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Article

Multi-factor Econometric Model for Developing Ecological Tourism in Surkhandaryo Region

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Abstract: According to the World Tourism Organization (WTO) forecasts, ecotourism is considered one of the five main types of tourism. Strategic development directions and expert assessments for the period up to the 20th century indicate that population growth and nature-related problems have been increasing. Environmental issues compel people to change and reassess their relationship with nature. They need to actively participate in nature, protect and preserve it, and pass it on to future generations as a natural heritage.

Keywords: Ecological Tourism, Flora And Fauna, Tourism Resources, Soft Tourism

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1. Introduction

Today, in the economies of developed countries worldwide, special attention is being paid to the development of tourism services within the service sector. According to the World Tourism Organization (UNWTO), by 2025, the number of international tourists is expected to reach 1.9 billion, and tourism revenue is projected to reach 3 trillion US dollars [1], [2]. It is anticipated that tourist flow will increase steadily by 3-5% annually. Additionally, in the context of a threefold increase in demand for traditional types of tourism worldwide, ecotourism is also gaining popularity, accounting for 7-10% of the global tourism market. It is also significant that the global community has entered a new stage of development in tourism - the post-pandemic stage. Every country is now selecting a tourism industry strategy to overcome the consequences of the pandemic and revitalize tourism [3], [4].

2. Materials and Methods

The results of scientific research conducted by national and foreign scholars who have analyzed the challenges of effective ecological tourism development served as the theoretical and methodological foundation for this study. In preparing the article, various methods were employed, including abstract and analytical reasoning, comparative and factor analysis, indicative and selective observation, comparison, economic-statistical analysis, and other approaches.

Literatur Review

Issues related to the development of ecological tourism are being addressed by scientists in leading scientific centers and higher educational institutions around the world, including: Kotler, Dj.Bouen,Suzen Briggs, F. Maykenz, Dj.Saak, A.E.Xarris, Kas R.A. in the scientific works of such scholars. Among the scientists of our country

N.T.Tuxliyev, I.S.Tuxliyev, M.Q.Pardayev, A.S.Soliyev, B.To‘rayev, M.M.Muxammedov, M.R.Usmonov, D.K.Usmanova, M.T.Alimova, Q.X.Abduraxmanov, N.E.Ibadullayev, O.X.Hamidov, M.Xoshimov, A.N.Norchayev, Islomova R.A,To‘rayev Z.N Certain aspects of the development and management of tourism, including its integral component of ecological tourism, have been investigated in the scientific research of scholars such as those mentioned [5], [6], [7].

3. Results

One of the objectives of our research is to develop the tourism sector in Surkhondaryo Region and enhance its economic attractiveness. Currently, the number of tourists visiting ecotourism sites in Surkhondaryo Region is increasing day by day. This situation necessitates conducting an economic analysis of the tourism sector. In the process of economic analysis, it is advisable to use econometric models. Specifically, correlation dependency - the diversity of factors, their interrelationships, and opposing effects - leads to large-scale changes in variables. This phenomenon is observed not in isolated cases, but in numerous situations, and mass observations are necessary to study it. The relationship between variables x and y is not complete, but rather manifests itself only in average indicators.

It is advisable to select several factors influencing the number of tourists visiting ecotourism sites in Surxondaryo Region and then identify the ones that have a clear impact. The gross regional product per capita of Surxondaryo Region, the volume of services provided to tourists in the region, and the amount of utilized investments were chosen as influential factors.

One of the main tasks of correlation analysis is to examine the existence of relationships between the studied indicators and analyze their quantitative expressions. This is accomplished through the analysis of correlation coefficients. Regression analysis is a set of statistical methods used to investigate the influence of one or more independent variables on a dependent variable. Bearing this in mind, it is appropriate to conduct a correlation and regression analysis of the number of foreign tourists visiting Surxondaryo Region. We will now examine an econometric analysis of the values presented in the figure 1.

Tourism development indicators in Surxondaryo Region for 2010-2023

Years	Number of tourists visiting eco-tourism sites in Surkhandarya region	Surkhandarya region (gross regional product per capita in million soums)	Volume of services provided to tourists in Surkhandaryo Region, million soums	The volume of assimilated investments in Surkhandarya region, million sums
t	Y	X1	X2	X3
2010	1264	1,6	1 928	312,7
2011	1483,2	2,4	3 812	365,4
2012	1865,4	2,9	4 856	437,7
2013	1917,7	3,3	6 756	600,1
2014	2000,8	3,9	8 141	646,8
2015	2246,4	4,7	9 587	773
2016	2644,4	5	11 441	879,1
2017	2896,8	5,8	18 796	1427,1
2018	6410	7,3	27 523	2848,3
2019	23951,2	8,6	34 923	4552,8
2020	24242	9,3	25 412	3792,2
2021	38180,2	11	50 989	4438,7
2022	46421,6	12,4	58 343	4169,4
2023	61141,6	14,4	67 448	6442,3

Figure 1. Tourism Development.

4. Discussion

In Surxondaryo Region, the resultant indicator (Y) represents the number of tourists visiting eco-tourism sites. This indicator is directly influenced by several factors, including: the gross regional product per capita in millions of sums (x1), the volume of services provided to tourists in millions of sums (x2), and the volume of investments utilized in the region in millions of sums (x3).

Table 1. Paired correlation matrix.

The number of tourists visiting eco-tourism sites in Surxondaryo Region Y	1			
Surkhandarya region (gross regional product per capita in million soums) X1	0,892977551	1		
Surxondaryo viloyatida sayyohlarga xizmatlar hajmi, mln. so‘m X2	0,958349513	0,978841322	1	
The volume of investments utilized in Surkhandaryo Region, million soums X3	0,852319973	0,962292399	0,94777329	1

The paired correlation between the number of tourists visiting eco-tourist sites in Surxondaryo Region (Y) and the gross regional product per capita in Surxondaryo Region is 0.89, indicating a very strong relationship. The correlation coefficients are as follows: Y and x1 is 0.89, Y and x2 is 0.95, and Y and x2 is 0.85. All paired correlation coefficients demonstrate very strong relationships. The quantitative relationship between the resultant factor (Y) and other factors can be expressed as a multi-factor regression model.

$Y \circledcirc a0 \circledcirc a1\ x1 \circledcirc a2\ x2 \circledcirc a3\ x3 \circledcirc ... \circledcirc an\ xn \circledcirc \circledcirc$

in here: Y – resultant indicator (dependent variable),

xn – factors influencing the resulting indicator (independent variables),

an – unknown model parameter,

$\circledcirc$ – random variable (residual value).

Before building a regression model, the correlation relationship between the indicators of the dependent and independent variables included in the model is identified. And for this purpose, a pairwise correlation matrix is constructed.

Based on the above, it is appropriate to forecast the impact of these factors using a multi-factor regression model and a trend model. The factors include: (Y) the resulting indicator and the number of visiting foreign tourists, (x1) the volume of gross regional product per capita, and (x3) the volume of investments utilized in the region.

$Y1 \circledcirc a0 \circledcirc a1x2 \circledcirc a2\ x3 \circledcirc a3\ x4 \circledcirc a4\ x5 \circledcirc\circledcirc$

$xn \circledcirc a0 \circledcirc a1t$

The unknown parameters of multi-factor regression and trend models are determined using the least squares method. For this purpose, a system of normal equations is constructed as follows.

$$\begin{cases} a_0 n + a_1 \sum x_1 + a_2 \sum x_2 + \ldots\ldots\ldots + a_n \sum x_n = \sum y \\ a_0 \sum x_1 + a_1 \sum x_1^2 + a_2 \sum x_1 x_2 + \ldots\ldots\ldots + a_n \sum x_n = \sum y x_1 \\ \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \\ a_0 \sum x_n + a_1 \sum x_1 x_n + a_2 \sum x_2 x_n + \ldots\ldots\ldots + a_n \sum x_n^2 = \sum y x_n \end{cases}$$

Using existing indicators, the following regression models were constructed and evaluated based on the coefficient of determination (R2) and Fisher's (F) criteria.

$Y1 \circledcirc 5426 \circledcirc\circledcirc\circledcirc\circledcirc\circledcirc\circledcirc\circledcirc x1 \circledcirc 1,86\ x2 \circledcirc 0,01x3$

($R^2 \circledcirc 0{,}9468$; $F \circledcirc 53{,}4$)

Ushbu chiziqli regressiya tenglamasi orqali har bir omilni tahlilini ko‘rib chiqish mumkin. Ya’ni har qaysi ta’sir etuvchi X omilni 1 foiziga oshishi natijaviy omil Y ni necha foizga olib kelishini aniqlash mumkin.

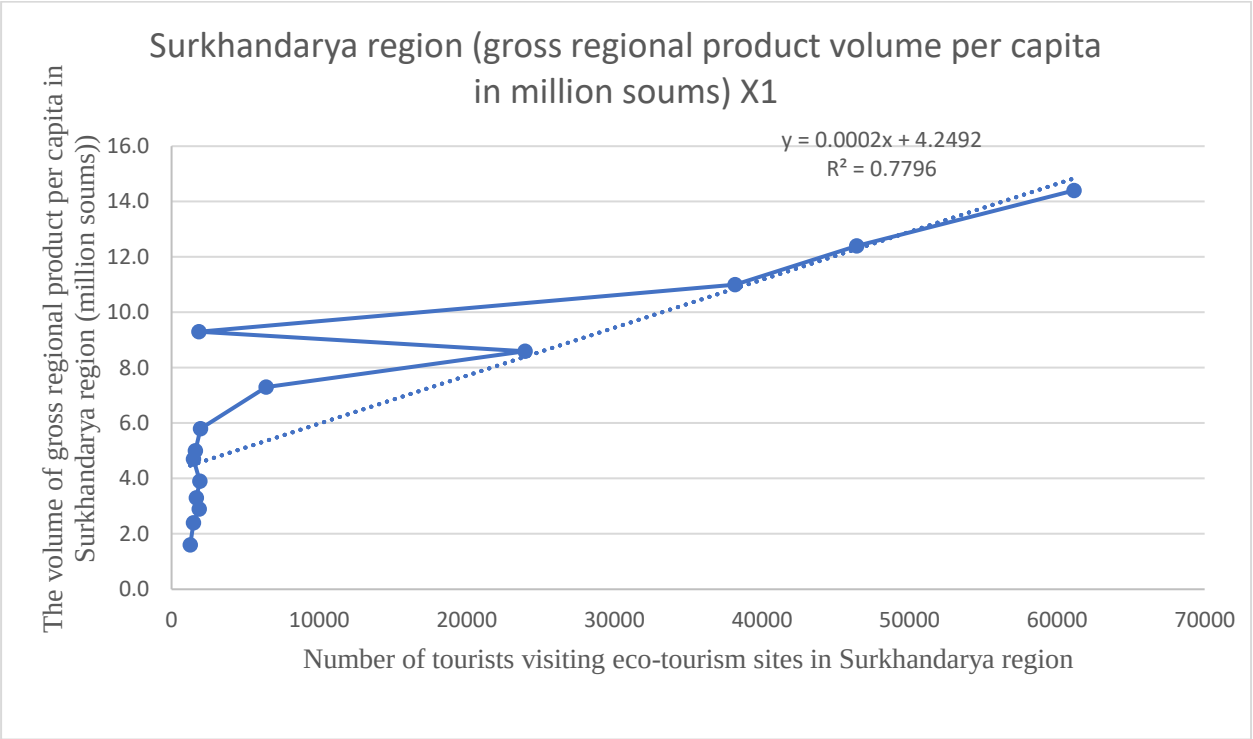

Figure 2. Linear regression equation and diagram depicting the relationship between the number of tourists visiting ecotourism sites in Surxondaryo Region (Y) and the gross regional product per capita of Surxondaryo Region (X1).

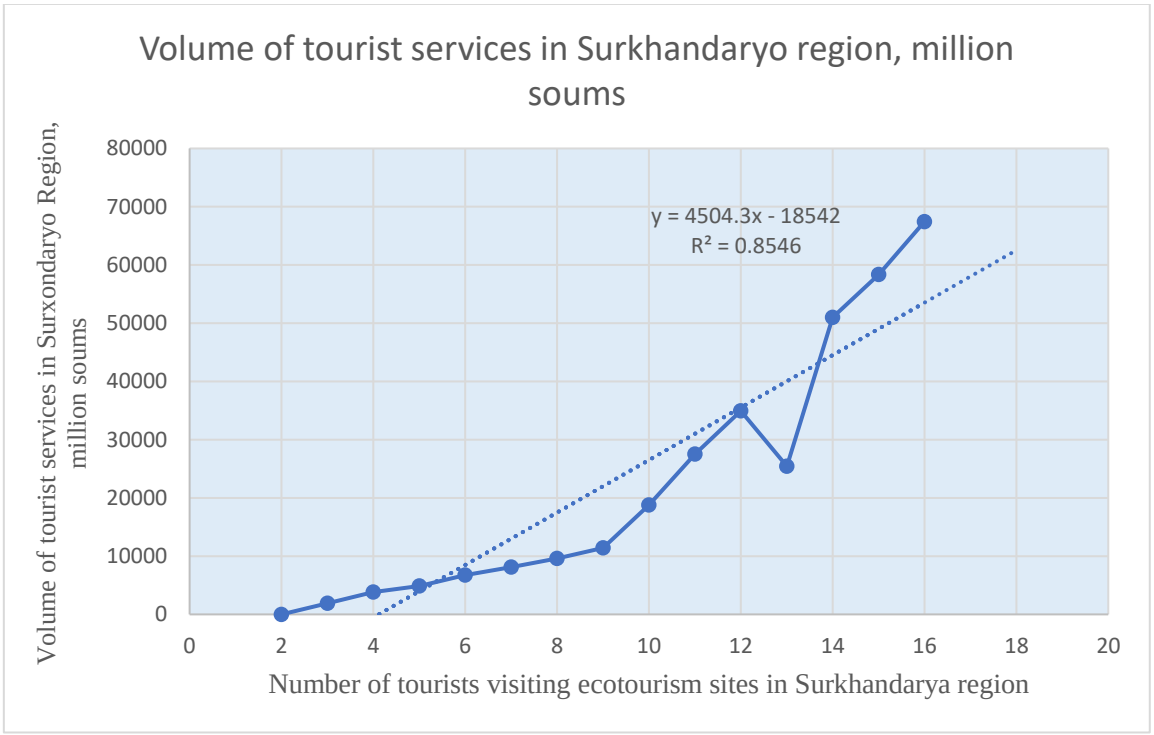

Figure 2. Linear regression equation and diagram illustrating the relationship between the number of tourists visiting ecotourism sites in Surxondaryo Region (Y) and the volume of services provided to tourists in Surxondaryo Region (X2).

Table 2. Forecast of tourism development indicators for Surkhandarya region for 2024-2030.

Years	Number of tourists visiting ecotourism sites in Surkhandarya region	Gross regional product per capita in Surkhandarya region (in million soums)	Volume of tourist services in Surkhandaryo region, million soums	The volume of investments utilized in Surkhandaryo region, million soums
	Y	X1	X2	X3
2010	1264	1,6	1 928	312,7
2011	1483,2	2,4	3 812	365,4
2012	1865,4	2,9	4 856	437,7
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2022	46421,6	12,4	58 343	4169,4
2023	61141,6	14,4	67 448	6442,3
2024	60437,6	13,6	59707,7	5661,9
2025	62565,8	14,5	64526,3	6115,1
2026	67694,0	15,5	69344,9	6568,2
2027	69822,2	16,4	74163,5	7021,4
2028	73950,4	17,3	78982,1	7474,6
2029	74078,6	18,2	83800,7	7927,7
2030	76206,8	19,2	88619,3	8380,9

5. Conclusion

In conclusion, econometric analysis models will help forecast a further increase in the number of visitors to ecotourism sites in Surxondaryo Region.

Forecasting socio-economic processes in Surkhondaryo region involves scientifically anticipating the future based on past experiences, current development patterns and trends, as well as defining goals and objectives for future development. Forecasting indicators hold great practical significance in the theory and practice of regulating socio-economic processes of ecological tourism in Surkhondaryo Region. This field of study serves as the foundation for selecting management solutions and optimal options, while also identifying ways to influence economic processes in the present to achieve future goals.

In 2023, compared to 2010, we can observe that the number of tourists visiting ecotourism sites in Surxondaryo Region increased 48-fold. Additionally, in Surxondaryo Region, the gross regional product per capita (in millions of soums) grew 9 times, the volume of services provided to tourists expanded 35 times, and the amount of investments utilized rose 21 times.

Based on this regression model and the corresponding trend models, forecast values for the main economic indicators of the regional tourism sector have been developed for the period up to 2030 (covering the years 2024-2030).

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