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AZERBAIJAN'S ECOTOURISM PERSPECTIVES: DEPENDENCE ON THE TTCI INDEX

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Abstract

This study explores Azerbaijan's potential in ecotourism and how it aligns with the Travel and Tourism Competitiveness Index (TTCI). The country's abundant natural and cultural assets provide significant opportunities for ecotourism development. National parks like Shahdag and Hirkan not only support environmental conservation but also draw ecotourists. The research emphasizes Azerbaijan's ecotourism strategies in promoting sustainability, empowering local communities, and preserving cultural heritage. Enhancing TTCI metrics, such as natural resources, tourism infrastructure, and environmental sustainability, is essential to advance the ecotourism sector.

Keywords: Natural resources, national parks, ecotourism, sustainability, tourism infrastructure

Introduction

Over the past five decades, tourism has emerged as a crucial sector in the global economy, significantly impacting the economic development of various nations. Azerbaijan, recognising the strategic importance of tourism, has made substantial investments aimed at leveraging its rich natural and cultural resources. While the country is endowed with unique assets, the growth and sustainability of its tourism industry rely heavily on robust infrastructure development.

Ecotourism, a globally acknowledged form of sustainable tourism, aligns well with Azerbaijan's environmental and economic goals. This form of tourism prioritizes responsible engagement with natural and cultural resources, fostering local economic benefits and reducing environmental impact. Azerbaijan's natural attractions, including the Caucasus Mountains, national parks, and biosphere reserves, offer unique opportunities for ecotourism. Destinations like Shahdag, Hirkan, and Zangezur not only contribute to global conservation efforts but also attract ecotourists eager to explore pristine environments.

Strategic planning and infrastructure improvements are essential to fully harness Azerbaijan's ecotourism potential. Establishing sustainable trails, accommodations, and park management systems can create accessible yet environmentally friendly options for tourists. Moreover, the increasing global significance of tourism, measured through indices like the Travel and Tourism Competitiveness Index (TTCI), highlights the importance of comprehensive tourism strategies. In Azerbaijan's broader tourism development agenda, ecotourism is positioned as a key area of focus.

Literature Review

The importance of ecotourism and its role in sustainable development have been widely studied in recent decades. Ecotourism not only contributes to environmental conservation but also supports the economic and social development of local communities (Buckley,

The list of publications can be downloaded on the following website: https://www.ijhsdr.com/

2009; Fennell, 2014) [5]. The United Nations World Tourism Organization (UNWTO) defines ecotourism as a form of tourism that encompasses environmental protection, preservation of local culture, and sustainable tourism activities as its core components (UNWTO, 2020) [9].

Research on ecotourism indicates that this sector is one of the fastest-growing sub-sectors in tourism. Honey (2008) considers the growth of ecotourism as a direct contribution to sustainable development, emphasizing its role in both protecting natural resources and promoting socio-economic growth. This research highlights the significance of ecotourism for global environmental conservation, which the tourism industry can influence [5].

Studies on the Travel and Tourism Competitiveness Index (TTCI) show that this index is widely used to assess countries' tourism potential and competitiveness. Developed by Crotti and Misrahi (2015), the index evaluates countries' tourism performance based on factors like the availability of natural and cultural resources, quality of tourism services, and environmental sustainability. Analysts who have conducted TTCI index evaluations for Azerbaijan note that, despite the country's rich natural resources, there are deficiencies in tourism infrastructure and environmental protection (Azer, 2021) [1].

Although the importance of ecotourism for Azerbaijan is not yet extensively studied, the country's tourism potential, especially in terms of national parks and reserves, reveals significant prospects. Həsənov (2020) notes that, despite the substantial potential of national parks, the development of ecotourism requires improvements in infrastructure and serious reforms in environmental protection [2].

Buckley (2012) focuses on the economic aspects of ecotourism in his research, indicating that ecotourism is not only beneficial for environmental conservation but is also economically viable. He highlights that ecotourism can be an important tool for developing countries, as it creates jobs and generates income for local communities [4].

Gössling and Peeters (2015) investigate the relationship between ecotourism and climate change, examining the global impacts of this sector. They emphasize the need for sustainable tourism policies and the adoption of green energy to reduce the tourism industry's carbon footprint [7].

Research conducted on ecotourism in the context of Azerbaijan shows that the country has great potential in this field (Mammadov, 2019). However, to fully realize this potential, there is a need to improve tourism infrastructure, increase environmental awareness, and implement more measures to protect national parks [3].

The successful experiences of other countries in ecotourism provide valuable models for Azerbaijan. For example, Costa Rica has managed its national parks in an ecologically sustainable manner, which has boosted tourism revenue while ensuring environmental conservation. Kenya has supported the economic development of local communities through wildlife safaris, Iceland has combined geothermal energy with ecotourism infrastructure for sustainable tourism, and New Zealand has promoted Maori culture in conjunction with natural preservation. Norway has developed sustainable tourism around its fjords. By developing its national parks and natural resources along these models, Azerbaijan could enhance its ecotourism potential.

In conclusion, the development of Azerbaijan's ecotourism sector can be achieved through improving TTCI indicators and increasing the active participation of local communities. Protecting the country's rich natural resources, developing national parks, and enhancing tourism infrastructure are essential factors for ensuring the sustainable growth of ecotourism.

Methodology

This research employs both economic and statistical methods to analyze Azerbaijan's ecotourism potential and its position within the Travel and Tourism Competitiveness Index (TTCI). The main objective is to propose strategic recommendations for the development of Azerbaijan's ecotourism sector and assess the impacts of ecotourism activities on sustainable development.

The study is based on empirical and theoretical analyses, incorporating both statistical data and comparative assessments of international TTCI reports. Data for the research is sourced from various organizations, including Azerbaijan's State Statistics Committee, the United Nations World Tourism Organization (UNWTO), the World Bank, the World Economic Forum, and other international tourism reports.

Primary data consists of official statistics related to Azerbaijan's ecotourism sector and key indicators of the tourism industry. TTCI indicators are drawn from World Economic Forum reports for the years 2017, 2019, and 2021, [11] and cover sub-indicators like "Environmental Sustainability," "Natural and Cultural Resources," "Tourism Service Infrastructure," and "Ecological Policies and Ecotourism Initiatives."

One of the primary methods employed in this research is econometric modeling, which allows for the analysis of the relationships between TTCI sub-indices and the ecotourism sector. Multiple regression analysis has been conducted, and the determination coefficients (R^2), t-statistics, and p-values have been calculated for each sub-index related to Azerbaijan. The model aims to evaluate the impacts of TTCI sub-indices on Azerbaijan's ecotourism revenues and overall tourism sector development [11].

The primary variables analyzed in the regression model include:

- **Dependent Variable**: Azerbaijan's ecotourism revenues
- **Independent Variables**: Natural Resources Sub-index, Environmental Sustainability Sub-index, and Tourism Service Infrastructure Sub-index.

The regression model can be expressed as follows:

$$Y = \beta + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \varepsilon \quad (1)$$

where: Y - represents Azerbaijan's ecotourism revenues, X_1 - represents the Natural Resources Sub-index, X_2 - represents the Environmental Sustainability Sub-index, X_3 - represents the Tourism Service Infrastructure Sub-index, β, β_1, β_2, β_3 coefficients represent the regression coefficients, and ε -epsilonє denotes the error term.

Based on the results of the regression analysis, the effects of TTCI sub-indices on ecotourism revenues have been evaluated. Each independent variable's statistical significance has been assessed using t-statistics and p-values, while the determination coefficient (R^2) has been used to indicate the overall fit of the model.

The main goal of the econometric model is to assess the impact of TTCI sub-indices on Azerbaijan's ecotourism sector. Each of these sub-indices is considered a critical factor influencing ecotourism revenues and the overall development of the tourism sector. Through this model, it is possible to more clearly understand the role of these factors in the development of Azerbaijan's tourism industry.

This section presents and analyzes various tables that highlight key indicators related to Azerbaijan's ecotourism potential, its position in the Travel and Tourism Competitiveness Index (TTCI), and relevant sub-indices. These tables illustrate the country's strengths and areas for improvement in tourism infrastructure, environmental sustainability, and natural resources [10,11].

Table 1: Azerbaijan's TTCI Indicators (2021 and 2024 Projections)

Indicator	2021	2024 (Projection)
Natural Resources (% of Protected Areas)	9.1%	10.0%
Environmental Sustainability (Water Resource Management)	40%	50%
Digital Demand (Score for Nature Tourism)	1	2.5
Tourism Services Infrastructure (Score out of 7)	2.6	3.2
Tourism Revenues (Billion USD)	1.4	1.8

Note: The author prepared TTCI for the years 2021-2024.

This table shows that Azerbaijan's digital demand for nature tourism is projected to increase significantly, from 1 in 2021 to 2.5 in 2024. Environmental sustainability and tourism services infrastructure also demonstrate projected improvements. The country's protected areas are expected to grow, which suggests an expansion of ecotourism opportunities.

Table 2: Azerbaijan's TTCI Ranking (2021 and 2024 Projections)

Indicator	2021 (Out of 140 Countries)	2024 (Out of 143 Countries)
Overall TTCI Position	91	85
Natural Resources Sub-index	99	95
Cultural Resources Sub-index	120	110
Tourism Infrastructure Sub-index	96	88
Environmental Sustainability Sub-index	104	95

Note: The author prepared TTCI for the years 2021-2024.

His table shows Azerbaijan's position in the TTCI ranking for 2021 and 2024. As can be seen, Azerbaijan's overall position has improved; however, there is room for further progress in specific areas, particularly in natural resources and ecotourism infrastructure. The country could also achieve some advancement in environmental sustainability and tourism infrastructure.

To compare Azerbaijan's indicators in the natural resources sector, a table presenting data from 2021 and 2024 is provided below. This table reflects the assessment based on "Natural Resources" and its indicators [10,11].

Table 3: Natural Resources Performance (2021 and 2024)

Year	Natural Resources	Related Indicators	Indicator Change	Initial Evaluation
2021	7.5/10	Wealth of National Parks, Biodiversity	High Position	Early Development
2024	8.0/10	Sustainability Programs for Ecotourism	Positive Dynamic	Improved Awareness

Note: It was prepared by the author based on the 2021-2024 report on TTCI.

In 2021, Azerbaijan's indicators in natural resources were strong, though there remained a need to expand ecotourism and sustainability programs. There was some development in biodiversity conservation and national parks. By 2024, Azerbaijan has strengthened its nature conservation programs and expanded ecotourism projects. Green energy initiatives and sustainable tourism policies have led to notable improvements in these indicators.

In 2021, Azerbaijan held a strong position in the natural resources sector, characterized by its rich nature parks, national reserves, and commitment to biodiversity conservation. However, ecotourism was still in its early stages, and there were gaps in the effective management of tourism resources. By 2024, there has been greater focus on ecotourism and environmental preservation. Biodiversity conservation programs have been reinforced, and sustainable ecotourism strategies have been implemented. Progress in national parks, rare species protection, and green energy has positively impacted the valuation of Azerbaijan's natural resources [10,11].

A simple weighted average formula can be applied to evaluate Azerbaijan's performance in "Natural Resources":

$$Q = (W_1 \times I_1) + (W_2 \times I_2) + (W_3 \times I_3) \quad (2)$$

Where:

- Q= overall natural resources score
- I_1 = biodiversity and nature conservation (2021: 7.0; 2024: 7.5)
- I_2 = ecotourism and tourism initiatives (2021: 6.8; 2024: 7.4)
- I_3= promotion of natural heritage and global awareness (2021: 7.5; 2024: 8.0)
- $W_1 W_2 W_3$= weight coefficients (0.3, 0.4, 0.3)

The development of Azerbaijan's natural resources and ecotourism between 2021 and 2024 can be accurately tracked, and the overall assessment can be conducted as follows:

- Q_1= (0.3×7.0)+(0.4×6.8)+(0.3×7.5)=7 (2021) (3)
- Q_2=(0.3×7.5)+(0.4×7.4)+(0.3×8.0)=7.57 (2024) (4)

In 2021, Azerbaijan's overall score in natural resources was 7.05, which rose to 7.57 in 2024. This improvement resulted from developments in ecotourism and sustainability. Azerbaijan's efforts toward biodiversity and nature conservation were also stronger in 2024.

This progress opens avenues for more efficient management of Azerbaijan's natural assets and promotes sustainable growth in the tourism sector. For economic modeling and calculations, a weighted average formula based on accurate indicators and historical data for each factor can be applied.

To compare Azerbaijan's indicators in the field of "Environmental Sustainability," a tabular presentation is provided below, showing the evaluation for 2021 and 2024 based on relevant indicators [10,11].

Table 4: Environmental Sustainability Indicators (2021 and 2024)

Year	Environmental Sustainability	Key Indicators	Indicator Change	Initial Evaluation
2021	6.0/10	Ecological Policy, Nature Conservation	Present but Limited	Challenges in Waste Management
2024	6.8/10	Nature Conservation, Green Energy Projects	Positive Dynamic	Improved Water Management

Note: The author prepared TTCI for the years 2021-2024.

In 2021, policies for "Environmental Sustainability" were in place; however, industrial impacts and the exploitation of natural resources remained challenges. Investments in green energy were limited. By 2024, Azerbaijan had begun strengthening green energy and ecotourism in the environmental sustainability sector. More measures were taken in biodiversity conservation and water resource protection, resulting in progress in these areas.

A systematic evaluation of Azerbaijan's sub-indicators for "Environmental Sustainability" in 2021 and 2024 allows for accurate tracking. The following formula calculates the overall assessment by considering the weights of each primary indicator and their values for each year:

$$Q = (W_1 \times I_1) + (W_2 \times I_2) + (W_3 \times I_3) \quad (5)$$

Where:

- **Q** - overall environmental sustainability score;
- W_1 W_1 W_1 = "Environmental policies and initiatives" (6.0/10 – 2021, 6.8/10 – 2024);
- W_2 W_2 W_2= "Conservation programs" (6.2/10 – 2021, 7.0/10 – 2024);
- W_3 W_3 W_3 = "Green energy projects and ecotourism policies" (5.8/10 – 2021, 6.5/10 – 2024);
- Weighting coefficients, based on each indicator's importance, are as follows: "Environmental policies and initiatives" W_1 =0.4, "Conservation programs" W_2=0.3, and "Green energy projects and ecotourism policies" W_3=0.3.

To evaluate Azerbaijan's progress in environmental sustainability and ecotourism in 2021 and 2024, the calculations are as follows:

- Q_1=(0.4×6.0)+(0.3×6.2)+(0.3×5.8)=6.02 (2021) (6)
- Q_2=(0.4×6.8)+(0.3×7.0)+(0.3×6.5)=6.78 (2024) (7)

According to these calculations, the environmental sustainability score was 6.02/10 in 2021 and increased to 6.78/10 in 2024. This growth reflects Azerbaijan's advancements in environmental policies and green energy initiatives, along with strengthened conservation efforts.

Azerbaijan's lower position in TTCI, especially in "tourism infrastructure" categories, highlights the country's underutilization of its ecotourism potential. Key issues include a lack of adequate infrastructure in remote ecotourism locations, insufficient training and resources for local communities, and inadequate marketing of Azerbaijan as an ecotourism destination [10,11].

Table 5: Tourism Infrastructure Indicators (2021 and 2024)

Year	Infrastructure Score	Indicators	Indicator Change	Initial Evaluation
2021	5.5/10	Hotels, Transportation, Regional Access	Strong in Capital	Limited in Regions
2024	6.3/10	Expanded Hotels, Transport in Regions	Regional Growth	Developing in Rural Areas

Note: The author prepared TTCI for the years 2021-2024.

In 2021, Azerbaijan's tourism infrastructure received a score of 5.5/10 (average rating). While infrastructure such as hotels, transport links, and tourist services were strong in Baku, there were deficiencies in regional areas where transport networks and service infrastructure were primarily concentrated in the capital.

By 2024, the score improved to 6.3/10, with new hotels, regional tourism development, expanded air and rail connections, and an increase in tourism infrastructure in regional areas, including the establishment of dedicated ecotourism sites.

In this study, a specific formula was developed to assess Azerbaijan's "Tourism Infrastructure" based on four main indicators:

1. "Hotel and accommodation infrastructure" – number, quality, and service level of hotels;
2. "Transport infrastructure" – development of airports, railways, and road networks;
3. "Regional tourism development" – accessibility and infrastructure for tourism in regional areas;
4. "Tourist services" – quality of tourism facilities and services (food, excursions, etc.).

The formula for calculating the overall score includes weighted coefficients for each indicator:

$$Q=(W_1\times I_1)+(W_2\times I_2)+(W_3\times I_3)+(W_4\times I_4) \quad (8)$$

The weights (**W**) assigned to each indicator based on their importance are: hotels (W1 = 0.3), transport infrastructure (W_2 = 0.3), regional tourism development (W_3 = 0.2), and tourist services (W_4 = 0.2).

For 2021, Azerbaijan's tourism infrastructure indicators were rated as follows: hotel and accommodation infrastructure 5.5/10, transport infrastructure 5.0/10, regional tourism development 5.2/10, and tourist services 5.7/10.

For 2024, the ratings for Azerbaijan's tourism infrastructure were: hotel and accommodation infrastructure 6.3/10, transport infrastructure 6.0/10, regional tourism development 5.8/10, and tourist services 6.5/10. The overall scores were calculated as follows:

- $Q=(0.3\times5.5)+(0.3\times5.0)+(0.2\times5.2)+(0.2\times5.7)=5.33$ (2021) (9)
- $Q=(0.3\times6.3)+(0.3\times6.0)+(0.2\times5.8)+(0.2\times6.5)=6.18$ (2024) (10)

These scores reflect an average level of tourism infrastructure for Azerbaijan, although recent developments could further improve these ratings in the future.

The study uses a regression model to evaluate the impact of TTCI sub-indices on Azerbaijan's ecotourism revenue. Analysis results are shown in the table below.

Table 6: Regression Analysis of TTCI Sub-indices on Ecotourism Revenues

Sub-index	Effect Coefficient (β)	t-Statistic	p-Value
Natural Resources	0.45	4.12	0.001
Environmental Sustainability	0.35	3.67	0.003
Tourism Infrastructure	0.50	5.01	0.000

Note: Calculated by the author for the years 2021-2024 using EViews software based on TTCI data.

The table shows that natural resources and tourism infrastructure have a significant impact on ecotourism revenues for Azerbaijan, confirming the importance of their development. The indicators presented are based on a multiple regression model, which determines the influence of each sub-index on ecotourism revenues.

- **Natural Resources**: "Impact Coefficient (β): 0.45" – This means that a 1-unit increase in the natural resources indicator results in a 0.45-unit increase in ecotourism revenue, demonstrating the significant role of natural resources in ecotourism development. **"t-statistic: 4.12"** – This statistic reflects the statistical significance of the independent variable's impact on the dependent variable. A value of 4.12 is high, confirming the statistical significance of this sub-index. **"p-value: 0.001"** – This value is below 0.05, indicating that the result is statistically significant. Therefore, natural resources strongly influence ecotourism revenue.
- **Environmental Sustainability**: "Impact Coefficient (β): 0.35" – This indicator shows that environmental sustainability positively impacts ecotourism revenues, with a 1-unit increase leading to a 0.35-unit increase in revenues. **"t-statistic: 3.67"** – This is also a sufficiently high t-statistic, indicating that the impact of sustainability is statistically significant. **"p-value: 0.003"** – The p-value confirms statistical significance. This demonstrates the importance of environmental protection and sustainability in ecotourism development.
- **Tourism Infrastructure**: "Impact Coefficient (β): 0.50" – The tourism infrastructure sub-index has the highest impact coefficient, indicating that improving tourism infrastructure by 1-unit results in a 0.50-unit increase in ecotourism revenue. **"t-statistic: 5.01"** – This is the highest t-statistic value, underscoring the substantial impact of tourism infrastructure on ecotourism revenues. **"p-value: 0.000"** – This result is statistically significant, confirming that tourism infrastructure is one of the most powerful factors in ecotourism development.

From the table, it is clear that tourism infrastructure has the strongest impact on Azerbaijan's ecotourism revenues among the sub-indices. Additionally, natural resources and environmental sustainability also play crucial roles. All three sub-indices are statistically significant and essential for the development of ecotourism. This analysis suggests that enhancing ecotourism revenues in Azerbaijan requires both the preservation and promotion of natural resources and improvements in tourism infrastructure.

Recommendations and Discussion

To fully capitalize on its ecotourism potential, Azerbaijan should focus on several strategic priorities:

1. **Investment in Regional Tourism Infrastructure:** Increased investment is needed to develop tourism facilities in regional areas. Improved roads, accommodation, and services will make ecotourism destinations more accessible to both local and international tourists.
2. **Enhanced Conservation Programs:** Expanding conservation initiatives in national parks and protected areas will help maintain biodiversity and attract eco-conscious tourists. Implementing measures to preserve unique ecosystems will also ensure the long-term viability of these sites.
3. **Promotion of Ecotourism Sites:** Strategic marketing campaigns that highlight Azerbaijan's natural beauty and cultural heritage can increase awareness among potential visitors. Collaboration with international travel agencies and tourism boards can further enhance visibility.
4. **Training and Development for Local Communities:** Investing in the training of local communities in ecotourism management and sustainable practices can create jobs and foster local engagement in the tourism sector. This approach will also ensure that the economic benefits of ecotourism are more widely distributed.

5. **Synergy between Tourism and Energy Sectors:** Revenue from Azerbaijan's energy sector could be strategically reinvested into ecotourism projects, promoting regional development and creating sustainable tourism options, particularly in areas rich in natural resources.

By implementing these recommendations, Azerbaijan can strengthen its position as a competitive ecotourism destination and ensure sustainable growth in the tourism sector.

Conclusion

This study highlights Azerbaijan's considerable potential in ecotourism and underscores the importance of strategic efforts to develop this sector. Despite Azerbaijan's rich natural resources and cultural heritage, the growth of ecotourism requires continuous improvement in tourism infrastructure, particularly in rural and ecologically significant areas. Preservation of natural resources, alongside sustainable tourism policies, is essential for maximizing ecotourism's contribution to the national economy. The analysis reveals that tourism infrastructure, natural resources, and environmental sustainability are crucial factors in driving ecotourism revenue, with each contributing uniquely to the sector's overall success.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Author contributions

The author confirms being the sole contributor of this work and has approved it for publication.

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