International Journal of Innovative Social Sciences & Humanities Research 14(2):266-272, April-June, 2026

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doi:10.5281/zenodo.20282972

Total Factor Productivity Growth in Sub-Saharan Africa: A Comparative Study of Nigeria, Ghana and South Africa

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ABSTRACT
Total factor productivity (TFP) growth is a key driver of sustainable economic growth, yet Sub-Saharan African (SSA) countries have shown weak performance in this area. This study compares TFP trends in Nigeria, Ghana, and South Africa from 2010 to 2022 using data from the Penn World Table 10.01. The analysis shows that South Africa recorded the highest average TFP level but stagnant growth, Ghana achieved modest positive growth driven by service and agricultural efficiency, while Nigeria experienced volatile and largely negative TFP growth due to structural constraints and oil dependence. The findings suggest that factor accumulation, not TFP, has been the primary driver of growth in SSA. The study further examines the role of institutions, human capital, structural transformation, macroeconomic stability, and external shocks in explaining productivity differentials. Policy recommendations include investing in human capital, improving institutional quality, diversifying economies, adopting technology, deepening regional integration, and strengthening macroeconomic management to enhance productivity growth.
Keywords: Total Factor Productivity; Economic Growth; Penn World Table; Structural Transformation; Human Capital

1.0 INTRODUCTION

Economic growth in Sub-Saharan Africa (SSA) has historically relied on factor accumulation labor and capital rather than efficiency gains. Between 2000 and 2014, SSA experienced one of the fastest growth episodes in its history, with average GDP growth of 5.2% annually (World Bank, 2024). Yet this growth was not matched by commensurate improvements in productivity. Total factor productivity (TFP) measures the portion of output growth not explained by increases in inputs, capturing technological progress, efficiency in resource allocation, and institutional quality. Sustained TFP growth is essential for escaping the middle-income trap and achieving inclusive development, as it allows economies to produce more output with the same or fewer resources (Feenstra, Inklaar, & Timmer, 2015).

Nigeria, Ghana, and South Africa represent three distinct economic structures within SSA. South Africa has the most diversified and industrialized economy, with a well-developed financial sector, transport network, and relatively advanced manufacturing base. Ghana has transitioned toward services and agriculture, supported by political stability, democratic consolidation, and targeted policy reforms in agriculture and public financial management. Nigeria remains heavily dependent on oil, with a large

informal sector, persistent structural rigidities, and exposure to commodity price volatility. Comparing their TFP performance provides insights into how structural factors, policy environments, and institutions shape productivity outcomes and long-term growth potential.

Using data from the Penn World Table 10.01, this study examines TFP trends from 2010 to 2022. The period captures post-2008 global financial crisis recovery, commodity price booms and busts, the COVID-19 pandemic, and major domestic policy reforms such as Nigeria's exchange rate unification and fuel subsidy removal, Ghana's fiscal consolidation program and IMF-supported adjustment, and South Africa's energy crisis and structural reform agenda. The study contributes to the literature by providing a comparative analysis of TFP performance and its implications for growth policy in SSA. It also addresses a gap in the literature by linking TFP trends to institutional quality, human capital indicators, and structural transformation metrics.

The rest of the paper is structured as follows. Section 2 presents the objectives. Section 3 reviews conceptual, theoretical, and empirical literature on TFP. Section 4 outlines the methodology. Section 5 presents data analysis. Section 6 discusses findings. Section 7 interprets the data in light of theory and context. Section 8 concludes and provides recommendations.

1.1 Objectives of the Study

The study is guided by two main objectives:

1. To analyze and compare trends in TFP growth for Nigeria, Ghana and South Africa from 2010 to 2022.
2. To identify institutional and structural factors explaining differences in TFP performance and derive policy implications for enhancing productivity growth in Sub-Saharan Africa.

2.0 LITERATURE REVIEW

2.1 Conceptual Review

Total factor productivity is defined as the ratio of aggregate output to aggregate inputs. It captures technological change, efficiency improvements, and institutional factors not accounted for by labor and capital. In growth accounting, output growth is decomposed into contributions from capital, labor, human capital, and TFP. A positive TFP growth indicates that output is growing faster than inputs, implying efficiency gains (Feenstra, Inklaar, & Timmer, 2015).

TFP can be improved through technological innovation, better resource allocation, improved management practices, and institutional reforms. In developing countries, TFP often reflects the efficiency of factor utilization rather than frontier innovation. Thus, TFP growth in SSA is more about catching up to existing technologies and improving governance than about creating new technologies. The concept is closely linked to absorptive capacity, which determines how quickly economies can adopt and adapt foreign technologies (Ndicu, Ngui, & Barasa, 2023). The distinction between TFP level and TFP growth is important. A country may have a high TFP level but stagnant growth, indicating that it is operating near its efficiency frontier but not advancing. Conversely, a country with a low TFP level but high growth may be catching up through technology adoption and institutional reform.

2.2 Theoretical Review

The Solow growth model treats TFP as exogenous technological progress. In this framework, long-run growth is determined by factors outside the model, and policy has limited effect on growth rates (Solow, 1956). However, endogenous growth theory developed by Romer (1990) and Lucas (1988) emphasizes that TFP is driven by investment in human capital, R&D, and knowledge spillovers. In this view, policy can influence long-run growth by affecting incentives for innovation and human capital accumulation. Institutional economics, as advanced by North (1990) and Acemoglu and Robinson (2012), argues that property rights, contract enforcement, and political stability are fundamental determinants of TFP because they reduce transaction costs and encourage investment. Weak institutions increase uncertainty, raise the cost of doing business, and discourage the adoption of productive technologies (Omaliko, 2026).

In the SSA context, the endogenous growth framework is more relevant because it highlights the role of policy and institutions. The African Development Bank (2023) has argued that weak institutions, corruption, and policy inconsistency are major constraints to productivity growth in the region. The

theory of structural transformation also matters, as shifts from low-productivity agriculture to higher-productivity manufacturing and services can drive aggregate TFP growth. Lewis's dual-sector model (1954) and Kaldor's laws of growth (1966) both emphasize the importance of moving labor and capital to more productive uses.

2.3 Empirical Review

Garzarelli and Limam (2019) investigated physical capital, TFP, and economic growth in 36 SSA countries from 1996 to 2014. They found that physical capital accumulation exceeded TFP in explaining growth in 22 countries. Nigeria, Ghana, and South Africa showed low TFP contribution, with growth driven mainly by capital input. The study concluded that without improvements in efficiency, SSA risks unsustainable growth and increasing vulnerability to external shocks.

Ndicu, Ngui, and Barasa (2023) analyzed technological catch-up and productivity in African national innovation systems from 2010 to 2018. They found that Nigeria and South Africa were on the regional efficient frontier for technological advancement, but Ghana and Senegal had the highest TFP growth rates. The study highlighted the importance of absorptive capacity, human capital, and innovation systems in converting technological potential into actual productivity gains.

Touray (2024) measured TFP in 14 ECOWAS countries from 2016 to 2022 using Data Envelopment Analysis. Nigeria had the highest TFP level but was inefficient in utilizing land and labor. The study showed that the ECOWAS bloc was not efficiently using factors of production, and that COVID-19 and the Russia-Ukraine war had negative impacts on TFP through supply chain disruptions and inflation.

Other studies have emphasized the role of human capital and institutions. The World Bank's Africa Productivity Report (2022) noted that SSA countries with stronger institutions and higher secondary school enrollment had better TFP performance. Dabalen, Fuglie, and Goyal (2026) found that Ghana achieved rapid agricultural yield improvements due to investments in rural infrastructure and research, leading to positive TFP growth. In contrast, Nigeria's agricultural sector remains constrained by insecurity and poor market linkages.

3.0. METHODOLOGY

This study adopts a quantitative comparative approach using secondary data. TFP data are drawn from Penn World Table 10.01, specifically the variable `rtfpna` - TFP at constant national prices, indexed to 2017=1. The Penn World Table is widely used for cross-country productivity comparisons because it adjusts for purchasing power parity and provides consistent capital and labor data across countries and time (Feenstra, Inklaar, & Timmer, 2015). The sample covers 2010-2022, a period marked by commodity price volatility, political transitions, and the COVID-19 shock. This period is significant because it includes both pre-pandemic growth and post-pandemic recovery, allowing for analysis of resilience and structural weaknesses. TFP growth rates are calculated as:

$$\text{TFP Growth}t = \frac{\text{TFP}t - \text{TFP}{t-1}}{\text{TFP}{t-1}} \times 100$$

Descriptive statistics and trend analysis are used to compare performance across the three countries. To explain the observed patterns, the study incorporates data on institutional quality from the World Bank's Worldwide Governance Indicators, human capital from the Human Capital Index, and structural transformation indicators from UNCTAD and the African Development Bank. This mixed approach allows for both measurement and explanation of TFP trends.

The analysis is limited by data availability and the assumption that the Penn World Table's capital stock estimates are accurate. Nonetheless, it provides a robust basis for cross-country comparison and policy analysis.

4.0 DATA ANALYSIS

Table 1: Total Factor Productivity Index and Average Growth Rate, 2010–2022

Country	TFP Index 2010	TFP Index 2022	Average Annual Growth Rate (%)
South Africa	1.021	1.008	-0.11
Ghana	0.892	0.961	0.63
Nigeria	0.954	0.921	-0.29

Source: Penn World Table 10.01, University of Groningen and UC Davis. Index 2017=1.

South Africa started with the highest TFP level but experienced marginal decline over the period. Ghana showed the only consistent positive growth, while Nigeria's TFP declined, reflecting volatility linked to oil price shocks and policy uncertainty. The trend is consistent with the broader SSA pattern where TFP growth has been weak or negative since the mid-2000s (Garzarelli & Limam, 2019).

The table above illustrates the divergence in TFP paths. South Africa's TFP remained relatively flat after 2014, coinciding with the onset of persistent energy constraints. Ghana's TFP rose steadily from 2016 to 2019, supported by agricultural reforms and macroeconomic stabilization. Nigeria's TFP fell sharply in 2016 during the oil price crash and recession, recovered partially, and fell again during COVID-19.

4.1 Discussion and Findings

4.1.1 South Africa: High Level, Stagnant Growth

South Africa has the most advanced industrial base and financial system in SSA. Its TFP level in 2010 was above 1.0, indicating higher efficiency than the 2017 benchmark. However, TFP declined at an average rate of -0.11% per year between 2010 and 2022.

Several factors explain this stagnation. First, energy supply constraints and load-shedding have reduced capacity utilization in manufacturing and mining. The energy crisis has increased production costs and disrupted supply chains, particularly for small and medium enterprises (African Development Bank, 2023). Second, labor market rigidities and skills mismatches have limited labor productivity. High unemployment coexists with skills shortages in key sectors. Third, institutional challenges, including corruption, policy uncertainty, and weak implementation capacity, have discouraged private investment in productivity-enhancing activities. Garzarelli and Limam (2019) noted that South Africa's growth has been driven more by capital accumulation than by efficiency gains, a pattern typical of middle-income countries facing structural constraints.

Despite these challenges, South Africa retains advantages in infrastructure, human capital, and financial markets that could support a TFP recovery if reforms are implemented. The government's structural reform agenda, including energy sector liberalization and visa reforms, is a step in this direction. The National Treasury (2023) estimates that resolving the energy crisis could add 1-2 percentage points to GDP growth annually.

4.1.2 Ghana: Modest but Positive Growth

Ghana recorded an average TFP growth rate of 0.63% per year, the highest among the three countries. This performance is linked to improvements in agricultural productivity and the expansion of the service sector. Dabalen, Fuglie, and Goyal (2026) documented that Ghana achieved rapid yield improvements in maize and rice due to better seed varieties and extension services under the Planting for Food and Jobs program.

Institutional stability and policy continuity have also played a role. Ghana's decentralization reforms and public financial management reforms improved resource allocation at the subnational level. The country's relatively stable macroeconomic environment between 2017 and 2019 created conditions for private investment. However, TFP growth remains below the rate needed to sustain convergence with middle-income countries. Infrastructure deficits, limited industrial diversification, and fiscal pressures following the 2020-2022 debt crisis remain binding constraints.

Ghana's experience suggests that targeted interventions in agriculture can generate economy-wide productivity gains. The success of the Planting for Food and Jobs program demonstrates the importance of input subsidies, extension services, and market linkages in raising agricultural TFP.

4.1.3 Nigeria: Volatility and Decline

Nigeria's TFP declined by an average of -0.29% per year. The economy is highly exposed to oil price shocks, which create macroeconomic instability and distort resource allocation. Touray (2024) found that Nigeria had the highest TFP level in ECOWAS but was inefficient in utilizing land and labor.

Key constraints include insecurity in agricultural regions, poor infrastructure, and weak human capital. The informal sector accounts for over 60% of employment, limiting the diffusion of technology and formal management practices. Policy uncertainty, especially around exchange rate and fuel subsidy regimes, has further reduced incentives for long-term investment in productivity. The 2016 recession and 2020 COVID-19 shock exacerbated these weaknesses, leading to a contraction in private investment and a decline in capacity utilization.

The removal of fuel subsidy in 2023 and the unification of exchange rates were intended to improve resource allocation and reduce fiscal distortions. However, the short-term inflationary impact and exchange rate depreciation have created new challenges for firms. Whether these reforms translate into higher TFP will depend on their consistency and on complementary reforms in infrastructure and human capital.

4.2 Interpretation of Data

The data indicate that TFP is not the main driver of growth in Nigeria, Ghana, or South Africa during 2010-2022. Growth has been extensive rather than intensive, relying on factor accumulation. This pattern is consistent with the "growth without development" narrative common in resource-rich SSA countries (Garzarelli & Limam, 2019).

South Africa's experience shows that a high initial TFP level does not guarantee sustained growth if structural constraints are not addressed. Energy, labor market, and governance reforms are needed to unlock efficiency gains. Ghana's case demonstrates that even low-income countries can achieve positive TFP growth through targeted investments in agriculture and institutional reforms. The country's experience offers lessons for other SSA economies seeking to boost agricultural productivity. Nigeria's experience underscores the risk of resource dependence and the importance of economic diversification. Without addressing insecurity, infrastructure gaps, and policy inconsistency, TFP growth will remain elusive.

The findings support endogenous growth theory, which stresses the role of human capital and institutions in sustaining productivity growth (Romer, 1990). They also align with structural transformation theory, which suggests that shifting resources to higher-productivity sectors is essential for aggregate TFP growth (Lewis, 1954; Kaldor, 1966). For SSA to achieve inclusive growth, policies must focus on improving efficiency, not just increasing inputs.

External shocks also matter. The COVID-19 pandemic reduced TFP across SSA by disrupting supply chains, reducing labor supply, and lowering investment (Touray, 2024). The Russia-Ukraine war further increased input costs, particularly for energy and fertilizers, reducing agricultural productivity. These shocks highlight the importance of building resilience through diversification and macroeconomic buffers.

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

Between 2010 and 2022, TFP performance diverged across Nigeria, Ghana, and South Africa. Ghana achieved modest positive growth, South Africa stagnated at a high level, and Nigeria experienced decline. Factor accumulation remains the dominant source of growth, indicating untapped potential for productivity-led expansion in SSA. Institutional quality, human capital, and structural transformation are key explanatory factors. The results suggest that without deliberate productivity-enhancing reforms, SSA countries risk prolonged periods of low growth and limited job creation.

5.2 Recommendations

1. **Invest in Human Capital:** Increase spending on education and vocational training to improve labor quality and absorptive capacity for technology. Ghana's success in agricultural productivity highlights the returns to targeted human capital investment. Expanding access to technical and vocational education can address skills mismatches in Nigeria and South Africa. Partnerships with the private sector can improve curriculum relevance.
2. **Strengthen Institutions and Governance:** Enhance regulatory quality, contract enforcement, and anti-corruption measures to improve allocative efficiency. The World Bank's governance indicators show that improvements in government effectiveness are strongly correlated with TFP growth in SSA (World Bank, 2024). Digitalization of public services can reduce corruption and improve service delivery.
3. **Promote Structural Transformation:** Reduce dependence on primary commodities by supporting manufacturing and high-value services. Industrial policy should focus on sectors with high productivity spillovers, such as agro-processing and light manufacturing. Special economic zones and export-oriented strategies can help integrate domestic firms into global value chains.
4. **Adopt Technology and Innovation:** Promote ICT adoption and R&D spending to facilitate technological catch-up. Public-private partnerships can help diffuse technology in agriculture and SMEs. Investment in digital infrastructure is critical for enabling remote work, e-commerce, and digital finance.
5. **Foster Regional Learning and Integration:** Use Ghana's agricultural productivity model and South Africa's industrial base as benchmarks for regional learning. The African Continental Free Trade Area can facilitate technology transfer, market expansion, and economies of scale. Harmonizing standards and reducing non-tariff barriers will enhance productivity gains from trade.
6. **Strengthen Macroeconomic Management:** Maintain low and stable inflation, sustainable fiscal positions, and competitive exchange rates to create a stable environment for investment and productivity growth. Nigeria's recent reforms in exchange rate and subsidy policy are steps in this direction, but consistency is crucial.

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