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Connecting Tourism and Economic Growth: Rethinking Bangladesh Through AI-Powered Sustainable Tourism

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Abstract: Tourism in Bangladesh has significant potential to improve environmental sustainability, promote cultural preservation, and stimulate economic growth. This study examines how artificial intelligence (AI) can transform the sustainable tourism and hospitality industry in Bangladesh. Using a quantitative approach, the research analyzes tourism revenue from 1995 to 2021, with tourism revenue as the independent variable and GDP per capita as the dependent variable. The results indicate a positive correlation between tourist revenue and GDP per capita, suggesting a beneficial impact on economic growth. Additionally, the Johansen Cointegration method confirms a long-term relationship between these variables. Despite this potential, the industry faces several challenges, including inadequate infrastructure, limited promotion, safety concerns, and issues related to airlines. To address these challenges and promote economic sustainability, the government should implement targeted policies. This study offers recommendations that aim to strike a balance between economic growth, environmental protection, and social responsibility, with a focus on community benefits and cultural preservation.

Keywords: Artificial Intelligence, economic growth, gross domestic product, sustainable tourism, tourism revenue, tourists

I. INTRODUCTION

The tourism industry in Bangladesh plays a vital role in boosting the country's economic growth. It has been a major source of foreign currency. It offers tourists a variety of sights, stunning landscapes, friendly local communities, and mild weather while also ensuring their safety and security [1]. The industry's economic importance is clear in its contribution of 3.02% to the nation's GDP and its role in accounting for 8.07% of total employment in Bangladesh [2]. The growth potential is further highlighted by Bangladesh's rich natural attractions, diverse cultural experiences, and many historical sites [3]. The tourism industry has seen significant growth, with more visitors from both domestic and international sources [4]. Therefore, including top tourist destinations and resources is essential for expanding tourism in Bangladesh. These attractions provide a unique chance to showcase the country's untapped potential to visitors worldwide [5]. Effective tourism management strategies can lead to positive environmental effects, help preserve cultural heritage, and promote cultural exchange [6]. The tourism sector is not only a key economic driver but also a facilitator of cultural exchange and global understanding [7],[8],[9],[10].

The study aims to demonstrate the following objectives, with practical implications for the real-world issues of sustainable tourism in Bangladesh:

- To assess the connection between tourism and economic growth in Bangladesh.
- To examine how sustainability practices impact long-term tourism growth.
- To explore how AI applications, such as smart tourism (e.g., AI-powered virtual tour guides), predictive models (e.g., forecasting tourist influx based on historical data), and data-driven marketing (e.g., personalized marketing strategies based on tourist preferences), can enhance sustainable tourism.
- To create a framework connecting AI-driven sustainable tourism and economic growth in Bangladesh.

This study is timely because sustainable development strategies, which aim to promote economic growth while minimizing environmental impacts, are gaining importance. Historically, tourism growth has closely followed economic prosperity, with GDP serving as a reliable indicator of a destination's financial health and its ability to attract tourists [11], [12].

Relationship between GDP and Tourism Growth

The relationship between economic growth and tourism has been extensively studied across different regions, consistently showing patterns of interaction between international tourism and economic performance. Research indicates that global uncertainties, especially economic and political instability, negatively affect tourism demand [13]. Notably, Antonakakis, Dragouni, Eeckels, and Filis [14] and Fawaz, Rahnema, and Stout [15] have identified a strong connection between tourism and economic growth that goes beyond differences in political systems, economic conditions, and the development of the tourism industry across countries. Their findings underscore the significant role of tourism in driving economic growth. The link between GDP and tourism growth is also affected by economic cycles, with varying results during periods of expansion and recession. For example, while tourism specialization might lessen some positive growth effects, higher tourism receipts generally support economic growth [16]. The degree to which tourism impacts local income levels often depends on a country's stage of development and infrastructure capacity [17].

Can and Gozgor [18] introduce a market diversification index showing how diverse tourism arrivals positively influence economic growth. Panagiotou and Katrakilidis

[19] emphasize the complexity of the tourism-economic growth relationship, considering factors such as tourism specialization, globalization, and financial complexity. Antonakakis, Dragouni, Eeckels, and Filis [14] discovered that tourism-driven growth is particularly significant in developing, nondemocratic countries with low tourism specialization, highlighting the potential of tourism to drive economic growth in these regions. In contrast, bidirectional growth dynamics are more evident in democratic nations with high governance effectiveness. Additionally, Figini and Patuelli [20] and Badulescu, A., Badulescu, D., Simut, and Dzitac [21] analyze the long-term contributions of tourism to GDP, employment, and value added in EU countries, further highlighting the economic importance of tourism.

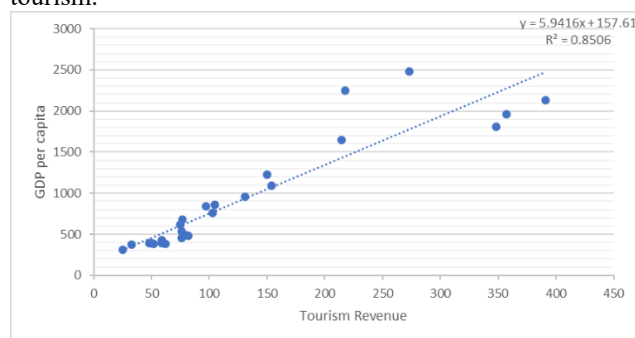


Fig 1 Relationship between GDP per capita and Tourism Growth

Source: Author's generation

Travel and tourism contributed BDT 809.6 billion, or 4.7% of the country's GDP, to the GDP of Bangladesh overall. By 2026, it is expected to have grown by 6.4% a year to BDT 1,596.0 billion, or 5% of the GDP [22]. Bangladesh must concentrate on developing new tourism industries to draw both local and foreign tourists in order to sustain this development rate, though, because traditional historical, cultural, and natural attractions are fiercely competitive in the global tourism market. Figure 1 shows a scatterplot that indicates a positive relationship between economic growth and tourism growth (revenue) in Bangladesh. The correlation r is 0.92.

Relationship between AI adoption and Tourism Growth

AI refers to the simulation of human intelligence processes by machines, especially computer systems, which can perform tasks that typically require human intelligence, such as problem-solving, decision-making, and learning [23], [24]. The adoption of AI in the tourism industry marks a significant shift, enabling more personalized, efficient, and environmentally friendly experiences. This transformation is well-documented in the literature. For example, Huang, Ozturk, Zhang, de la Mora Velasco, and Haney [25] and Ku and Chen [26] highlight the significant impact of AI on both economic outcomes and customer satisfaction in the tourism industry. Furthermore, as noted by Ansari et al. [27], AI reduces operational costs and helps

develop new business models, making this a transformative period for the industry. AI has the potential to transform the industry from traditional to innovative tourism, meeting the demands of modern travelers for more customized and sustainable travel experiences [28].

Moreover, AI technologies, from chatbots to predictive analytics and personalized travel solutions, are essential in improving customer service by meeting individual needs and promoting sustainability through adaptable practices. Consequently, tourist satisfaction is notably enhanced [27]. This development highlights AI's widespread influence in both digital and real-world interactions within the tourism industry. Beyond virtual exchanges, AI also plays a key role in strengthening digital connectivity during face-to-face experiences, thereby enriching the hospitality environment. For example, [29] argues that AI is crucial for enhancing service standards, streamlining operations, and tailoring travel experiences. This integration of technology and tourism has transformed the industry, making AI a major driver of growth [30]. As AI capabilities grow, smart tourism—focused on personalized experiences and operational efficiency—has increasing potential [31]. However, despite its benefits, AI implementation also presents challenges. Stakeholders must carefully balance technological advances with maintaining human interaction in tourism [32]. As [28] notes, ongoing developments in AI and related technologies are likely to accelerate the adoption of intelligent automation in the tourism sector, further emphasizing AI's role in industry growth. Based on this substantial research, we contend that AI adoption is crucial for advancing tourism development, illustrating the intersection of technological innovation and industry evolution. Artificial Intelligence (AI)-powered tourism has a huge and mainly unrealized potential to support economic progress as Bangladesh plots its path to becoming a developed country. A favorable, if currently weak, association has been found between tourism earnings and the country's economic prosperity. A deliberate move toward AI-powered sustainable tourism, however, may realize the industry's full potential and turn it into a major engine of economic growth.

II. METHODOLOGY

The study uses time series data from 1995 to 2021 to examine the impact of tourism revenue on economic growth in Bangladesh. Tourism revenue serves as an independent variable, GDP per capita (an indicator of economic growth) as a dependent variable, and the number of tourists as a control variable. Using econometric software EViews SV 12, the study employs a quantitative approach, specifically the Ordinary Least Squares (OLS) model, to analyze the data. The Total observations are 27. For the ease of discussion and analysis, the Log-Lin model is reproduced as follows:

$$LGDP_{pct} = \beta_1 + \beta_2 TOT_t + \beta_3 TREV_t + U_t \text{-----}(1)$$

Where LGDPpc denotes the Natural Log of GDP per capita, TOT means the Total Number of Tourists, and TREV means Tourism Revenue.

III. RESULTS AND DISCUSSIONS

TABLE I

ESTIMATION RESULTS OF OLS

Dependent Variable LGDPpc

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	6.098477	0.163801	37.23102	0.0000
TOT	-1.25E-06	7.23E-07	-1.724601	0.0975
TREV	0.005886	0.000521	11.28756	0.0000
R-squared = 0.841567				
Adjusted R-squared = 0.828364				
F-statistic = 63.74174				
Probability = 0.000000				

Source: Author's calculation using EViews SV 12

The estimation of the equation by direct OLS gives the following integration equation:

$$LGDPpc = 6.098477 - 1.25E-06 TOT + 0.005886 TREV - (2)$$

Table 1 indicates that the slope coefficient is statistically significant at the 5% level, and the relationship between GDP per capita and tourism revenue is positive. It shows that a 1% increase in tourism revenue in Bangladesh leads to a 0.005% rise in GDP per capita, and its t-value is highly significant. However, there is a negative and insignificant relationship between GDP per capita and the total number of tourists.

Results of Unit Root Tests

The study used the Phillips-Perron (PP) test for all variables shown in Table 2, which employs the test statistic to assess the null hypothesis of a unit root in GDP per capita, total number of tourists, and tourism revenue. The results in Table 2 show that all variables are stationary in their first differences, indicating they are all integrated of order I(1).

TABLE II PP TEST RESULTS

Variable	PP Test		Order of Integration
	Level	First Difference	
LGDPpc	1.49 (0.99)	-3.83 (0.000)	I(1)

TOT	-2.66 (0.09)	-5.69 (0.000)	I(1)
TREV	-1.32 (0.60)	-5.14 (0.000)	I(1)

Source: Author's calculation using EViews SV 12

Cointegration Test

Since the variables are found to be I(1), the cointegration method is appropriate for identifying their long-term relationships. Maximum Eigenvalue and Trace statistics are used to assess the number of cointegrating vectors. The results of these tests are presented in Tables 3 & 4. The Johansen cointegration test determines whether a long-term equilibrium relationship exists between LGDPpc, TOT, and TREV. The results of this test are detailed in Table 3. The theory suggests that LGDPpc, TOT, and TREV should be cointegrated. The Johansen cointegration test employs a 1-to-1 lag, meaning the model starts with one lag of one period, as shown in Tables 3 & 4.

RESULTS OF JOHANSEN CO-INTEGRATION TEST

TABLE III Unrestricted Cointegration Rank Test (Trace)

Hypothesized No of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob**
None *	0.584260	34.03943	29.79707	0.0153
At most 1	0.296654	12.09706	15.49471	0.1523
At most 2	0.123638	3.299389	3.841465	0.0693

Trace Test indicates 1 cointegration equation (s) at the 0.05 level

TABLE IV Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob**
None *	0.584260	21.94237	21.13162	0.0384
At most 1	0.296654	8.797669	14.26460	0.3034
At most 2	0.123638	3.299389	3.841465	0.0693

Max-Eigenvalue Test indicates 1 cointegration equation(s) at the 0.05 level

Source: Author's calculation using EViews SV 12

Considering the linear deterministic trend, a lag interval in first differences up to 1, and the MacKinnon-Haug-Michelis (1999) p-values, we see that the null hypothesis of no cointegrating relationship can be rejected at the five percent level using the Trace statistic (trace statistic = 21.94237 > critical value = 21.13162, p-value: 0.0384), indicating that there is one linear combination of these non-stationary variables in their stationary form. The Trace statistic identified one cointegrating vector, and the Maximum Eigen statistic also detected one. As a result, the study used one cointegrating vector to establish the long-term relationships among the variables.

TABLE V PAIRWISE GRANGER CAUSALITY TESTS

Null Hypothesis	Obs	F-Statistic	Prob.
TOT does not Granger-cause LGDPpc		0.15293	0.8592
LGDPpc does not Granger-cause TOT	25	0.10491	0.9009
TREV does not Granger-cause LGDPpc		3.61229	0.0458
LGDPpc does not Granger-cause TREV	25	6.13320	0.0084
TREV does not Granger-cause TOT		0.00760	0.9924
TOT does not Granger-cause TREV	25	1.09527	0.3537

Source: Author's calculation using EViews SV 12

According to Table 5, a bidirectional causal relationship is confirmed between economic growth and tourism revenue. Tourism revenue does not Granger-cause GDP per capita, which has been rejected at a 5% significance level based on the model. Similarly, GDP per capita does not Granger-cause Tourism revenue, which has also been rejected. These results imply that tourism revenue Granger-causes economic growth, and economic growth Granger-causes tourism revenue.

IV. RECOMMENDATION

A. Rethinking Bangladesh with AI-Powered Sustainable Tourism

In Bangladesh, integrating Artificial Intelligence (AI) into the tourism sector is still in its early stages. However, several initiatives are underway to harness AI's potential for enhancing sustainability and economic growth. According to the World Economic Forum, Bangladesh ranked 109th out of 119 countries in the Travel and Tourism Development Index 2024, with a score of 3.19. In comparison, the USA ranked 1st with a score of 5.24, where a score of 1 is the worst and 7 is the best.

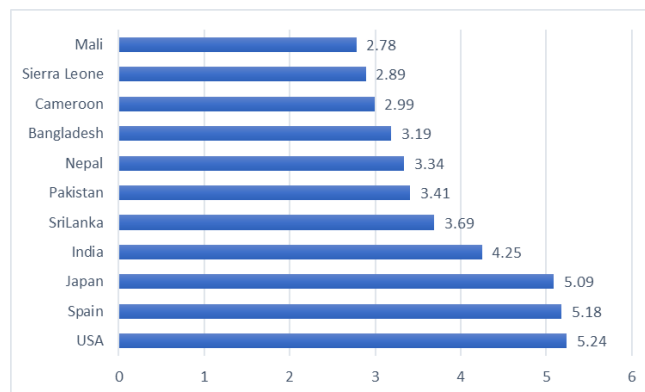


Fig 2 Status of Travel and Tourism Development Index 2024

Source: World Economic Forum

B. Challenges and Strategies to overcome challenges to adopting AI-powered sustainable tourism

Bangladesh faces various challenges in establishing an AI-driven sustainable tourism framework, including technological, environmental, and socio-economic factors, as outlined in Table 6.

TABLE VI

CHALLENGES AND STRATEGIES TO OVERCOME CHALLENGES TO ADOPTING AI-POWERED SUSTAINABLE TOURISM

Challenge	Solution
Data scarcity	A national tourism data platform that integrates government and private data.
Skill gaps	AI and digital literacy training for tourism workers and local communities.
High costs	Attract international green funds and sustainable development grants.
Governance gaps	Establish a National AI Tourism Task Force.
Community resistance	Community-driven design of AI platforms and profit-sharing models.

Source: Author's findings

C. Sustainable Tourism Framework for Bangladesh

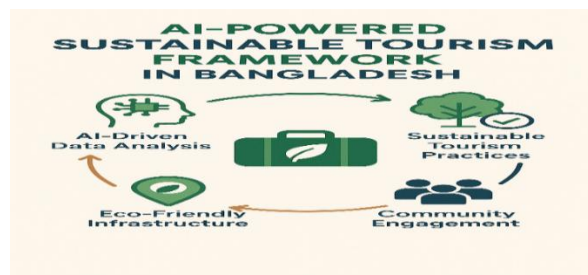


Fig 3 AI-Powered Sustainable Tourism Framework in Bangladesh [Source: Author's generation using AI]

1. Smart Tourism Planning Through AI

Use AI to predict visitor trends based on seasonality, festivals, and global travel patterns. This method helps prevent overcrowding and improves resource management.

For example, AI can track tourist flows at Cox's Bazar to reduce overcrowding and lessen environmental impact.

2. AI-Enhanced Sustainable Experiences

AI-driven applications can provide personalized recommendations for eco-friendly itineraries, local experiences, and low-carbon transportation options tailored to individual visitors. For example, AI can be leveraged to promote nature-based tourism initiatives, such as eco-tours in the Sundarbans and solar-powered boat tours through the wetlands of Sylhet.

3. Environmental Monitoring and Conservation

Artificial intelligence can effectively monitor water quality, forest health, and wildlife in tourist destinations by providing real-time alerts and predictive maintenance for natural sites. Implementing AI platforms that estimate the carbon footprint of tourism activities and promote low-emission options, while also incorporating incentives for environmentally conscious choices, is essential.

4. Data-Driven Policy and Investment

Artificial Intelligence (AI) can analyze the economic, social, and environmental effects of tourism projects, helping policymakers prioritize investments that provide high returns (ROI) and support sustainability. Additionally, AI tools can predict potential crises, such as natural disasters, overcrowding, or environmental damage, and suggest strategies to address these challenges, encouraging sustainable growth in the tourism industry.

5. Capacity Building and Community Engagement

Empower local businesses by using AI-powered tools to improve bookings, manage resources, and support sustainable services. Use AI to connect tourists with local guides, artisans, and eco-projects, ensuring the economic benefits go directly to the communities. Additionally, AI-driven chatbots and recommendation systems can educate visitors about sustainable practices, helping to reduce environmental and cultural impacts.

V. CONCLUSION

The intersection of tourism and economic growth presents Bangladesh with a unique opportunity to reshape its development strategy. The study demonstrated a positive relationship between tourism and economic growth through a scatterplot. Quantitative analysis indicates that tourism revenue has a positive and significant impact on economic growth. By adopting AI-driven sustainable tourism, the country can improve visitor experiences, protect its rich cultural and natural heritage, and ensure that financial benefits are shared fairly. AI technologies support predictive planning, enhance resource utilization, and provide personalized, eco-friendly travel experiences, positioning Bangladesh as a competitive and responsible tourism destination.

Rethinking tourism from this viewpoint encourages economic growth while supporting environmental sustainability and social equity goals. Combining AI with sustainable tourism creates a promising future for

Bangladesh, where innovation and responsible development work together to build a resilient and thriving economy.

Bangladesh can boost economic growth by adopting AI-driven sustainable tourism while preserving its cultural and natural heritage. AI enhances strategic planning, personalized experiences, and efficient resource management, making tourism both profitable and sustainable. This new approach to tourism helps position Bangladesh as a responsible, innovative, and competitive destination, offering long-term economic, environmental, and social benefits. However, implementing AI in Bangladesh's tourism industry presents challenges such as data privacy concerns, a lack of technical expertise, and significant investment needs. Overcoming these obstacles is crucial for the successful adoption of AI solutions. In summary, although AI applications in Bangladesh's tourism sector are still in their early phases, the efforts mentioned above show increasing recognition of AI's potential to transform the industry. With continued investment and collaboration, AI can become a key driver of sustainable and inclusive tourism in Bangladesh.

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