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Tourism Inflow and Economic Growth in South Africa: The Role of Digital Inclusion

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ABSTRACT

The importance of digital inclusion in promoting economic growth remains widely debated, particularly in the light of its impact on the framework of tourism-economic growth. Growing support from the government, legislators, and civil society in South Africa highlights how vital it is to address digital inequality through inclusive digital efforts. Nevertheless, there is still a lack of empirical data assessing how digital inclusion affects the relationship between tourism and economic expansion in South Africa. The neoclassical growth theory, which emphasizes technology as a crucial component of economic progress, serves as the foundation for this study. It also incorporates the tourist-led growth hypothesis, which emphasizes tourism as a major driver of economic performance. The results show that labour force participation and gross fixed capital formation have a major impact on South Africa's economic growth, but trade openness, the interaction of digital inclusion and tourism, and tourism inflows do not seem to be the main drivers of economic growth in South Africa. The study concludes that the synergy between tourism and digital inclusion currently lacks a substantial impact on economic growth. As a policy response, the study advocates for streamlined visa procedures, improved security and infrastructure to support sustained tourist arrivals, and a comprehensive national strategy to expand internet access, develop digital infrastructure, and enhance digital literacy, particularly in historically marginalized rural communities with high tourism potential.

Keywords: Tourism Inflow, Economic Growth, Digital Inclusion, Econometric Technique, South Africa
JEL Classifications: L83, Z32, O1, O3, O4

1. INTRODUCTION

The global discourse surrounding digital inclusion has intensified, driven by ongoing technological progress and its transformative effects on various aspects of daily life. This is particularly pertinent for developing and underdeveloped regions (Adedokun and Zulu, 2022). Significant disparities exist in access to and use of information and communication technologies (ICTs) in South Africa, a country with severe socioeconomic inequality. These disparities worsen existing social and economic issues, such as unequal income distribution and diminished quality of life, thereby undermining the United Nations' Sustainable Development Goals (SDGs) 4 and 10, which seek to promote inclusive development and leave no one behind (United Nations, 2015). As ICT access and usage grows, digital inclusion is increasingly viewed as a crucial instrument for mitigating economic disparities and promoting inclusive growth.

According to Rice and Pearce (2015) and Padilla et al. (2015), digital inclusion refers to the capacity of both people and communities to access and utilize ICTs in a meaningful way. It encompasses factors influencing digital access and utilization and their implications for socio-economic progress (Adedokun and Zulu, 2022). One of South Africa's pioneering initiatives in this area involved using public library networks to improve access to educational and informational resources among disadvantaged groups. This approach resonates with South Africa's constitutional principles, which emphasize equitable access to information, deeming restrictions on library services as a violation of basic human rights (Mathiesen, 2013). The growing penetration of

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mobile technology and internet access has further expanded digital inclusivity across the nation.

Although South Africa boasts one of Africa's most sizable economies with a GDP of approximately US$419 billion, a per capita GDP of US$7,055.04, and a 2021 growth rate of 4.9% (World Bank, 2023), it continues to experience structural barriers to growth. The COVID-19 pandemic exacerbated these issues, but recent economic performance suggests a rebound to pre-pandemic levels. Tourism is an essential component of South Africa's economy, driving employment and income generation. Pre-pandemic, in 2019, South Africa hosted over 10 million international visitors, a number that plummeted in 2020 due to global travel restrictions. Recovery has been gradual, with international arrivals rising to 1.3 million by January 2024. The government aims to attract 21 million international tourists by 2030 (South African Tourism, 2020; Statista, 2024b). Despite setbacks, tourism remains a critical livelihood source for both urban and rural communities (Malleka et al., 2022; Rogerson, 2011; Wessels and Tseane-Gumbi, 2022).

The positive relationship between tourism and economic growth has been confirmed by a large body of empirical research (Akan et al., 2007; Du et al., 2015; Rasool et al., 2021; Liu, 2022), although some studies, like Ekanayake and Long (2012), present different results. While Nyasha et al. (2020) reveal conflicting and ambiguous findings, research conducted in Africa supports the tourism-led growth theory (Fayissa et al., 2007; Makochekanwa, 2013; Kyara et al., 2021). Studies conducted in South Africa indicate that tourism may serve as a stimulant for economic growth (Muzekenyi et al., 2018; Akyurek et al., 2023). However, other studies (Phiri, 2016; van der Schyff et al., 2019) point to inconsistent results, indicating the need for more research on the relationship between tourism and growth in the nation.

Recent studies have underscored the growing significance of digital inclusion in economic activities (Ragnedda and Mutsvairo, 2018; Dapal et al., 2023; Gottschalk and Weise, 2023; Sabri et al., 2023) and its potential to strengthen the tourism-growth relationship (Stryzhak, 2022; Tang, 2022; Tang et al., 2022; Lee et al., 2023; Zhang et al., 2023; Luo et al., 2023). South Africa has implemented various digital inclusion initiatives, including ICT training programs, e-library services, digital resource monitoring, and support systems aimed at bridging the digital divide (Tustin et al., 2012; Faloye and Ajayi, 2022; Adedokun and Zulu, 2022; Woldegiorgis, 2022).

Civil society groups, policymakers, and government agencies continue to advocate for measures to reduce digital inequality through targeted inclusion initiatives (Gillwald, 2020; Faloye and Ajayi, 2021; Adedokun and Zulu, 2022). Research further emphasizes the role of digital inclusion in strengthening the tourism sector (Del-Mar, 2019; GIZ, 2021; Abouzeid, 2022; Zhang et al., 2023; Luo et al., 2024; Theofanous et al., 2024), including within the South African context (Butler and Rogerson, 2016; Goga, 2020; Tshidzumba and Oladunjoye, 2022). However, empirical studies specifically investigating the impact of digital inclusion on the tourism-economic growth relationship in South Africa remain scarce. The only notable study (Abeba, 2024) adopted a desk-based approach to explore how digital transformation enhances tourism competitiveness and sustainability but did not examine its economic growth implications.

Therefore, the purpose of this study is to investigate the relationship between tourism inflows and economic growth in South Africa, with a focus on the role of digital inclusion in this dynamic. The rest of the paper is organized as follows: Section 2 reviews the body of existing literature, Section 3 describes the research methodology, and the final two sections present the study's findings, conclusions, and recommendations.

2. LITERATURE REVIEW

2.1. Tourism and Economic Growth

Tourism has emerged as a pivotal economic sector, especially in developing countries, where it plays a crucial role in generating foreign currency, creating employment, attracting investment, and fostering overall economic growth (Atan and Arslanturk, 2012; Rasethuntsa, 2022). A wide range of empirical research has examined the link between tourism and economic growth in several geographical contexts employing various methodological techniques. Tasos et al. (2019), for example, evaluated the dynamics in Asia and Europe using a panel Granger causality paradigm. Their findings showed that while there is a bidirectional causal link between tourism and growth in Europe, tourism drives economic growth in Asian nations.

To investigate the nexus between tourism and economic growth in Beijing, Songling et al. (2019) employed econometric methods such as the Granger causality tests, the error correction model (ECM), and the vector autoregression (VAR). The study discovered strong evidence supporting the theory of tourist-led growth, showing that tourism has a favorable short- and long-term impact on economic performance. Similarly, Osunubi et al. (2020) used a bootstrap simulation technique to investigate the relationship between tourism and inclusive growth in Turkey and Nigeria. Although the study did not discover that inclusive growth substantially fueled the rise of tourism, but the study validates the existence of tourism-led growth in Turkey.

Wijijayanti (2021) examined the effects of both foreign and domestic travel expenditures in eight Southeast Asian nations between 1995 and 2018. Using the Pedroni cointegration method alongside FMOLS, DOLS, and Granger causality techniques, the study concluded that both types of tourism expenditures positively influence economic performance. Meanwhile, in research covering six popular tourist destinations worldwide (China, France, Germany, Italy, Mexico, and Spain), while Benkraiem et al. (2021) used a quantile autoregressive distributed lag (QARDL) model and discovered a nonlinear, nation-specific association between economic growth and tourism.

Literature reviews by Rasethuntsa (2022) and empirical studies by Liu (2022) further affirm tourism's role in fostering economic development, particularly by facilitating inter-sectoral linkages and regional output growth. Albaladejo et al. (2023), using data from 144 countries, employed clustering and panel causality methods to demonstrate that tourism innovations positively correlate with

economic advancement and poverty alleviation, especially in low-income countries.

2.2. Tourism and Economic Growth in South Africa

In South Africa, numerous empirical research has highlighted the rising importance of the tourism industry in driving economic growth (Phiri, 2016; Akyurek et al., 2023). Tourism is widely regarded as a key engine for employment creation, socio-cultural development, and the economic transformation of rural areas. These benefits have led to policy efforts to make tourism more inclusive and sustainable (Department of Tourism, 2017).

Using both linear and nonlinear cointegration methods, Phiri (2016) investigated the association between tourism and economic growth in South Africa. When tourist receipts were utilized as a proxy, the Engle and Granger (1987) model validated the tourism-led growth theory. On the other hand, Enders and Granger's (1998) nonlinear model suggested a more complicated dynamic by presenting a two-way causal relationship between tourism revenue and economic growth.

To examine the long-run association between foreign tourism revenue and South Africa's economic performance, Muzekenyi et al. (2018) used a Vector Error Correction Model (VECM). Their research showed that the money generated by tourism is essential to maintaining long-term economic growth. Using a similar approach, van der Schyff et al. (2019) found that, although their short-term analysis produced conflicting findings, tourism and economic growth were positively related over the long term.

At a subnational level, Garidzirai and Pasara (2020) used a panel data regression approach to evaluate tourism's contribution across South African provinces. Their findings indicated that both domestic tourism and international arrivals positively affect regional economic growth, reinforcing the sector's potential as a development tool at the local level.

Using data from 1995 to 2015 and ARDL cointegration approach, Rasool et al. (2021) investigated the dynamics within the BRICS countries (Brazil, Russia, India, China, and South Africa). The study discovered a strong long-term relationship between tourism, financial development, and economic growth. Furthermore, the Granger causality study supported the feedback hypothesis by showing a bidirectional causal relationship between incoming tourists' and economic performance.

2.3. Digital Inclusion

With the help of technologies like the Internet of Things (IoT), the quick growth of ICTs has completely changed how people, companies, and governments interact (Alamelu, 2013). One of the main pillars of the knowledge economy and globalization is the internet. However, the continued existence of digital inequalities highlights the necessity of inclusive policies that support fair access to technology, such as digital platforms, smart gadgets, and reasonably priced internet (Alamelu, 2013).

According to Alamelu (2013), digital inclusion refers to intentional efforts to ensure that people and communities, particularly those who are digitally marginalized, have access to essential digital tools and services to integrate them into the information society. Digital inclusion, according to Jaeger et al. (2012), includes training, digital literacy, and the chance to fully engage in digital life in addition to access. Similarly, Nguyen (2022) emphasizes the necessity of giving citizens the skills they need to use digital technologies efficiently.

Sabri et al. (2023) conceptualize digital inclusion as a socio-technological construct that facilitates access to ICTs while enhancing users' ability to engage meaningfully with digital ecosystems. This concept extends to fostering economic mobility, social integration, and lifelong learning opportunities. According to the National Digital Inclusion Alliance (National Digital Inclusion Alliance, 2017), the five essential elements of digital inclusion are: affordability, reliable internet access, internet-enabled devices, digital literacy programs, and user-centric online services.

The Microsoft (2009) White Paper on digital inclusion outlines a broader vision, framing it as a multidimensional goal that promotes equity, empowerment, and digital excellence. ICTs have become pivotal in expanding education, boosting economic performance, and improving service delivery in health and governance (Alamelu, 2013). Strategies focused on digital inclusion are increasingly seen as tools for addressing socio-economic inequalities, improving healthcare access, enhancing workforce skills, and enabling greater accessibility for individuals with disabilities.

Since the 1990s, digital inclusion has featured prominently in policy discussions across education, governance, and economic development (Sabri et al., 2023). As technology continues to evolve, digital inclusion strategies must be continuously updated and supported by long-term investments and policies that eliminate systemic barriers to access (National Digital Inclusion Alliance, 2018). Research shows that digital inclusion yields multiple benefits ranging from lower public service costs to better health outcomes, more inclusive education systems, and improved civic engagement (Sabri et al., 2023; Noh, 2019). Although no single model captures all aspects of digital inclusion, several frameworks have been proposed to evaluate it along dimensions such as accessibility, affordability, and service quality (Hilding-Hamann et al., 2008; Nielsen and Makpor, 2021).

Given the accessibility and thoroughness of pertinent data, the Global Innovation Index is employed in this study as a proxy for digital inclusion in the South African context.

Despite its high degree of technical development, South Africa, like many other African nations, continues to struggle with unequal access to and usage of ICT (Kanobe et al., 2022). Despite this, South Africa as well as some selected Africa countries such as Cape Verde, Egypt, Tunisia and Senegal are seen to have notable improvement in digital inclusion. More importantly, the use of mobile phones is seen to promote black economic empowerment though digital inclusion (Alamelu, 2013).

2.4. The Role of Digital Inclusion in the Tourism–Economic Growth Nexus

Although tourism has long been recognized as a major driver

of economic growth, new research indicates that its efficacy may be contingent on other important factors, including human capital, education, and infrastructure development, of which digitalization has been identified as a particularly important variable in moderating the relationship between tourism and economic performance.

For instance, the moderating effect of digitalization on the tourism-growth nexus was examined by Seetanah and Fauzel (2023) in 28 small island developing countries between 1990 and 2019. In both short- and long-term scenarios, the study applied a panel autoregressive distributed lag (PARDL) framework to validate the tourism-led growth theory. Additionally, the research revealed that digitization greatly increases the beneficial effects of tourism on economic expansion. The study found a substantial correlation between digitization and the expansion of tourism, and that tourism and growth are causally related in both directions.

In a different research, Ha (2023) examined how digital public services may increase inbound tourism inflow in 23 European countries. The study showed that digital public service infrastructure has a favorable impact on tourism growth by using techniques including panel-corrected standard errors, feasible generalized least squares, and PARDL models. Notably, long-term forecasts indicated a significant beneficial influence on the growth of tourism, even though the short-term consequences of digitalization were unfavorable.

The importance of information and communication technology (ICT) in the framework of tourism-led growth was examined by Adeleye (2023) in 33 East Asian and Pacific nations. The study used a variety of econometric techniques, such as the Arellano-Bond GMM methodology, Machado and Santos Silva's (2019) method of moments quantile regression, and the panel spatial correlation-consistent estimator developed by Driscoll and Kraay (1998). The findings demonstrated that, in a variety of economic situations and quantiles, ICT continuously improves the link between tourism and growth.

On a global scale, Nchofoung et al. (2022) examined how tourism and ICT influence inclusive development in 142 countries between 2000 and 2019. The researchers applied several estimation techniques, such as panel OLS, fixed effects Tobit regression, the Mean Group method, Driscoll-Kraay estimator, and System GMM. Their findings indicated that while tourism positively influences sustainable development, the effect of ICT varies depending on institutional and political conditions. In stable political environments, ICT and tourism jointly contributed to sustainability, whereas in politically unstable settings, the impact of tourism on sustainability was statistically insignificant.

2.5. The Role of Digital Inclusion in the Tourism–Economic Growth Nexus in South Africa

While there has been a lot of research on the association between tourism and economic growth in South Africa (e.g., Phiri, 2016; Muzekenyi et al., 2018; van der Schyff et al., 2019; Garidzirai and Pasara, 2020; Rasool et al., 2021; Akyurek et al., 2023), there are not many studies that specifically look at how digital inclusion affects this relationship. Although there is growing evidence from around the world that digital technologies strengthen the tourism-growth relationship (Seetanah and Fauzel, 2023), this aspect is still not well studied in the context of South African.

The work by Tshidzumba and Oladunjoye (2022), which used the autoregressive distributed lag (ARDL) model to evaluate how technology improvements impact the interaction between tourism and urban risk in South Africa, is a noteworthy addition to the literature. The research showed that although digital technologies might reduce some risks, their impacts are frequently mediated by more general macroeconomic factors, such as trade trends, currency volatility, and overall economic performance. The importance of digital inclusion in boosting the tourist industry's contribution to economic growth, however, was not specifically covered in this study.

Thus, it is crucial to evaluate how much digital inclusion may enhance tourism's contribution to national development, especially considering the growing integration of digital tools across all economic sectors. It is anticipated that greater digital inclusion would lower traveler search and transaction costs, increase accessibility to travel-related services and goods, boost destination marketing, and boost competitiveness internationally. By increasing access, efficiency, and sustainability, these digital innovations have the potential to greatly boost the economic advantages of tourism (Seetanah and Fauzel, 2023).

3. METHODOLOGY

3.1. Data and Sources

For this analysis, time-series data on important macroeconomic variables such as GDP per capita, gross fixed capital formation, labour force participation, tourism receipts, trade openness, and financial development are used. The World Bank's World Development Indicators (WDI, 2024) is the source for these variables. Because of its thorough evaluation of technology and digital infrastructure, the World Intellectual Property Organization's Global Innovation Index (GII), which was created in 2024, is used as a proxy of digital inclusion.

3.2. Theoretical Framework and Econometric Modeling

The neoclassical growth model developed by Mankiw et al. (1992) is the basis for this research. It highlights technological advancement as a key factor in long-term economic growth. The Tourism-Led Growth Hypothesis (TLGH), which holds that tourism serves as a major engine for economic growth, is also included in the analysis (Durbarry, 2004; Seetanah, 2011; Tang and Tan, 2015; Fauzel et al., 2017). The central premise is that when digital inclusion is integrated into the tourism-growth framework, it may amplify the economic benefits derived from the tourism sector. In the context of South Africa, a country with a strong tourism potential and uneven access to digital technologies. The hypothesis is that enhanced digital inclusion can strengthen the performance of the tourism sector. Potential benefits include lower search and information costs for tourists, Enhanced availability and access to tourism-related services, Improved marketing of

Table 1: Measures of digital inclusion index

Digital Inclusion Index	Measures of Index
ICT Development Index (ITU-IDI) Source: International Telecommunications Union (ITU)	Infrastructure accessibility, cost, and quality, as well as skills and genuine ICT (internet and phone) use.
Global Competitiveness Index (WEF-GCI) Source: World Economic Forum	The availability of contemporary technologies, firm-level technology adoption, internet users, fixed-broadband net subscriptions per 100, net bandwidth per capita, transfers, both foreign direct investment and technology transfer and mobile-broadband subscriptions per 100 residents are the seven metrics used to assess technological readiness.
Inclusive Internet Index (EIU-III) Source: Facebook and Economist Intelligence Unit	Evaluating the internet's accessibility, price, and applicability. The index also assesses "readiness," which is the ability of residents to access the internet, as well as policy support and cultural acceptance of the internet.
Digital Economy and Society Index (EC-DESI) Source: European Commission and Eurostat	Access points (home vs. work), technologies (e.g., fixed vs. mobile internet and telephony), various forms of usage (e.g., computer vs. internet, eCommerce, digital banking, eGovernment services, types of software usage), and frequency of use (daily, quarterly, annually) are used to break down indicators like access, skills, and usage. Several indicators pertaining to digital inclusion are broken down by nation, gender, age, income, degree of education, and even occupation.
eGovernment Development Index (UNDESA-EGDI United Nations Source: Department for Economic and Social Affairs (UNDESA)	Tracks human capabilities and skills, digital public services, and access to telecommunications infrastructure through its sub-indices, which measure overall digital inclusion.
State of Mobile Internet Connectivity Index (GSMAMIC) GSMA	Indicators include eGovernment, gender equality, technology kinds, skills, accessibility, affordability, and quality, and the public sector's preparedness for cyberattacks.
Global Innovation Index (WIPO-GII) Source: World Intellectual Property Organization (WIPO), INSEAD and Cornell University	Examines the human elements of innovation and policymaking in more than 120 nations. When measuring digital, the two subindices that deal with infrastructure, human capital, and research are particularly pertinent.
Affordability Drivers Index (A4AI-ADI) Source: Web Foundation Alliance for Affordable Internet	Availability and affordability of internet access.
Australian Digital Inclusion Index (AUS-ADI) Source: Roy Morgan Research, RMIT and Swinburne University	Ignored user group categorization and concentrated instead on access to technology, including internet and fixed and mobile phones.

Source: Alemelu, 2013; Sabri et al. (2023)

destinations, Reduction in uncertainty and perceived risks, Greater international competitiveness.

The objective is to examine how digital inclusion interacts with tourism to influence economic growth in South Africa, using a series of econometric models (see Seetanah and Fauzel, 2023).

$$Y_t = K_t^{\alpha}\left[A_t L_t\right]^{-\alpha},\ 0<\alpha<1 \tag{1}$$

Where, Y = economic growth, K = capital, L = labour, A = technology, α = factor contribution to output, and t = time dimension of the data.

Building on Tang and Tan (2015), Song and Wu (2021), and Adeleye (2023), the growth function is expanded to include tourism (T) and other control variables (Z), such as trade openness and financial development as indicated in Equation (2):

$$Y_t = f\left(K_t, L_t, T_t, Z_t\right) \tag{2}$$

Where, T = tourism, Z = vector of control variables such as trade openness and financial deepening.

Consequently, to estimate equation (3), the study adapted and transformed equation (2) following the model specified by Oladunjoye and Akinbobola (2018), Adeleye (2023), and Seetanah and Fauzel (2023) where economics growth is expressed as a function of gross fixed capital formation, labour force, tourism, trade openness and financial deepening.

$$lnGDPPC_t = \delta_0 + \delta_1 lnGFCF_t + \delta_2 lnLBF_t + \delta_3 lnTOU_t + \delta_4 lnTON_t + \delta_5 lnFID_t + \mu_t \tag{3}$$

In order to capture the moderating impact of digital inclusion in explaining the relationship between tourism and economic growth in South Africa, the model then incorporates the interaction between tourism inflow and digital inclusion.

$$lnGDPPC_t = \delta_0 + \delta_1 lnGFCF_t + \delta_2 lnLBF_t + \delta_3 ln\left(TOU * DGI\right)_t + \delta_4 lnTON_t + \delta_5 lnFID_t + \mu_t \tag{4}$$

4. FINDINGS

To determine the degree of stationarity of the variables, the preliminary unit root test was conducted using the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) approaches. Table 2 presents the findings.

All the variables used in this study are of order *I(1)* series as shown in Table 2. The variables are stable after the first difference. This suggests that the variables have an order-one integration process.

Furthermore, the cointegration test developed by Johansen was used to investigate the possibility of a long-run relationship among

the variables. The finding rejected the null hypothesis, which holds that there is no cointegration between the variables. There are at least three (3) cointegrating models among the variables, as shown in Table 3. As a result, the present research discovered a long-run relationship among the model's variables.

In this work, the Hannan-Quinn Information Criterion (HQC), the Akaike Information Criterion (AIC), and the Schwarz Information Criterion (SIC) were used to determine the ideal lag length. The AIC suggested a larger lag length of three (3), whilst the SIC and HQC supported a maximum lag length of one (1). In order examine the tourism-led growth hypothesis in South Africa, a lag length of one (1) was used for the study.

Similarly, when examining how digital inclusion can moderate the link between tourism and economic growth in South Africa, the AIC recommended a maximum lag of three (3), whereas the SIC and HQC once more advised a maximum lag of one (1). A cautious approach was used in order to guarantee a robust estimation, and the Generalized Method of Moments (GMM), Fully Modified Least Squares (FMOLS), and Dynamic Least Squares (DOLS) approaches were used with a maximum lag length of one (1) (Table 4).

Table 2: Unit root test

Series	ADF test			PP test		
	I (0) Order	I (1) Order	Status	I (0) Order	I (1) Order	Status
ln (GDPPC)	−1.34	−4.30*	I (1)	−1.34	−4.21*	I (1)
ln (GFCF)	−1.21	−4.44*	I (1)	−1.21	−4.37*	I (1)
ln (LBF)	−0.57	−5.99*	I (1)	−0.49	−6.14*	I (1)
ln (TOU)	−1.21	−4.76*	I (1)	−1.31	−4.76*	I (1)
ln (DGI)	−1.45	−6.55*	I (1)	−2.83*	−13.36*	I (1)
ln (TON)	−1.23	−6.09*	I (1)	−0.59	−11.14*	I (1)
ln (FID)	−0.59	−4.59*	I (1)	−0.59	−4.59*	I (1)
Critical values	I (0) Order	I (1) Order		I (0) Order	I (1) Order	
1%	−3.65	−3.65		−3.65	−3.65	
5%	−2.95	−2.96		−2.95	−2.96	
10%	−2.62	−2.62		−2.62	−2.61	

Source: Authors' computation. 1%, 5%, and 10% significance levels are indicated by the symbols *, **, and ***. The PP test uses the automatic maximum lag length based on the Newey-West bandwidth, while the ADF test uses the automatic maximum lag length based on SIC

Table 3: Johansen cointegration test

Variables: ln (GDPPC) ln (GFCF) ln (LBF) ln (TOU) ln (DGI) ln (TON) ln (FID)				
Trace test (non-restricted Cointegration Rank)				
No. of CE (s) hypothesised	Trace statistic	Engen-value	0,05 critical value	P value
None*	193.40	0.86	150.56	0.00
At max. 1*	131.27	0.71	117.71	0.00
At max. 2*	91.32	0.67	88.80	0.03
At max. 3	56.24	0.50	63.88	0.18
At max. 4	33.91	0.43	42.92	0.29
At max. 5	16.12	0.30	25.87	0.48
At max. 6	4.81	0.14	12.52	0.62

Trace test specifies at minimum, three (3) cointegrating models at 0.05 level.
Source: Authors' computation

To guarantee a robust empirical study, four estimate procedures were applied once the variables' long-term cointegration was confirmed and the ideal lag duration was established. These techniques include Generalized Method of Moments (GMM), Fully Modified Least Squares (FMOLS), Dynamic Least Squares (DOLS), and Ordinary Least Squares (OLS), they were used to measure the impact of digital inclusion on the relationship between tourism and economic growth in South Africa as well as to investigate the relationship between tourism. Tables 5 and 6 provide a summary of the findings from these estimations.

Table 4: Lag length selection criteria

Regressands: ln (GDPPC) ln (GFCF) ln (LBF) ln (TOU) ln (DGI) ln (TON) ln (FID)						
Sample: 1990 2023						
Lag	LogLC	LRC	FEC	ACC	SCC	HCC
0	138.23	NA	7.95	−8.53	−8.25	−8.44
1	296.88	245.64*	3.05*	−16.44	−14.50*	−15.81*
2	324.06	31.57	7.15	−15.87	−12.27	−14.70
3	375.50	39.82	6.35	−16.87*	−11.60	−15.15
Regressands: ln (GDPPC) ln (GFCF) ln (LBF) ln (TOU*DGI) ln (TON) ln (FID)						
Sample: 1990 2023						
Lag	LogLC	LRC	FEC	ACC	SCC	HCC
0	139.11	NA	7.51	−8.59	−8.31	−8.50
1	294.86	241.16*	3.48*	−16.31	−14.37*	−15.68*
2	321.79	31.28	8.28	−15.73	−12.12	−14.55
3	374.31	40.66	6.86	−16.79*	−11.52	−15.08

*Indicates lag order selected by the criterion (at 5% level). LRC: Sequential modified LR test, ACC: Akaike information criterion, FEC: Final prediction error, HQC: Hannan-Quinn information criterion, SCC: Schwarz information criterion.
Source: Authors' Computation

Table 5: Estimate of Tourism and Economic Growth Nexus in South Africa

	GMM	FMOLS	DOLS	OLS
Regressand: ln (GDPPC)				
Regressors	Eqn. 1	Eqn. 2	Eqn. 3	Eqn. 4
C	−16.39***	−13.19*	−12.25*	−13.49*
	(−1.88)	(−7.41)	(−5.64)	(−5.64)
	0.07	0.00	0.00	0.00
ln (GFCF)	0.75*	0.76*	0.67*	0.78*
	(6.48)	(22.82)	(13.63)	(16.64)
	0.00	0.00	0.00	0.00
ln (LBF)	0.60	0.32**	0.31***	0.32***
	(1.07)	(2.58)	(1.96)	(1.94)
	0.29	0.02	0.08	0.06
ln (TOU)	−0.06***	−0.04**	−0.58	−0.05**
	(−1.71)	(−2.51)	(−0.14)	(−2.15)
	0.09	0.02	0.89	0.04
ln (TON)	−1.07*	−0.39*	−0.58**	−0.43*
	(−3.05)	(−4.84)	(−2.72)	(−3.74)
	0.00	0.00	0.02	0.00
ln (FID)	0.54	0.08	0.39	0.08
	(1.32)	(0.78)	(1.63)	(0.56)
	0.20	0.44	0.13	0.58
R^2	0.96	0.98	0.99	0.98
Adj.	0.95	0.98	0.99	0.98

Source: Authors' Computation. Note: t statistics are in (). *Implies level of significance at 1%. **Implies level of significance at 5%. ***Implies level of significance at 10%. Eqn. implies Equation (Model)

Table 6: Estimate of the role of digital inclusion in Tourism and Economic Growth Nexus in South Africa

	GMM	FMOLS	DOLS	OLS
	Regressand: ln (GDPPC)			
Regressors	Eqn. 1	Eqn. 2	Eqn. 3	Eqn. 4
C	−17.76***	−13.13*	−12.58*	−13.42*
	(−1.79)	(−7.30)	(−5.61)	(−5.57)
	0.08	0.00	0.00	0.00
ln (GFCF)	0.70*	0.75*	0.66**	0.78*
	(4.74)	(22.45)	(14.20)	(16.49)
	0.00	0.00	0.00	0.00
ln (LBF)	0.72	0.33**	0.34**	0.33***
	(1.14)	(2.62)	(2.28)	(2.00)
	0.26	0.01	0.05	0.06
ln (TOU*DGI)	−0.02	−0.04**	0.00	−0.05**
	(−0.61)	(−2.43)	(0.15)	(−2.09)
	0.54	0.02	0.89	0.05
ln (TON)	−1.27**	−0.39*	−0.62*	−0.43*
	(−2.76)	(−4.84)	(−3.210)	(−3.76)
	0.01	0.00	0.00	0.00
ln (FID)	0.66	0.09	0.40	0.09
	(1.07)	(0.80)	(1.80)	(0.58)
	0.30	0.43	0.10	0.56
R^2	0.95	0.98	0.99	0.98
Adj. R^2	0.94	0.98	0.99	0.98

Source: Authors' Computation. Note: t statistics are in (). *Implies level of significance at 1%. **Implies level of significance at 5%. ***Implies level of significance at 10%. Eqn. implies Equation (Model).

4.1. Analysis of the Tourism–Economic Growth Relationship in South Africa

The crucial role that capital investment plays in improving economic performance was highlighted by the constant positive and statistically significant influence that gross fixed capital formation (GFCF) had on economic growth across all models. This finding is consistent with other research that highlights the value of local investment (Bakari, 2017; Ijirshar et al., 2019; Bakari and El-Weriemmi, 2022; Hobongwana et al., 2023) which emphasize the importance of domestic investment in an economy.

The labour force also positively contributed to growth in most models, except for one. Its significance in Models 2 through 4 suggests that labor participation remains a vital engine for economic development. This supports the broader consensus in the literature about the importance of human capital (Lechman and Kaur, 2015; Ul-Haque et al., 2019; Eludire, 2023).

However, the results revealed that tourism inflow (TOU) negatively impacted economic growth in three out of four models. Despite its theoretical importance, tourism does not appear to drive growth in South Africa. Factors such as restrictive visa policies, post-COVID travel disruptions, high crime rates, inadequate rural infrastructure, and institutional inefficiencies may be limiting tourism's economic contribution. These findings resonate with earlier critiques found in Shaw et al. (2012), Reed (2013), Mogale and Odeku (2019), and Slabbert (2023).

The same is true for all estimated models, which show that trade openness has not boosted South Africa's economy. The trade openness coefficient in Models 1 through 4 was negative and statistically significant at the 1% level. Even though South Africa has a liberalized trade regime and participates actively in both bilateral and multilateral trade agreements, such as the World Trade Organization (WTO), the African Continental Free Trade Agreement (AfCFTA), the Southern African Development Community (SADC), and BRICS, these agreements seem to have exposed the economy to unfavorable trade dynamics, which could limit growth. The findings align with arguments that excessive trade liberalization may adversely affect economic performance, particularly in sub-Saharan Africa, where reduced trade barriers may undermine local industries (see Khalid, 2016; Malefane and Odhiambo, 2019; Nam and Ryu, 2024). However, this result diverges from the broader empirical literature that identifies a positive relationship between trade openness and economic growth, as supported by Dao (2014), Keho (2017), Silajdzic and Mehic (2017), and Cheung and Ljungqvist (2021).

4.2. Analysis of Digital Inclusion's Role in the Tourism–Economic Growth Nexus in South Africa

The empirical results from Models 1 through 4 show that South Africa's economic development is not substantially boosted by the relationship between digital inclusion and tourist inflows (TOU*DGI). Contrary to predictions, digital inclusion has not yet increased the contribution of tourism to overall economic performance, as demonstrated by the fact that the interaction term's coefficient is negative and statistically significant in two of the models.

This outcome points to underlying structural and policy-related challenges that may be weakening the tourism sector's ability to benefit from digital transformation. Persistent issues such as complicated visa procedures, post-pandemic travel limitations, institutional inefficiencies, crime, political instability, weak infrastructure, particularly in rural tourism hubs and insufficient integration of rural communities continue to hinder tourism's growth potential. These constraints are well documented in the works of Shaw et al. (2012), Reed (2013), Mogale and Odeku (2019), and Slabbert (2023).

The analysis also reveals that digital inclusion has not yet functioned as an effective catalyst in strengthening tourism's economic impact. This may be attributed to the uneven distribution and accessibility of digital infrastructure across South Africa. While internet penetration and mobile access are expanding, large segments of the population, particularly in rural and low-income areas, still face significant barriers to full digital participation (Galperin, 2010).

Several factors perpetuate this digital divide, including Historical socio-economic inequalities: unequal access to internet infrastructure, lack of investment in rural broadband, frequent power outages (load shedding), low levels of digital literacy and ICT training. As noted by Power (2021), Aruleba and Jere (2022), and Faloye and Ajayi (2022), access to digital services in South Africa remains disproportionately concentrated in urban areas, benefitting predominantly wealthier and more educated demographics. Variables such as income, race, age, and educational attainment still heavily influence digital access and utilization (Hilbert, 2011).

Other important factors including gross fixed capital creation, labor force participation, and trade openness continue to show patterns comparable with the previous findings, despite the negative moderating impact of digital inclusion. This further supports the findings' robustness.

5. CONCLUSION AND RECOMMENDATION

By examining their impact on South Africa's economy, this study adds to the body of evidence already available on the relationship between digital inclusion, tourism, and economic growth. The findings show that there is no discernible effect of tourism or its integration with digital inclusion on economic growth. Rather, the main forces for economic growth were found to be domestic investment and a robust labour force. Conversely, trade openness was found to hinder economic growth, indicating that despite South Africa's participation in multiple bilateral and multilateral agreements, as well as its membership in various trade and economic organizations, the expected growth benefits have not materialized.

In light of these findings, the study suggests simplifying visa application procedures, fostering a safe and stable environment to attract consistent tourist inflows, and strengthening institutional support and infrastructure to facilitate tourism development, particularly in rural areas. Furthermore, it underscores the importance of a nationwide expansion of internet connectivity and digital literacy programs, particularly for historically marginalized communities with tourism potential. Promoting greater digital inclusion can support South Africa's efforts in advancing the United Nations' 2030 Agenda and contribute to achieving the Sustainable Development Goals (SDGs).

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