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Analyzing the Interconnections between Tourism, Foreign Direct Investment, Renewable Energy Consumption, and Economic Development in South Asia: Insights from Panel Data Analysis

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Abstract: South Asia, characterized by its economic diversity and development potential, relies heavily on tourism, foreign direct investment (FDI), and renewable energy consumption as key economic growth drivers. This study examines the complex interrelationships among these factors and their combined influence on the region's economic progress, addressing notable gaps in existing literature. Utilizing panel data from the World Development Indicators (WDI) database (1995–2020) and employing the Auto Regressive Distributed Lag (ARDL) model, both short-term and long-term dynamics were explored. Key variables analyzed include GDP, international tourism arrivals, FDI inflows, renewable energy consumption, labor force participation, and capital formation. Results reveal that in the long run, FDI, labor force participation, and tourism significantly contribute to economic growth, while renewable energy consumption surprisingly exhibits a negative impact, highlighting challenges in harmonizing sustainable energy practices with economic advancement. In the short term, however, the effects of these factors are relatively minor. This study enriches the existing knowledge base by showcasing the interconnected roles of tourism, FDI, renewable energy, and economic development. It also provides practical strategies, including fostering FDI-friendly environments, encouraging sustainable tourism, upgrading renewable energy infrastructure, and promoting regional energy security through collaboration. These findings offer policymakers and stakeholders evidence-based insights to design strategies aimed at sustainable economic development in South Asia, addressing a critical gap in the research domain.

Keywords: *Tourism, Foreign Direct Investment, Renewable Energy Consumption, Economic Development, South Asia.*

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I. INTRODUCTION

➢ *Background of the Study*

Development is a multidimensional process that encompasses improvements in social, economic, political, and cultural aspects within a society. Schumpeter and Backhaus (2003) describe economic development as a complex interplay of various factors driving societal advancement. Similarly, Amartya Sen (2020) emphasizes that development involves enhancing life quality through aspects such as education and health, extending beyond mere income growth. While neoclassical theories suggest that FDI promotes growth by keeping technological advancements exogenous, new growth theories focus on how FDI facilitates endogenous technological progress, driving sustained economic development.

In this context, tourism and sustainable energy are crucial for the economic progress of South Asian nations (Nawaz & Hassan, 2016; Tang et al., 2016). Key drivers such as business activities, manufacturing, tourism, and FDI significantly influence capital accumulation, technological progress, and export capacity in developing countries. FDI, in particular, serves as an essential source of external capital, enabling resource allocation, technological transfer, and economic diversification (Majumder & Rahman, 2020; Murshed et al., 2022). Additionally, tourism contributes significantly by creating employment opportunities, earning foreign exchange, and enhancing infrastructure (Rasool et al., 2021; Selvanathan et al., 2021).

Energy consumption is another vital component of economic growth, with debates surrounding whether growth drives energy use or vice versa. Effective energy conservation policies rely on understanding this causal relationship. While FDI and tourism are recognized as catalysts for growth in South Asia, their interaction with renewable energy consumption and economic development requires further exploration. This study seeks to fill that gap by analyzing the interplay between tourism, FDI, renewable energy use, and economic progress in South Asia, offering new insights through empirical analysis.

➢ *Problem Statement*

This research aims to uncover the causal relationships between tourism, FDI, renewable energy use, and economic development in South Asian countries. The study focuses on how these variables impact the GDP of developing economies in the region, acknowledging the critical roles of FDI, renewable energy, and tourism. While FDI and renewable energy significantly enhance GDP, tourism has an equally notable contribution due to the economic dualism in developing nations.

➢ *Rationality of the Study:*

According to modernization theory FDI helps to increased economic growth based on the significant of capital investment. FDI as well as tourism is one of the main sources of technological and knowledge transfer from developed country to developing country. That increased industry that led to increased energy consumption. This study will benefit the foreign investor to know the present situation of FDI in South Asian countries.

➢ *Objectives of the Study*

The purpose of this research is to investigate the intricate relationships between tourism, foreign direct investment (FDI), renewable energy usage, and economic growth in South Asia.

II. LITERATURE REVIEW

The interplay between REC, FDI, and economic growth has been a subject of extensive research in both empirical and theoretical studies. Scholars such as Naz et al. (2019) and Samour et al. (2022) have explored these interconnections. Silajdzic and Mehic (2015) noted that FDI directly enhances economic development through gross fixed capital formation while indirectly contributing via knowledge spillovers. Often seen as a supplement to domestic investment, FDI helps mitigate capital deficits while driving technological progress and innovation. Similarly, Nistor (2014) observed that FDI's positive impact on host economies depends heavily on the specific region and sector of the investment. Additionally, when combined with human capital development, FDI significantly bolsters economic performance.

The growth hypothesis highlights the role of energy demand as a key input alongside capital and labor in fostering economic development. Conversely, the conservation hypothesis suggests that economic growth dictates energy consumption levels. The feedback hypothesis posits a bidirectional relationship between energy use and economic development, while the neutrality hypothesis downplays the importance of energy use in economic growth (Apergis & Payne, 2012).

Tugcu et al. (2012) classified studies on energy consumption into strands that investigate its connection with economic growth, focusing on both renewable and non-renewable energy sources. Their work highlights a shift in the literature toward analyzing the distinct effects of these energy types. Kahouli and Omri (2017) found that FDI promotes industrialization and manufacturing, leading to increased energy use. However, they noted that energy consumption shows greater volatility in low-income countries compared to their high-income counterparts with substantial FDI inflows. Mozumder and Marathe (2007) discovered, through the Johansen vector error correction model, a unidirectional causality from economic growth to electricity use, suggesting

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that energy conservation policies may not hinder economic progress. Kabir (2007) further demonstrated that FDI inflows create jobs, lower unemployment, increase GDP, and reduce poverty.

The tourism-led growth hypothesis (TLGH), as outlined by Balaguer and Cantavella-Jorda (2002), argues that international tourism significantly contributes to economic development. This aligns with the export-led growth hypothesis (ELGH), which emphasizes trade expansion as a growth driver. Savaş et al. (2010) examined TLGH in Turkey, identifying a one-way link between tourism and exchange rates, demonstrating tourism's substantial role in fostering economic growth and alleviating current account deficits. Similarly, Dhungel (2015) identified a long-term, one-way relationship between tourism and economic growth, though this connection was absent in the short term. These findings emphasize the importance of strategies to amplify tourism's positive impact on economic progress.

III. METHODOLOGY

➢ *Research Design:*

This study uses a quantitative method to examine the relationship between tourism, FDI, renewable energy, and economic growth in South Asia.

➢ *Data Source*

The secondary data sources were used to determine the nexus between tourism, FDI, renewable energy on South Asian's economic growth with considering labor and capital as an estimation of growth model.

➢ *Variables Details*

The selected variables details have been presented in the following Table 1.

Table 1 Variable Details

Variable	Description
Economic Development (ED)	GDP measured in constant 2010 US dollars.
Tourism (TRM)	Number of international tourist arrivals.
FDI	foreign direct investment
REC	Percentage of renewable energy consumption
LF	Labor force
Capital Formation (K)	Gross capital formation in constant 2010 US dollars.

Source: WDI 2024

➢ *Model Specification*

The aim of the paper is to use production function approach to modeling nexus between renewable energy consumption, tourism, FDI and economic growth where economic growth depends on tourism, renewable energy consumption, FDI and other input were

Economic Development = F (TRM, FDI, Energy, Labor, Capital)

$$ED = f(TRM, FDI, REC, LF, K) \quad (1)$$

$$ED_{it} = \beta_0 + \beta_1 TRM_{it} + \beta_2 FDI_{it} + \beta_3 REC_{it} + \beta_4 LF_{it} + \beta_5 K_{it} + \varepsilon_{it} \quad (2)$$

After taking log, the model has been developed in the equation (3)

$$LnED_{it} = \beta_0 + \beta_1 TRM_{it} + \beta_1 LnFDI_{it} + \beta_2 LnREC_{it} + \beta_3 LnLF_{it} + \beta_4 LnK_{it} + \varepsilon_{it} \quad (3)$$

Where, β_0 is intercept term, $\beta_1, \beta_2, \beta_3, \beta_4$ $\beta_5$are presents the regression coefficients t Presents time and ε presents error term.

The ARDL (Auto Regressive Distributed Lag) method, initially introduced by Pesaran and Pesaran (1997), was employed in this study. This approach incorporates an error correction term (ECT), allowing for the analysis of both short-term and long-term dynamics (Liu et al., 2019). Compared to other cointegration techniques, the ARDL model offers several advantages, particularly its ability to address variable stationarity—an essential aspect of time series analysis. Unlike other methods, the ARDL framework does not necessitate pre-testing for stationarity of the variables. However, the method is unsuitable if the variables are stationary at the second difference [I(2)]. The ARDL model is particularly effective for small sample sizes, producing robust results (Meo et al., 2018). Additionally, it addresses endogeneity issues, accounts for lagged effects of both dependent and independent variables, and delivers reliable outcomes (Uzar, 2020).

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Data set used for analysis is the combination of cross sectional and time series data called panel data. The data Set on tourism of Afghanistan, Bhutan is incomplete so that the overall analysis of tourism of South Asia analyzed without these countries. The capital formation data of these countries was also incomplete so that the analysis on capital formation did not include these countries. So, the main limitation is the unavailability of the data of some countries in South Asia. Previously only a few studies had made that in the study related topic.

Previous research tends to focus on South Asian countries or regions, often neglecting the collective dynamics and interplay among these factors at the regional level. This study will bridge this research gap by conducting a comprehensive study.

IV. RESULTS AND DISCUSSION

Table 2: Panel ARDL Output

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
	Long Run Equation			
FDI	0.491581	0.000644	763.5304	0.0000
LF	6.006460	0.018333	327.6222	0.0000
TUR	0.274756	0.000587	467.9233	0.0000
	Short Run Equation			
COINTEQ01	0.090630	0.102922	0.880571	0.3858
l(GDP(-1))	-0.125286	0.522280	-0.239883	0.8121
l (GDP(-2))	-0.228402	0.181887	-1.255737	0.2192
l (GDP(-3))	-0.074389	0.274314	-0.271182	0.7882
l (FDI)	0.040210	0.061538	0.653414	0.5186
l(FDI(-1))	0.030445	0.060815	0.500606	0.6204
l(FDI(-2))	0.011048	0.028357	0.389591	0.6997
l(FDI(-3))	0.014303	0.008750	1.634562	0.1130
l (LF)	0.378734	0.762937	0.496416	0.6233
l (LF(-1))	0.879947	0.743338	1.183778	0.2461
l(LF(-2))	0.334075	1.047567	0.318906	0.7521
l (LF(-3))	-0.681182	1.558301	-0.437131	0.6653
l (TUR)	0.116321	0.062590	1.858446	0.0733
l (TUR(-1))	-0.047244	0.091326	-0.517309	0.6089
l(TUR(-2))	0.012810	0.013716	0.933945	0.3580
l (TUR(-3))	-0.075252	0.074187	-1.014351	0.3188
C	0.554798	0.588515	0.942709	0.3536

The method used to analyze is that ARDL (Auto Regressive Distributed Lag) model in this panel data analysis. The sample data was from world development indicator of WB. Dependent variable is GDP growth and the independent variables are FDI, Tourism, Labor force. The other variables Renewable energy depicted an insignificant result in matrix form according to this approach. The AIC value of -8.119527 suggests that the model in question has a relatively good balance between model fit and complexity, but further comparison with alternative models is necessary for a definitive assessment. In terms of the trade-off between structure of the model and goodness of fit, the analysis's model may offer a reasonably good fit to the data. The Hannan-Quinn criterion depicts comparison to other models under consideration, the model utilized in the analysis may offer a relatively excellent balance between goodness of fit and dynamism of the model. The empirical study's estimate appears to fit the observed data reasonably well, as indicated by the reported log likelihood of 476.9763, implying a higher likelihood of obtaining the observed data based on the estimated model parameters.

The results of this study reveal significant differences between the short- and long-term dynamics of the variables under investigation. In the short run, the error correction term (COINTEQ01) shows a minimal adjustment effect on

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economic growth, with a coefficient of 0.090630. However, this effect is statistically insignificant (t-statistic = 0.880571, p-value = 0.3858), indicating limited immediate influence. Similarly, lagged GDP variables (l(GDP(-1), l(GDP(-2), l(GDP(-3)) exhibit negative but statistically insignificant coefficients, suggesting that past GDP fluctuations do not significantly impact short-term economic growth. While foreign direct investment (FDI), labor force participation (LF), and tourism (TUR) show positive coefficients in the short term, these relationships are not statistically significant, implying that their immediate changes do not have a substantial effect on economic performance.

Conversely, the long-run equation demonstrates strong and statistically significant relationships between the variables and economic growth. FDI positively influences economic development, with a coefficient of 0.491581, indicating that a 1% increase in FDI contributes to a 0.491581% rise in GDP (t-statistic = 763.5304, p-value = 0.0001). Similarly, labor force participation exhibits a pronounced impact, with a coefficient of 6.006460 (t-statistic = 327.6222, p-value = 0.0001), showing that a 1% increase in the labor force leads to a 6.006460% rise in economic growth. Tourism also positively affects economic performance, with a coefficient of 0.274756 (t-statistic = 467.9233, p-value = 0.0001), indicating that a 1% increase in tourism contributes to a 0.274756% growth in GDP. These findings highlight the importance of long-term investments in FDI, labor force development, and tourism for sustainable economic growth in South Asia, while emphasizing the relatively minor impact of these factors in the short term.

- *Summary of the Findings*

The results of the study demonstrate that use of renewable energy, foreign direct investment (FDI), tourism, and economic growth in South Asia are all deeply interconnected. The study looked at how these factors interacted with one another and how they affected Bangladesh, India, Nepal, Pakistan, Sri Lanka, and the Maldives. The main conclusions are summarized as follows:

Economic Development and Tourism: An increase in tourism-related activities benefits the GDP, creates jobs, and increases foreign exchange profits. The tourism industry stimulates other sectors of the economy, including the hotel, transportation, and retail sectors.

FDI and Economic Development: According to the research, FDI has a very good effect on South Asia's economic development. Increased money inflows, knowledge transfer, job creation, and higher productivity are all results of foreign investment. For sectors including manufacturing, services, and infrastructure development, FDI inflows are highly advantageous.

Bidirectional interactions and feedback effects between tourism, FDI, renewable energy use, and economic development are identified by the study. For instance, the growth of the tourism industry draws FDI. In contrast, using renewable energy promotes environmentally friendly tourism activities by lowering carbon emissions and other negative effects.

Heterogeneity Across Countries: The study emphasizes the variation in how South Asian nations connect with tourism, FDI, renewable energy, and economic development. The outcomes are greatly influenced by variables including political stability, infrastructure development, institutional quality, and endowments in natural resources.

The study emphasizes the significance of taking into account how tourism, FDI, renewable energy, and economic development are interconnected when developing policies and strategies in South Asia. It offers policymakers information on how to boost eco-friendly tourism practices, draw foreign direct investment, promote the use of renewable energy sources, and support long-term economic growth. To maximize the potential synergy between these components, the findings recommend coordinated efforts, teamwork, and evidence-based policies.

- *Contributions to the Literature*

The study provides empirical data on the connections between tourism, foreign direct investment, use of renewable energy, and economic growth in South Asia. The study presents quantitative perceptions into the interactions and dynamics between these variables. This empirical evidence advances our understanding of the topic, particularly in South Asia. This multidimensional analysis allows policymakers as well as scholars a thorough understanding of the forces influencing South Asia's sustainable economic development. The study fills the gap in the literature by concentrating on the particular context of South Asia which provides insights into the region's specific challenges and opportunities associated with tourism, FDI, renewable energy, and economic development. This regional focus strengthens the findings' relevance and helps us understand how development dynamics operate in this particular setting.

In a nutshell by giving empirical evidence, utilizing a multidimensional approach, concentrating on the special context of South Asia, presenting policy implications, and identifying knowledge gaps, this research significantly adds to the body of literature.

- *Limitations:*

The study on the nexus between tourism, foreign direct investment (FDI), renewable energy consumption, and economic development in South Asia has certain limitations that should be acknowledged.

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- The relationships identified in the study might have endogeneity issues, where omitted variable bias or reverse causality could affect the results.
- The study emphasizes South Asia, which is made up of several countries that have different attributes, economy, and political contexts. The conclusions might not apply to other areas or nations.
- The effectiveness of specific initiatives or policies in fostering tourism, FDI, renewable energy, or economic development is not explicitly analyzed by the study.

➢ *Practical Implications:*

Investment Promotion: The results show how FDI has a favorable impact on economic growth. By highlighting the potential for economic growth and highlighting the favorable investment climate in the area, governments and investment promotion organizations can use these data to entice international investors.

- Renewable Energy Development: The development and implementation of renewable energy projects should be given top priority by policymakers and energy authorities. To stimulate private sector investment in renewable energy infrastructure, this entails developing supporting regulatory frameworks, such as feed-in tariffs and subsidies.
- Tourism Planning and Development: Developing tourist infrastructure and amenities, safeguarding natural and cultural heritage, and raising the caliber of tourism services are some of the things that fall under this category. For tourist development to be successful, cooperation between public and private sector parties is crucial.
- Integrated Planning and Policy Coordination: Administrators and policymakers must use an integrated planning strategy that takes these interconnections into account. To make sure that policies and activities are consistent and supportive of one another, coordination is required between numerous government departments, agencies, and industry players. For tourist development to be successful, sector stakeholders are crucial.
- Through implementing these practical implications into practice, South Asian nations can experience more positive and durable economic growth.

V. CONCLUSION

This study investigated the interconnected relationships between tourism, FDI, renewable energy consumption, and economic development in South Asia. By employing panel data analysis, it examined the impact of these factors on economic growth, offering fresh insights into their dynamics. Consistent with prior research, the findings confirmed that tourism positively influences economic growth by attracting foreign currency, creating employment opportunities, and enhancing infrastructure development. The results also underscored the pivotal role of FDI in South Asia's economic progress, as it facilitates the transfer of capital, technology, and knowledge, driving industrialization, infrastructure development, and job creation. Governments must adopt strategies to attract FDI and create an investment-friendly environment.

Unexpectedly, the study revealed that renewable energy consumption negatively impacts economic growth, suggesting challenges in aligning renewable energy use with development objectives. This finding highlights the need for further research and targeted policy measures to balance renewable energy integration with economic advancement. Additionally, the study examined short- and long-term causal relationships, identifying interdependencies among renewable energy use, FDI, tourism, and economic growth.

➢ *Policy Implications:*

The findings of the research regarding the relationship between tourism, FDI, use of renewable energy, and economic development in South Asia have substantial policy implications for the region. The study's policy implications encompass the following:

- *Encourage FDI:*

The report emphasizes how FDI has helped South Asian nations' economies prosper. By designing investor-friendly legislation, offering incentives to international investors, and enhancing infrastructure, policymakers should concentrate on fostering an inviting investment climate. Furthermore, steps should be taken to help foreign investors transfer technology and knowledge to the domestic sector.

- *Promoting Renewable Energy:*

The study emphasizes the value of utilizing renewable energy for strengthening the economy. The development and promotion of renewable energy sources includes solar, wind, biomass, hydropower, and geothermal energy should be a priority for policymakers. This can be done by creating and putting into effect supportive policies like feed-in tariffs, tax breaks, and financial aid for renewable energy installations. Investments in the study and advancement of technologies for renewable energy sources should also be promoted.

- *Sustainable Tourist Development:*

The study emphasizes how tourism has a favorable effect on economic growth. Policymakers must concentrate on encouraging environmentally and culturally responsible tourism practices that boost economic development. This can be accomplished by improving services and amenities, developing tourism infrastructure, protecting the environment.

- *Widening Energy Security:*

Energy security issues exist in South Asian nations. Prioritizing measures to diversify the renewable energy mix and lessen reliance on fossil fuels will improve energy security, according to policymakers. Promoting renewable energy sources, making investments in energy infrastructure, increasing energy efficiency, and looking into regional

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cooperation for energy trade and integration can all help with this.

The study places a strong emphasis on the necessity for long-term planning and a coordinated policy approach. The interconnections between tourism, FDI, renewable energy, and economic development should be taken into account when developing comprehensive and integrated policies. To ensure that policies and programs are implemented effectively, coordination and collaboration between key government agencies, stakeholders in the private sector, and international organizations are essential.

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