., Shi, W.: Tourism as an important impetus to promoting economic growth: a critical review. Tour. Manag. Perspect. **26**, 135–142 (2018). https://doi.org/10.1016/j.tmp.2017.10.002
2. Ghimire, K.B.: The Growth of National and Regional Tourism in Developing Countries: An Overview. In: The Native Tourist. Routledge (2001)

3. Christie, I., Fernandes, E., Messerli, H., Twining-Ward, L.: Tourism in Africa: harnessing tourism for growth and improved livelihoods (2013)
4. Safarov, B., et al.: Prospects of agrotourism development in the region. Economies **12** (2024). https://doi.org/10.3390/economies12120321
5. Safarov, B., Janzakov, B.: Measuring competitiveness in tourism enterprises using integral index. Geo J. Tourism Geosites **37**, 768–774 (2021). https://doi.org/10.30892/gtg.37305-707
6. Khujaev, K.: The development of Uzbekistan's tourism contributes to the growth of the people's welfare. https://uzbekistan.org/the-development-of-uzbekistans-tourism-contributes-to-the-growth-of-the-peoples-welfare/4597/. Accessed 14 Feb 2025
7. Dwyer, L., Forsyth, P.: Assessing the benefits and costs of inbound tourism. Ann. Tour. Res. **20**, 751–768 (1993). https://doi.org/10.1016/0160-7383(93)90095-K
8. Allaberganov, A., Preko, A.: Inbound international tourists' demographics and travel motives: views from Uzbekistan. J. Hosp. Tourism Insights **5**, 99–115 (2021). https://doi.org/10.1108/JHTI-09-2020-0181
9. Mukhammedov, M., Safarov, B., Hasanov, H., Isxakova, S., Buzrukova, M., Hassan, T.H.: Methods for optimizing property relations as a key aspect of stimulating the development of the tourism industry. Geojournal Tourism Geosites **58**, 484–491 (2025). https://doi.org/10.30892/gtg.58145-1430
10. Safarov, B., et al.: Forecasting the volume of tourism services in Uzbekistan. Sustainability **14**, 7762 (2022). https://doi.org/10.3390/su14137762
11. Witt, S.F., Witt, C.A.: Forecasting tourism demand: a review of empirical research. Int. J. Forecast. **11**, 447–475 (1995). https://doi.org/10.1016/0169-2070(95)00591-7
12. Goh, C., Law, R.: The methodological progress of tourism demand forecasting: a review of related literature. J. Travel Tourism Mark. (2011)
13. Peng, B., Song, H., Crouch, G.I.: A meta-analysis of international tourism demand forecasting and implications for practice. Tour. Manage. **45**, 181–193 (2014). https://doi.org/10.1016/j.tourman.2014.04.005
14. Li, S., Chen, T., Wang, L., Ming, C.: Effective tourist volume forecasting supported by PCA and improved BPNN using Baidu index. Tour. Manage. **68**, 116–126 (2018). https://doi.org/10.1016/j.tourman.2018.03.006
15. Hong, W.-C., Dong, Y., Chen, L.-Y., Wei, S.-Y.: SVR with hybrid chaotic genetic algorithms for tourism demand forecasting. Appl. Soft Comput. **11**, 1881–1890 (2011). https://doi.org/10.1016/j.asoc.2010.06.003
16. Milenkovski, A., Gjorgievski, M., Nakovski, D.: The impact of the traffic infrastructure on the tourist destination. UTMS J. Econ. **11**, 43–47 (2020)
17. Breda, Z., Costa, C.: Safety and security issues affecting inbound tourism in the People's Republic of China. In: Tourism, Security and Safety. Routledge (2005)
18. Biagi, B., Brandano, M.G., Detotto, C.: The effect of tourism on crime in Italy: a dynamic panel approach. Economics **6**, 20120025 (2012). https://doi.org/10.5018/economics-ejournal.ja.2012-25
19. Khadaroo, J., Seetanah, B.: Transport infrastructure and tourism development. Ann. Tour. Res. **34**, 1021–1032 (2007). https://doi.org/10.1016/j.annals.2007.05.010
20. Caciora, T., et al.: Digitization of the built cultural heritage: an integrated methodology for preservation and accessibilization of an art nouveau museum. Remote Sens. **15** (2023). https://doi.org/10.3390/rs15245763
21. Wendt, J.A., et al.: Natural sources in preventive conservation of naturally aged textiles. Fibres Text. East. Europe (2021). https://doi.org/10.5604/01.3001.0014.9309

22. Ilies, D.C., et al.: Indoor air quality perception in built cultural heritage in times of climate change. Sustainability **15** (2023). https://doi.org/10.3390/su15108284
23. Endo, K.: Foreign direct investment in tourism—flows and volumes. Tour. Manage. **27**, 600–614 (2006). https://doi.org/10.1016/j.tourman.2005.02.004