

Innovation and Tourism Industry in the BRICS Economies an Empirical Analysis (2011-2022)

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ABSTRACT

This study aims to explore and measure the impact of innovation on the tourism sector specifically, tourism growth in the BRICS economies during the period 2011-2022. The Global Innovation Index (GII) was employed as a measure of innovation to assess its influence on GDP. In addition, a set of explanatory variables was included, such as GDP, GDP per capita, foreign direct investment (FDI), and the inflation rate, to analyze their relationship with tourism growth, the study relied on data from multiple sources, including: World Intellectual Property Organization (WIPO), the World Bank, and statistical organizations in the BRICS economies,

For data analysis, a dynamic panel data approach was applied using the single-step GMM estimator of the Blundell-Bond model (1998), in order to obtain consistent and efficient estimates of the relationships between variables. The results of the study indicate that innovation plays a positive and crucial role in improving tourism's contribution to GDP by enhancing efficiency and developing services. The analysis confirms that innovation is a pivotal driver of tourism development, significantly improving the sector's contribution to GDP through better efficiency and service quality. In parallel, GDP, per capita income, and FDI also positively influence tourism growth, while inflation has a negative effect. These findings support theoretical perspectives that emphasize the critical role of innovation and investment in improving competitiveness and ensuring sustainable development in the tourism sector

Keywords: Innovation, Tourism Growth, Foreign Direct Investment, GDP, GDP per capita, Inflation, BRICS economies

1. Introduction

Over the past decade, the tourism sector has experienced significant transformations, with innovation emerging as a major factor in boosting competitiveness and economic growth.

The BRICS economies (Brazil, Russia, India, China and South Africa) are a prime example of this, combining their vast cultural and natural diversity with their growing needs to develop tourism infrastructure and attract visitors. Innovation is a vital tool to deliver unique tourism experiences, enhance resource sustainability, and address environmental and economic challenges that may hinder the development of this vital sector.

With the acceleration of technological progress and the rapid spread of digital innovations such as artificial intelligence and augmented reality, innovation in tourism is no longer limited to improving traditional services, but includes the development of completely new concepts that reshape the tourist's relationship with the tourist destination. (Ku & Chen, 2024) .A focus on sustainability has also become central to tourism innovation strategies, as BRICS destinations seek to strike a balance between the protection of natural resources and their economic development. (Santos, Sousa, Costa, & Au-Yong-Oliveira, 2021) .Moreover, innovation in regulation and marketing has become essential to stimulate competition, increase efficiency, and respond to the needs of

ever-changing markets. (Işık, Günlü Küçükaltan, Taş, & Akoğul, 2019).

The importance of the study

The importance of this study lies in its exploration of the relationship between innovation and tourism growth in BRICS economies. With these countries facing a distinctive set of development challenges within emerging markets, this study's focus on how innovation can optimize tourism sector performance provides critical, real-world insights for policymakers and practitioners.

Research Problem

While innovation in tourism has attracted significant global interest, a gap persists in understanding its effects on BRICS economies over the past decade, particularly against the backdrop of swift technological and economic changes. Thus, this study is guided by the following central question:

How does innovation relate to tourism growth in the BRICS economies over the 2011–2022 period? to address this gap, the study undertakes a detailed examination using empirical evidence and recent literature to better understand the influence of innovation on sustainable tourism growth in BRICS economies.

2- Theoretical framework

1.2- Definition of basic concepts:

A- Innovation in Tourism

Innovation in tourism refers to new processes, products or ideas that are adopted to improve the overall performance of the tourism industry. According to (Işık, Günlü Küçükaltan, Taş, & Akoğul, 2019) « Innovation in tourism is seen as a key driver for improving tourism experiences, achieving excellence, and enhancing customer satisfaction. Types of innovation in tourism include:

Technological innovation:

It includes the adoption of modern technologies such as artificial intelligence, augmented reality, and the Internet of Things. These tools contribute to the provision of customized services to tourists and improve the efficiency of operations (Ku & Chen, 2024) .

Organizational Innovation:

It is associated with the redesign of management structures or the introduction of innovative management practices to improve the internal and external performance of tourism companies. For example, developing organizational networks for business-to-business collaboration to increase efficiency (Brandão, Breda, & Costa, 2019)

Marketing Innovation:

It involves designing innovative marketing campaigns or using digital means to reach new markets. This type of innovation boosts customer engagement and increases revenue.

Environmental Innovation:

It focuses on achieving sustainability by reducing the environmental impact of the tourism industry, such as the use of renewable energy sources and recycling.

Tourism differs from other sectors due to its highly human interaction and personalized service nature, making innovation require a balance between technology and the human touch. (Işık, Günlü Küçükaltan, Taş, & Akoğul, 2019)

B- Sustainability in Tourism

Sustainability in tourism aims to strike a balance between economic development, environmental protection, and contributing to the well-being of local communities. Innovation is an effective means to achieve this sustainability, as modern technologies and methods are used to mitigate environmental impact and enhance efficiency. (Santos, Sousa, Costa, & Au-Yong-Oliveira, 2021) By promoting sustainability practices, tourism contributes to sustainable development across generations.

C. The relationship between innovation and economic development

Innovation supports economic development by improving efficiency and increasing productivity. In tourism, innovation enables new experiences to be introduced and attract more tourists, contributing to increased revenues and job creation. Innovation also mitigates the effects of economic crises by developing resilient products and services. (Verreynne, Williams, Ritchie, Gronum, & Betts, 2019)

2.2- Models and theories related to innovation and tourism

A- Schumpeter's theory of innovation

According to Joseph Schumpeter, innovation is the primary driver of "creative destruction," in which old products and services are replaced by new ones that better meet market needs. In tourism, this concept is

manifested through the development of new technologies such as smart booking applications and virtual experience platforms, opening up new markets and changing the dynamics of the traditional industry. (Işık, Günlü Küçükaltan, Taş, & Akoğul, 2019)

B- The idea of organizational networks

This theory emphasizes the importance of relationships between tourism organizations and international and local partners to foster innovation. By collaborating within organizational networks, tourism companies can share knowledge and resources to develop innovative products and services, such as in coastal tourism where international partnerships foster competitiveness. (Brandão, Breda, & Costa, 2019)

C. The idea of the socio-technical system

This theory refers to the interaction between man and technology in achieving innovation. In tourism, modern applications of artificial intelligence are showing how the tourist experience can be improved by integrating smart technologies with human interaction, such as interactive booking systems and virtual personal assistant services. (Ku & Chen, 2024)

3.2 Relationship between innovation, tourism and economic development

Innovation in tourism promotes economic development by improving the quality of services, attracting more tourists, and increasing revenues. For example, studies show (Verreynne, Williams, Ritchie, Gronum, & Betts, 2019) How innovation in SMEs has helped improve their performance and reduce the impact of economic challenges.

Mutual influences

Innovation not only contributes to the improvement of the tourism sector, but also leads to spurring innovation in other tourism-related sectors, such as transportation and logistics. On the other hand, tourism itself creates a demand for innovative solutions, which promotes cooperation between different sectors. (Brandão, Breda, & Costa, 2019)

3- Literature Review:

Beginning with his study (Zvaigzne, Mietule, Kotane, Sprudzane, & Bartkute-Norkuniene, 2023) ‘The research focused on the role of digital innovations in the Baltic tourism sector, where challenges such as lack of data analytics and long-term maintenance costs of digital tools were identified. The results underscored the great potential of digital marketing in the tourism sector, while warning of the consequences of under-planned investments in innovation.

Moreover, (Cem Işık, Aydın, Dogru, Rehman, & Sirakaya-Turk, 2022), They conducted a bibliometric and depictorial research related to innovation in tourism, classifying the studies into conceptual frameworks, reviews and methodologies. Their study highlighted emerging topics such as sustainability, the sharing economy and technology, providing a powerful intellectual map for future researchers in the field.

Well explore (Booyens & Brouder, ntroduction: Innovation for tourism sustainability. In I. Booyens & P. Brouder (Eds.), (2022) In their book the role of innovation in addressing sustainability challenges in the tourism sector. Their work emphasized the importance of innovation not only to enhance competitiveness but also to promote environmental and social responsibility, especially in sectors affected by major economic and geopolitical changes.

Besides (Nunes & Cooke, 2020) critically examined the intersection between tourism, innovation and capitalist systems, especially in the post-COVID-19 era. They highlighted the potential that innovation offers to promote sustainable tourism practices, while warning against its misuse that could further degrade the environment.

The study also dealt with (Wszendybył-Skulska, Kopera, & Bascavusoglu-Moreau, 2013) The role of creativity in driving innovation in tourism, with a focus on the need for educational systems and work environments that support creative capabilities. Their results showed that creativity can act as a bridge to adapt to rapidly changing environments and implement innovative solutions.

As for the study (Booyens & Rogerson, Creative Tourism in Cape Town: An Innovation Perspective, 2015) It has investigated innovation tourism in Cape Town, where it has been identified as an emerging market with a significant impact within urban tourism. They recommended promoting innovation clusters and integrating creative tourism into destination strategies to maximize the benefit possible.

Furthermore, (Fuchs, Fossgard, Stensland, & Chekalina, 2021) Nature-based in Norway, where they highlighted the unique role of stereotypical entrepreneurship in balancing creativity with sustainable business practices. Their empirical assessments revealed a strong tendency towards combining humanitarian and business goals to ensure long-term sustainability.

As presented (Richards, reativity and tourism: The State of the Art, 2011) A fundamental understanding of

creative tourism, he introduced a 'creative transformation' that shifted the focus from tangible cultural heritage to shared experiential tourism. His work critically explored how creativity can transform traditional tourism models and provide more authentic and flexible experiences for tourists.

In response to the COVID-19 pandemic, (Richards, *Tourism in challenging times: Resilience or creativity?*, 2020) A recovery strategy based on creativity, he proposed a development framework that connects local communities to global resources. This approach emphasized adaptive strategies that go beyond mere flexibility to promote sustainable growth.

As developed (Dias, González-Rodríguez, & Patuleia, 2021) A comprehensive model for competitiveness in creative tourism destinations, where they identified key dimensions such as community engagement, stakeholder competencies and marketing strategies. Their study provided a roadmap for future research and practical implementation.

In the context of island tourism, a study (Baixinho, et al., 2020) Review the literature on creative tourism, focusing on the distinction between urban creative groups and community tourism experiences in rural areas. The findings emphasized the dual role of creative tourism in supporting sustainable development and enhancing the well-being of communities.

Finally, introduce (Ahmad, Youjin, & Hdia, 2022) A macroeconomic perspective by examining the impact of innovation and tourism on sustainable development in the economies of the Group of Seven. Their results showed the role of technological innovation and tourism in reducing environmental pollution and promoting economic growth.

The importance of the current study :

This study aims to fill the gap in research on tourism innovation in BRICS economies by examining the relationship between innovation and tourism growth from 2011 to 2022. Previous studies have made important contributions to understanding the link between creativity, sustainability, and digital innovation, but they often fail to focus on emerging economies, particularly those within the BRICS group. However, in this study we focus on the impact of foreign direct investment, inflation, and socio-economic factors on tourism development.

4. Model and Results:

1.4. Descriptive Statistics:

Table 1: Descriptive statistics

Variable	Obs	Mean	Std. dev.	Min	Max
gii	60	38.50667	6.536323	29.8	55.3
fdi	60	2.136558	1.497118	-1.776443	9.677949
gdp	60	3.191719	3.726867	-5.963358	9.550832
inf	60	5.383836	2.7842	.9810151	15.5344
gdppcg	60	2.424666	3.742182	-7.106589	8.953816

Source: Generated by researchers from STATA 17 outputs

The table above summarizes the descriptive statistics of the study variables, revealing considerable variability in the data. Specifically, the GII has a mean of 38.5067 and a standard deviation of 6.5363, with a range from 29.8 to 55.3, indicating significant differences in innovation levels across the countries analyzed.

FDI shows an average value of 2.1366 and a standard deviation of 1.4971, with a range from -1.7764 to 9.6779, illustrates the wide disparities in foreign investment levels among the countries studied.

The gross domestic product (GDP) reflects an average growth rate of 3.1917% with a standard deviation of 3.7269%. The growth rates range from -5.9634% to 9.5508%, indicating substantial variation in economic performance across the countries examined.

With an average of 5.3838% and a standard deviation of 2.7842%, inflation rates vary widely, from a low of 0.981% to a high of 15.5344%, indicating significant variation in inflationary pressures across countries.

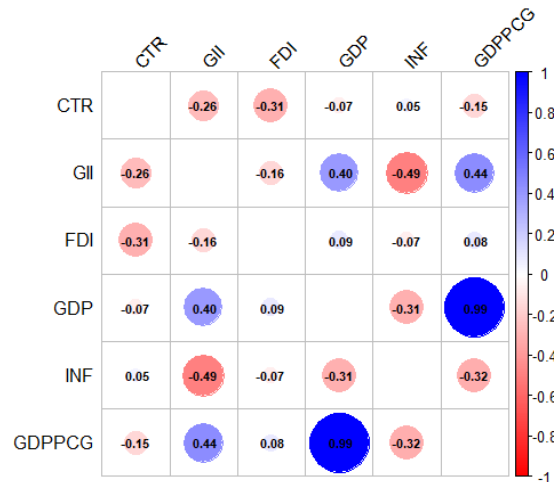
Finally, the per capita GDP growth rates show clear variation, with an average of 2.4247% and a standard deviation of 3.7422%, and a range from -7.1066% to 8.9538%. These figures reflect considerable variation in living conditions and economic performance the countries in the sample.

2.4-Correlation matrix:

The correlation matrix shows how strongly variables are related, with values between -1 and 1. Negative values imply an inverse relationship, where one variable rises as the other falls, conversely, a positive correlation signifies that both variables move in the same direction. If the correlation coefficient is close to zero, it implies

that the variables are largely unrelated in terms of a linear relationship.

Figure 1: Correlation matrix



Source: Generated by researchers from R studio outputs

A positive correlation is observed between the Global Innovation Index (GII) and GDP (0.3997), as well as GDP per capita growth, indicating that higher innovation contribute to economic growth and improved individual income level.

However, the GII is negatively correlated with inflation (-0.4908), implying that rising inflation may hinder innovation by discouraging investment in research and development.

The observed negative correlation (-0.1578) between FDI and the Global Innovation Index implies that foreign capital inflows may not effectively support innovation, potentially due to their allocation in traditional or low-tech sectors.

In this context, the correlation between FDI and GDP (0.0894) is relatively weak, indicating that foreign direct investment has only a marginal influence on economic growth within the context of this study.

There is a strong positive correlation (0.9902) between GDP and GDP per capita growth, suggesting that economic growth typically leads to gains in per capita income.

The observed negative correlations between inflation and GDP (-0.3090), as well as GDP per capita growth (-0.3167), suggests that rising prices economies and suggesting that higher inflation can slow economic progress and limit gains in living standards.

The negative correlation between inflation and the Global Innovation Index (GII) (-0.4908) indicates that inflation exerts a suppressive effect on innovation, potentially through reduced investor confidence and discourages long-term investment in research and development.

3.4-multicollinearity problem test :

Table 2: Testing the problem of multicollinearity

Variable	VIF	1/VIF
GII	1.61	0.622753
INF	1.37	0.729625
GDPPCG	1.29	0.772706
FDI	1.08	0.925026
Mean VIF	1.34	

Source: Generated by researchers from STATA 17 outputs

Variance inflation factor (VIF) values reveal how strongly independent variables are correlated. A VIF above 5 or 10 usually signals multicollinearity, which can affect coefficient stability and interpretation.

According to the VIF results, values range from 1.08 to 1.61, are all below 5, the results suggest that the model does not suffer from problematic multicollinearity among its independent variables.

With a VIF of 1.61, the GII variable shows slight correlation with other variables, but not enough to suggest any

serious multicollinearity.

The inflation variable (INF) has a VIF of 1.37, suggesting only a weak correlation with the other independent variables, confirming the absence of serious multicollinearity.

GDP has a VIF of 1.58, suggesting no significant multicollinearity with other variables in the model.

With a VIF value of 1.29, the GDPPCG variable does not exhibit multicollinearity issues, suggesting that it is statistically independent of the other predictors.

FDI has the lowest VIF value at 1.08, signaling that it's practically independent from the other variables.

Overall, these results indicate that the model is free from multicollinearity, ensuring the robustness and precision of the estimated coefficients in the regression model.

4.4-Transverse Independence Test :(Cross-Sectional dependence Test)

test Pesaran CD :(Pesaran, General Diagnostic Tests for Cross-Section Dependence in Panels, 2004)

According to Pesaran (2004), evidence of cross-sectional dependence varies across variables. Notably, CTR, GDP, INF, and GDPPCG show significant interdependence ($p < 0.05$). This indicates that the variables are strongly interconnected across countries, meaning changes in one may influence outcomes in the others.

In contrast, GII and FDI show no strong correlation across countries ($p > 0.05$). This indicates that these variables are relatively independent and less affected by external economic conditions

Table 3: Pesaran Test (2004) CD

Variables series tested: CTR GII FDI GDP INF GDPPCG
 Group variable: id
 Number of groups: 5
 Average # of observations: 15.00
 Panel is: balanced

Variable	CD-test	p-value	corr	abs(corr)
CTR	5.00	0.000	0.456	0.565
GII	-1.46	0.144	-0.133	0.553
FDI	-0.62	0.533	-0.057	0.197
GDP	6.86	0.000	0.626	0.626
INF	2.79	0.005	0.255	0.321
GDPPCG	6.83	0.000	0.624	0.624

Notes: Under the null hypothesis of cross-section independence $CD \sim N(0,1)$

Source: Generated by researchers from STATA 17 outputs

test Pesaran :(2015)(Pesaran, 2015)

The test provides a more in-depth analysis of episodic dependence, uncovering a consistent pattern across the variables, focusing more closely on minor or marginal correlations. The results suggest slight incidental dependence observed between CTR, GDP, INF, and GDPPCG. Conversely, variables such as GII and FDI demonstrate weak or negligible cross-sectional influence.

Significant p-values (at 1%) for CTR, INF and GDPPCG suggest some degree of interdependence across countries, though weaker than that detected by Pesaran's (2004) CD test.

Table 4: Pesaran Test (2015) CD

Testing for weak cross-sectional dependence (CSD)

H0: weak cross-section dependence

H1: strong cross-section dependence

	CD	CDw	CDw+	CD*
CTR	5.00 (0.000)	-0.76 (0.445)	18.20 (0.000)	0.09 (0.924)
GII	-1.46 (0.144)	-1.58 (0.114)	16.19 (0.000)	0.92 (0.356)
FDI	-0.62 (0.533)	1.13 (0.258)	5.98 (0.000)	5.28 (0.000)
GDP	6.86 (0.000)	0.28 (0.782)	21.97 (0.000)	0.55 (0.585)
INF	2.79 (0.005)	0.25 (0.806)	9.18 (0.000)	0.35 (0.729)
GDPPCG	6.83 (0.000)	0.19 (0.845)	21.80 (0.000)	2.93 (0.003)

p-values in parenthesis.

References

- CD: Pesaran (2015, 2021)
 CDw: Juodis, Reese (2021)
 CDw+: CDw with power enhancement from Fan et al. (2015)
 CD*: Pesaran, Xie (2021) with 4 PC(s)

Source: Generated by researchers from STATA 17 outputs

Interpretation of incidental dependence:

The results from both tests reject the null hypothesis of no cross-sectional dependence at the 1% level, implying that the countries in the sample are interlinked through incidental dependence where changes in one economy may affect others.

- Effects on the model:**

As both tests confirm incidental dependence, even marginally in some cases per the Pesaran (2015) results, the econometric model must account for cross-sectional correlations.

These results show why it's important to use panel data approaches that take into account the connections between countries, as shocks originating in one country may have spillover effects on others

- Using the one-step GMM method:**

Given the presence of cross-sectional dependence as indicated by the diagnostic tests, the one-step GMM estimation technique was applied to ensure consistent and reliable results.

The one-step GMM estimator is appropriate for dynamic panel data analysis due to its robustness against autocorrelation and individual-level fixed effects.

This estimator corrects for cross-sectional bias, ensuring more valid and robust findings (Arellano & Bond, Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations, 1991) (Blundell & Bond, 1998) (Roodman, 2009)

4. One-Step Generalized Method of Moments.

Estimating dynamic tablet data models is an effective technique for addressing the effects and heterogeneity of interpretive variables, as well as static and unobservable country-specific effects.

To deal with the problem of autocorrelation between explanatory variables, (Arellano & Bond, Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations, 1991) proposed Using the Difference GMM method, where delayed variables are used as tools to deduce the conditions of the corresponding moments, and this method depends on taking the first differences in the regression equation to remove the fixed effects of the countries, and then using the delayed variables as effective tools for the self-explained variables in the differential equation.

Although the Difference GMM method is effective in mitigating the problem of self-variance, it may suffer from the problem of "weak tools" when using small samples, resulting in reduced accuracy of estimates (Stephen, Hoeffler, & Jonathan , 2001)

To work around this issue, suggest (Blundell & Bond, 1998) and (Arellano & Bover, 1995) Estimated use System GMM The System GMM method makes it possible to address the problem of self-variance as well as reduce bias caused by deleted variables, and mitigate the problems of polylinearity, unobserved cross-section

heterogeneity and measurement errors often encountered by OLS and fixed-effect models. Furthermore, System GMM provides more accurate estimates compared to other estimators (Blundell & Bond, 1998).

The dynamic model used in this study is based on an equation that combines the two equations in the level and at the first difference:

$$y_{i,t} = \sum_{j=1}^p a_j y_{i,t-j} + x_{i,j} \beta_1 + w_{i,t} \beta_2 + v_i + \varepsilon_{i,t}$$

The study relies on a one-step GMM estimator to calculate the dynamic model, which is relevant when the number of countries is limited and the time period is longer. (Teixeiraa & Queirós, 2016)

While System GMM results are usually accurate, it is necessary to test the consistency of estimates by validating the tools used and ensuring that there is no rank II autocorrelation, and Sargan and Hansen tests are performed to ensure the correctness of the tools used. Furthermore, Arellano-Bond tests are used to verify second-order autocorrelation. (Teixeiraa & Queirós, 2016)

The Generalized Method of Moments (GMM) can be applied using two approaches: one-step and two-step estimation. The main distinction between them is the use of a homoscedastic or heteroscedastic weighting matrix. By reducing bias in standard errors, the two-step method proves to be more efficient, especially when working with limited sample sizes.

However, the generalized two-stage moment method may lead to the creation of many tools as the number of time periods increases, which can lead to over-specification and declining model accuracy. (Roodman, 2009)

Based on the findings of (Teixeiraa & Queirós, 2016), it is advisable to apply a single-stage estimator in models involving a small number of countries and an extended time period.

After analyzing the data from BRICS countries, we decided to use the single-stage generalized method of moments over the two-stage alternative introduced by. (Blundell & Bond, 1998)

$$ctr_{i,t} = a_i + ctr_{i,t-1}a_1 + gii_{i,t}a_2 + gdp_{i,t}a_3 + fdi_{i,t}a_4 + gdppcg_{i,t}a_5 + inf_{i,t}a_6 + \varepsilon_{i,t}$$

where:

- *ctr*: Represents the contribution of tourism to GDP, reflecting the tourism sector's impact on the economy.
- *gii*: the Global Innovation Index, which measures the level of innovation within a country.
- *gdp*: Gross Domestic Product, indicating the total value of goods and services produced by a country.
- *fdi*: Foreign Direct Investment (FDI), representing the flow of investment from foreign countries into the domestic economy. Expresses FDI flows.
- *gdppcg*: It expresses the growth rate of GDP per capita.
- *inf*: Inflation rate, indicating the rate at which the general level of prices for goods and services is rising. Represents the rate of inflation.
- *a_i*: It expresses the static effects specific to each country, which vary between countries.
- *a_1* *a_6* are the coefficients of independent variables.

The following table presents the estimation results obtained using the one-step Generalized Method of Moments (GMM):

Table 5: The estimation results based on the one-step GMM method

Variables	Transactions	P-value
GII	0.0220882	0.081
GDP	0.09108	0.001
FDI	0.0097739	0.053
GDPPCG	0.391408	0.061
INF	0.0226491	0.043
AR (1)	1.393	0.1636
AR (2)	0.4929	0.6221

Sargan test	25.25899	0.5969
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Source: Generated by researchers from eviews12 outputs

- **Impact of the Global Innovation Index (GII):**

An increase of 1% in the Global Innovation Index (GII) results in a 0.022% rise in tourism growth, reflecting tourism's contribution to the overall economic output, significantly enhancing the sector's efficiency and productivity, such as through improved tourist experiences and new products. As innovation advances in a country, its ability to attract tourists and generate economic returns from tourism increases. Innovation is crucial for gaining competitive advantages, improving experiences, and opening new markets. According to Schumpeter's "creative destruction" theory, innovation revitalizes tourism products and alters travel patterns.

- **Impact of Gross Domestic Product (GDP):**

A 1% growth in GDP results in a 0.091% increase in tourism growth. Economic growth positively impacts tourism by increasing individuals' ability to spend on travel, boosting demand for tourism services. It also provides resources for investing in tourism infrastructure, such as airports and hotels, which attract more visitors. Developing economies that embrace innovation and modern technologies improve the quality and competitiveness of tourism services. These findings align with traditional growth theories by Lucas and Romer, prove the importance of human capital, technology, and infrastructure investment in fostering sustainable tourism growth.

- **Impact of Foreign Direct Investment (FDI):**

An increase in foreign direct investment (FDI) by 1% increases tourism growth by 0.0098%, this implies the positive impact of foreign investment on the tourism sector, bringing capital, technology, expertise, and improving infrastructure. It helps establish major projects like resorts and international hotels, enhances competitiveness, and creates local jobs. Additionally, foreign companies entering the market can open new avenues for tourism promotion and attract more international tourists.

- **Impact of GDP per capita growth rate (GDPPCG)**

An increase in GDP per capita growth rate by 1% increases tourism growth by 0.391%, this reveals how higher individual income boosts spending on travel and entertainment, stimulating demand for tourism services. It also encourages changes in consumption patterns, with more spending on leisure activities, and enables destinations to offer higher-quality services, supporting sustainable tourism growth.

- **Impact of the inflation rate (INF):**

An increase in the inflation rate by 1% reduces tourism growth by -0.0226%. Inflation weakens purchasing power, lowering spending on travel and tourism. It also raises operating costs in the tourism sector, making destinations less competitive. High inflation can harm a country's appeal as a tourist destination and deter investments, making price stability crucial for sustaining tourism growth.

Model diagnostics and specification checks for the dynamic panel GMM estimator

Based on the results in Table 5, the p-value for AR(1) exceeds 0.05, indicating that we cannot reject the null hypothesis of no first-order autocorrelation in the residuals. This suggests that the model does not suffer from serious first-order serial correlation. Moreover, the p-value for AR(2) is also well above 0.05, confirming the absence of second-order autocorrelation, which is crucial for ensuring the reliability of GMM estimators.

Furthermore, the high p-value in the Sargan test indicates that the instruments are likely valid and do not correlate with the residuals, confirming the robustness of the model.

5- Interpretation and discussion of results:

5.1. Impact of the Global Innovation Index (GII):

The tourism sector, like other industries, thrives on innovation, which boosts efficiency and productivity. Innovation in products and services enhances customer satisfaction, which in turn boosts tourism demand.

Therefore, the digital innovations like e-booking, digital marketing, and virtual reality experiences significantly increases the attractiveness of tourist destinations.

According to Schumpeter's theory of "creative destruction," innovation leads to the emergence of new markets and industries by improving services and replacing obsolete practices, thus accounting for the positive impact on tourism performance when innovation increases.

5.2. Impact of Gross Domestic Product (GDP):

Economic growth stimulates both public and private spending, leading to increased resources for

enhancing tourism infrastructure like roads, airports, and hotels. Therefore, Economic growth fosters the development of tourism destinations and improves services, which draws more domestic and international tourists. In addition, Lucas and Romer's theories indicate that economic growth encourages investments in technology and infrastructure, making tourism sector as a key contributor to economic progress.

5.3. Impact of Foreign Direct Investment (FDI):

Foreign direct investment (FDI) improves access to global markets, strengthens supply chains, and brings capital, technology, and management expertise. This leads to the development of international resorts, hotel chains, and tourism projects, ultimately raising the quality of tourism services and driving the growth of the tourism sector. As a result, FDI plays a crucial role in expanding the tourism industry by enhancing its efficiency and competitiveness.

5.4. Impact of GDP per capita growth rate (GDPPCG):

Higher per capita income enhances financial capacity, encouraging increased spending on tourism and recreational activities. Since tourism demand is sensitive to income fluctuations, a rise in income often leads to a notable increase in tourism activity. According to consumer behavior theory, individuals are more inclined to allocate their additional income toward discretionary items like travel and leisure, making tourism a key beneficiary of economic growth.

5.5. Inflation Rate Effect (INF):

As inflation increases, the rising expenses reduce consumers' ability to afford travel, leading to a decline in tourism activity. High inflation reduces tourism competitiveness, risking market loss, in contrast, maintaining inflation through effective policy enhances the sector's attractiveness.

6. Conclusion

This research explores the complex relationship between innovation and tourism growth in the BRICS economies over the period 2011-2022. It examines how innovation, through advancements in technology and services, contributes to the expansion of the tourism sector. The findings emphasize the need for policies that foster innovation, encourage investment, and drive economic growth to enhance sustainability and competitiveness within the tourism industry.

Focusing on innovation allows these economies to capitalize on global changes, particularly in the face of growing economic challenges and inflationary pressures.

Analyses show that tourism growth depends on the combination of several factors, including advanced technology, infrastructure, and purchasing power, which calls for comprehensive strategies that promote the interaction between these factors. The findings also suggest that the balance between boosting innovation and reducing deterrents such as inflation plays a pivotal role in shaping the future of tourism in these economies.

Therefore, investing in education and research, enhancing the investment environment, and creating adaptable inflation control measures can serve as key drivers for boosting tourism development in BRICS economies. Through these strategies not only amplify the macroeconomic benefits of tourism, but also promote equitable development, improving the well-being of local populations and enhancing the global competitiveness of these economies

7. Study recommendations:

Based on the results of the study and its analysis, the following recommendations can be made to enhance the role of innovation in the growth of the tourism sector and the achievement of sustainable development in the BRICS economies:

7.1. Promote investment in tourism innovation: through

- Encourage governments to allocate resources to support research and development in the tourism sector, including new technologies such as artificial intelligence and the Internet of Things to provide innovative tourism experiences.

- Launching financing programs for small and medium tourism companies to develop creative solutions that suit the needs of the markets.

7.2. Leveraging innovation to improve efficiency and services: through

- Develop advanced digital platforms for booking and tourism marketing services, making it easier for tourists to reach destinations easily.

- Introducing virtual reality and augmented reality technologies to enhance the tourist experience and make destinations more attractive.

7.3.. Stimulate Foreign Direct Investment (FDI): through

Improving the investment climate by providing tax incentives and flexible legislation that encourages foreign investors to participate in the development of tourism infrastructure.

Encourage partnerships between local companies and foreign investors to transfer technology and management knowledge.

7.4.Focus on tourism sustainability: through

- Adopting innovative policies aimed at achieving a balance between preserving natural resources and promoting tourism activities.

- Supporting ecotourism and sustainable tourism projects to attract new markets and achieve long-term development.

7.5. Control inflation and promote macroeconomic stability: through

- Adopting stable monetary and fiscal policies to maintain low inflation rates, which supports the competitiveness of the tourism sector.

- Monitor prices and costs of tourism services to ensure their ability to compete in global markets.

7.6.. Investing in Human Capital: Through

- Designing training programs and workshops for tourism cadres to develop their skills in the use of technology and innovation.

- Promote tourism education to include courses focused on innovation and sustainability.

7.7. Strengthening regional and international cooperation: through

- Exchange of experiences between BRICS Economies in the fields of tourism innovation through conferences and cooperation networks.

- Develop joint marketing strategies to promote BRICS tourist destinations as a unified region.

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