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Impact of Infrastructural Development on Economic Growth in Selected African Countries

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Abstract

Purpose - This study examines the impact of infrastructural development on economic growth in selected African countries, with a focus on key indicators such as electricity consumption, mobile cellular subscriptions, and access to clean water.

Design/methodology/approach - Using annual panel data from 1990 to 2023 for fifteen African countries, the study employs fixed effects, random effects, and dynamic ordinary least squares (DOLS) estimation techniques. Control variables include foreign direct investment, exchange rate, and inflation. Panel unit root and cointegration tests were conducted to validate the robustness of the models.

Originality - The study offers updated empirical evidence on the infrastructure-growth nexus in Africa by using recent data and a broader set of infrastructure indicators. It also contributes to existing literature by employing dynamic panel modeling techniques to better capture long-run relationships.

Findings and Discussion - The results reveal that electricity consumption, mobile cellular subscriptions, and access to clean water have statistically insignificant and negative effects on economic growth. In contrast, foreign direct investment has a positive and significant impact. These findings suggest that the current state and management of infrastructure in the selected African countries may not yet support growth-enhancing outcomes, potentially due to inefficiencies, inadequate access, or policy shortcomings.

Conclusion - Infrastructure development, as currently implemented in the selected African countries, does not significantly promote economic growth. The study recommends that African governments reform infrastructure-related policies, improve service delivery, and ensure investments translate into economic outcomes through better governance and regulatory frameworks.

Keywords - Infrastructural Development, Economic Growth, Africa, Panel Data, DOLS

Introduction

Infrastructure is one of the major macroeconomic environment elements through which economic activities are propelled in various countries. Torrisi (2009) established that there is no specific generalized explanation of infrastructure across economic analysis. However, Dobbs et al. (2013) explained that infrastructure is the backbone upon which the consistent development of a country stands, this emphasizes the important role of infrastructure in socio-economic development. Infrastructure stocks in Africa were inherited from the

colonial powers, which have been a major bedrock of economic development since the early 1960s. Lately, however, the slowdown of the economy together with the rapid increase of interest in regional trade, Africa has made proper infrastructural development (Timilsina, Hochman, and Song 2020). Infrastructure, being the fundamental amenities and facilities that an economy needs to function properly (Agénor & Moreno-Dodson, 2016), is therefore unarguably the key that opens the development and progress of any country and ensures its growth. Any country with a deficit in infrastructure finds it difficult to sustain growth. This may discourage economic, social-cultural, and political activities that could influence the "take–off" activities of Africa's development process.

The continent of Africa faces several challenges regarding infrastructure capacity. African Development Bank (AfDB, 2018) posits that a reduction in African's infrastructure is a drawback to growth possibilities, faced with several challenges, one of which includes providing for the needs of its increasing population with basic infrastructural needs that ought to be affordable. Specifically, just about 53% of roads are good while the number of people with access to seasonal roads is not up to half the population hence making road safety a serious issue of concern, and this have led to the death of approximately 225,000 people annually. In addition to this, limited maintenance reduces the effectiveness of the railway systems in Africa. Meanwhile, these are nothing compared to the fact that less than half of the people with no access to good infrastructure survive on about than two dollars daily. On the other hand, the number of people that uses electricity in households is just 43%, resulting into about 600 million people with no access to electricity, and the demand for electricity have been estimated to grow by 93% from now to 2035 (AfDB, 2018). Africa is saddled with a major obstacle when it comes to building a solid infrastructure network, as the continent continues to rank at the lowest in all dimensions in terms of infrastructure performance in all developing regions (World Bank, 2017).

Odedokun, (2001); Peter, 2016 and Perkins, Fedderke, & Luiz, 2005, asserted that 6.5% of the total value added in low-income countries is contributed by infrastructure. This portion increases to 9% in middle income countries and 11% in high income countries. Therefore, the investment and development of a country's infrastructural base hastens up GDP growth and also alleviates poverty. Fan and Chan-Kang (2015) discovered that the government can attain a rapid growth rate of about 1.8% with a 20% sustained increase in infrastructural investment. The estimates come with a 0.2% reduction in the inflation rate with the rise in resulting income, leading to a 0.7 percentage point yearly reduction in poverty. This asserts that the economy can achieve 8-9% aggregate real GDP growth in the long run (Fan & Chan-Kang, 2015). With this improvement, it is expected that Africa will also gain such improvement in infrastructure. This is based on the assertion that the region gained GDP growth from the value of $1.92 trillion to $4.1 trillion (World Bank, 2022). On this premise, therefore, it is important to evaluate the impact of infrastructural development on the economic growth in selected African countries.

Some empirical studies (Olaluku, 2022; Nugraha et al. 2020; Sahoo et al. 2012; Straub &Terada-hagiwara, 2010; Odedokun, 2009; Agenor & Moreno-Dodson, 2006; Seethepalli et al. 2008; Servén & Calderón, 2004; Deininger &

Okidi, 2003) carried a study on the impact of infrastructure on growth, but the results are mixed and this warrants more studies on the impact of infrastructure development on growth in African countries. This paper is structured as follows: Section 1 gives the introduction, Section 2 reviews relevant literature, Section 3 outlines the methodology adopted for analysis, Section 4 discusses the results, and Section 5 presents the conclusion and policy recommendations.

Literature Review

Quite a number of empirical studies have investigated the impact of infrastructural development on economic growth. Some of the results are reviewed in the current study. Ifoghere and Olele (2024) investigated the impact of government infrastructural development on transportation (IFDT), road (IFDR), water (IFDW) and telecommunication (ITEL) as they impact the growth procedures of the Nigerian economy, proxy by real GDP (RGDP), from 1990 to 2023 using the ARDL model. The study posit that infrastructure development on transport services (IFDT) was positive and significant in explaining changes in the real GDP of Nigeria. Nonetheless, Infrastructure improvement on road, water, and telecommunication were negative and has no relevance in giving an explanation of changes in Nigeria's real GDP within the study period. Their recommendation was that the government, along with the private sector, should make an improvement on its investment in providing infrastructural facilities to promote economic growth. Olaluku (2022) examined social and economic infrastructure, testing the direction of causality using the PSS ARDL technique, and studied the relationship between his two infrastructure indicators, private investment and Gross Value Added (GVA), using a VECM model. The study accommodated the idea that there could be a direct or indirect relationship between infrastructure and growth through private investment. The study found that social infrastructure encouraged economic infrastructure, private investment, and GVA using physical measures of economic and social infrastructure.

Nugraha et al. (2020), using panel data of 26 different provinces, investigated the relationship between infrastructure and economic development in Indonesia They concluded that infrastructure has a notable beneficial impact on growth, with electricity having the highest impact. Investment in infrastructure like electricity produces more elasticity than investment in non-infrastructure. Kodongo and Ojah (2016) studied infrastructural expenditure and whether or not access to infrastructure is beneficial to the economic growth and development of sub-Saharan Africa. This positive relation is more substantial and essential for less developed countries, and this have a very low level of infrastructure in sub-Saharan Africa, when compared to more advanced countries of the same region. It was also asserted that access to infrastructure indirectly impact economic growth via trade openness, capital flows, and trade competitiveness.

Straub and Terada-Hagiwara (2010) used four approaches of tangible infrastructures which are; telecommunication, electricity, road, and water to carry out a study using two distinct strategy: growth regression and growth accounting by investigating the relationship between infrastructure, development, and outputs among developing Asian countries from 1971 to 2006. They discovered

that several countries in Asia that are developing have improved a great deal in their infrastructure improvements, and this notable improvement in infrastructure is beneficial to a rise in GDP per capita. Odedokun (2009) examined the causal relationships between economic infrastructure and both private investment and GVA. Using the VECM model, he found that GVA responds to social infrastructure expenditure with an elasticity of 0.06 and the private investment rate reacts to economic infrastructure spending with an elasticity of 0.02. Not regarding that a positive relationship was found between infrastructure growth, he proceeded to explicitly test for the probability of a non-linear relationship that infrastructure spending initially boosts growth. His findings established a correlation between social and economic infrastructure for all values of investment in infrastructure recorded in South Africa in the last thirty years. The finding in this study is of significant relevance for analyzing the other South African empirical studies because it implies that their results are not compromised because they don't account for the possibility of a nonlinear correlation between growth and infrastructure.

Calderon and Servén (2008) asserted that sub-Saharan Africa negatively impact wealth disparity and a long-term correlation in relation to growth, improved capital stock, along with advanced quality of service. Calderon (2009) discovered the link between infrastructure and economic growth in Africa, using data on 100 countries and adopting telecommunication, electricity, and roads as the key infrastructure sectors. The study stated that the result is both statistically and economically significant. It was concluded that economic growth is enhanced by infrastructural investment. Also, it was stated that larger infrastructure stock provides African countries with a better chance of growth than quality improvement of stock in hand. It also stated that Infrastructure stock adds 99 basis points to per head economic growth.

Straub (2008) discovered that a good number of studies show a strong connection between growth and infrastructure in notable metrics in transport, telecommunications, and electricity, especially in more advanced countries. However, it is not an easy task to figure out conclusive empirical findings on the expenditure on infrastructure across countries. There are certain countries in Latin America that diversify less than 3% of their GDP, while China expends not less than 10% of theirs. Seethepalli et al. (2008) studied public works which are; electricity production per head, size of bitumen road per head, water as a proportion of population having access to healthy water source, and sanitation as a proportion of population with access to advanced healthcare facilities. Adopting standard growth regression in a panel of 16 East Asian countries, the findings showed a positive impact on growth in all measures of capital assets. Nonetheless, the impacts were observed to not be consistent across regions due to of features that are unique to different countries. For instance, the findings posits that nations have to go beyond a certain level of income to see any notable improvement in nation' water capital stock. They also discovered elasticity of GDP for roads was the highest in poor countries.

In another study to examined public infrastructure and growth, Agenor and Moreno-Dodson (2006) argued that electricity generation directly influenced GDP with an elasticity of 0.2. But some of these results were not robust to the

replacement of total road length by other infrastructure measures. They also introduced a control for property rights to check for the role of institutions in the relationship between infrastructure and growth. Incorporating this control kept the indirect relationship through fixed capital stock while also revealing a strong positive direct association with elasticity ranging from 0.4 to 0.5. Servén and Calderón (2004) studied capital assets by stretching their model to accomodate both quantitative and qualitative aspects of capital assets, and they made an interesting observation. In the panel data from 1960 to 2000 of 100 countries, the study analyzed the effect of infrastructure stock on economic growth and how it affects the distribution of income. Using detailed and artificial measurement of both the quality of and quantity of infrastructure, it was discovered that not only did neither quantitative nor qualitative indices impact growth positively, but also the distribution of income and GDP.

Deininger and Okidi (2003) found that households that have access to basic infrastructure enjoyed more incomes and contributed to the economic growth of Uganda positively. Specifically, households that have availability to electricity benefited more significant incomes (3.5% points) and expenditures (6% points) than those without power supply. Along these lines, Sahoo et al. (2012) carried out a study investigating the effect of four types of Capital Assets in China using panel data within the period of 1975–2007. Measuring physical infrastructures, they used electric power usage per head, tarmac road as a proxy of total road, power usage per head, telephone lines per thousand, railway line per thousand, and how many people travel by air, as proxies. The results showed that putting money into capital assets had notable impact on economic growth, this investment appears to have more significant impact when compared to investments made by government and private individuals. The results obtained from the reviewed empirical studies revealed that the impacts of infrastructural development on economic growth are mixed. The lack of consensus among the studies warrants more studies on the impact of infrastructural development on economic growth, focusing on African countries.

Methods, Data, and Analysis

3.1 Model Specification

The model was specified based on the specification of Ifoghere and Olele(2024) with slight modifications. Ifoghere and Olele included road transportation, water, and telecommunication infrastructural variables in analysing the effect that infrastructure has on economic growth. The current study replaced road transportation variable with electricity infrastructure, following the assertion of Ishioro (2023) that energy consumption was important to quality of life.

Model:

$$GDP_{It} = \beta_0 + \beta_1 ELCON_{it} + \beta_2 MCS_{it} + \beta_3 ACWT_{it} + \beta_4 FDI_{it} + \beta_5 EXCHR_{it} + \beta_6 INFL_{it} + \varepsilon_{it}$$

Where:

- $GDPGR_{it}$: Economic growth, proxied by the Gross Domestic Product (GDP) growth rate of country i at time t.
- $ELCON_{it}$: Electricity consumption of country i and time t.
- MCS_{it}: Mobile cellular subscription in country i at time t,
- $ACWT_{it}$: Access clean water in country i at time t.
- FDI_{it}: Foreign Direct Investment inflows in country i at time t, an important driver of infrastructural development and economic growth.
- $EXCHR_{it}$: Exchange rate in country i at time t, measured by the unit of currency given for one unit of the other currency
- $INFL_{it}$: Inflation rate in country i at time t.
- β_0: The intercept term.
- $\beta_1,\beta_2,\beta_3,\beta_4,\beta_5,\beta_6$: Coefficients to be estimated, reflecting the marginal effects of the respective independent variables on economic growth.
- ε_{it}: The error term, capturing unobserved factors that affect economic growth.

3.2 Method of Data Analysis

The analysis employed the fixed effect model, random effect model and dynamic ordinary least squares panel data estimation technique as used by Ashakah et al. (2025) to estimate the impact of infrastructural development on economic growth in seven selected African countries. Panel data combines time-series and cross-sectional data, offering several advantages in econometric analysis. This approach allows for the assessment of variations across countries over time, enhancing the robustness of the results. The technique captures both time and cross-sectional dynamics, providing insights into how infrastructural development influences economic growth across different countries and over the study period.

3.3 The Data

The data were sourced from the World Development Indicators (WDI, 2024) within the period of 1990 to 2023. The study relies on secondary data acquired from reputable and reliable international and regional databases to investigate the impact of infrastructural development on economic growth in fifteen selected African countries (Algeria, Angola, Cameroon, Rep. of Congo, Cote d'Ivoire, Egypt, Ethiopia, Ghana, Kenya, Morocco, Nigeria, South Africa, Tanzania, Tunisia and Uganda) based on data availability.

Results

4.1 Descriptive Statistics

Table 4.1 Group Descriptive Statistics of Variables

	GDPGR	ELCON	MCS	ACWT	EXCHR	FDI	INFL
Mean	3.929830	6.822255	39.69951	425.3595	378.0582	1.961158	97.84291
Median	4.198179	5.240000	16.17351	4.780858	62.47475	1.458104	6.623253
Maximum	15.32916	21.62000	174.0251	7750.000	3727.069	40.16725	23773.13
Minimum	23.98342	2.290000	0.000000	0.000000	2.39E-09	-10.03838	-8.484249
Std. Dev.	4.096172	4.257426	46.38540	1594.245	696.5586	3.261301	1098.787

Skewness	-1.056004	1.373452	0.896243	3.696101	2.719088	4.509492	19.91956
Kurtosis	8.410053	4.232881	2.595697	14.91581	10.88501	46.27167	425.1127
Jarq-Bera	716.7466	192.6414	71.74999	4178.414	1949.626	41517.81	3820033.
Probability	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Sum	2004.213	3479.350	20246.75	216933.4	192809.7	1000.191	49899.88
S. Sq. Dev.	8540.319	9225.970	1095167.	1.29E+09	2.47E+08	5413.768	6.15E+08
Obser.	510	510	510	510	510	510	510

Source: Author's Computation

The growth rate of the selected African countries was between 15.32916% and -23.983427% with a standard deviation of 4.096172 and an average growth rate of 3.929830% between 1990 and 2023. The median growth rate within the period was 4.198179 %. Electricity consumption (ELCON) was between 21.622000 and .290000 with a standard deviation of 4.257426 and the average of 6.822255 between 1990 and 2023. The median of electricity consumption within the period was 5.240000.

The mobile cellular subscription (MCSP) was between 174.0251 and 0.00000 with a standard deviation of 46.38540 and the average value of 39.69951 between 1990 and 2023. The median value within the period was 16.17351. Access to clean water (ACWT) was between 7750.000 and 0.0000 with a standard deviation of 1594.245 and the average value of 425.3595 between 1990 and 2023. The median value of access to clean water within the period was 4.780858.

Exchange rate (EXCHR) was between 3727.069 and 2.39E-09 with a standard deviation of 696.5586 and the average value of 378.0582 between 1990 and 2023. The median of the exchange rate within the period was 62.47475 US dollars. Foreign direct investment (FDI) was between 40.16725 and -10.03838 with a standard deviation of 3.261301, and the average value was 1.961158 between 1990 and 2023. The median of FDI within the period was 1.458104 during the period of the study. Inflation rate (INFL) was between 23.773 and -8.484249 with a standard deviation of 10.98, and the average value was 97.84291 between 1990 and 2023. The median of the inflation rate within the period was 6.6232553 during the period of the study.

4.2 Correlation Matrix

Table 4.2 Matrix of Correlation Coefficients

VARIABLES	GDPGR	ELCON	MCS	ACWT	EXCHR	FDI	INFL
GDPGR	1	0.02714	-0.0173	0.0263	0.1513	0.2064	-0.1299
ELCON	0.0271	1	-0.3097	-0.2029	0.2882	-0.0408	0.1272
MCS	-0.0172	-0.3097	1	0.0423	0.0029	0.0385	-0.0709
ACWT	0.0263	-0.2029	0.0423	1	-0.1414	0.0310	-0.0214
EXCHR	0.1512	0.2882	0.0029	-0.1413	1	0.1022	-0.0451
FDI	0.2064	-0.0407	0.0385	0.0310	0.1022	1	-0.0122
INFL	-0.1299	0.1272	-0.0709	-0.0214	-0.0451	-0.0122	1

Source: Author's Computation

Gross domestic product growth rate (GDPGR) is perfectly and positively correlated with itself at 100%. It is positively correlated with other variables between about 20% and 2% during the period of the study. Electricity consumption

is positively and perfectly correlated with itself during the period of the study. It is negatively correlated with mobile cellular subscription (MCSP) and access to clean water (ACWT) at about 31% and 20% respectively. It was positively correlated with the other variables between 28% and 2% during the period of the study. Mobile cellular subscription was positively and perfectly correlated with itself during the period of the study. It was negatively correlated with economic growth rate (GDPGR), electricity consumption (ELCON), and inflation rate about 2%, 30% and 7% respectively.

Access to clean water (ACWT) was perfectly and positively correlated with itself at 100% during the period of the study. It is positively correlated with GDPGR at about 3%, mobile cellular subscription (MCSP) at about 4%, and FDI at about 3% during the period of the study. It was negatively correlated with electricity consumption (ELCON) at about 20%, exchange rate at about 14% and inflation rate at about 2% during the period of the study.

The control variables- exchange rate (EXCHR), foreign direct invest (FDI) and inflation rate (INFL) had both negative and positive correlation the other variable between 28% and 1%. Examining the various correlation coefficients shows that the coefficients are all less than 0.50. This is an indication to the possibility that regression models estimated with the variables may not suffer the problem of multicollinearity which is usually associated with highly correlated variables.

4.3 Unit Root Tests

Table 4.3 Unit Root Tests

Variables	Augmented Dickey-Fuller Unit Root Test						Integration Order
	Level			1st Difference			
	LLC statistics	Prob.	Inference	LLC statistics	Prob.	Inference	
GDPGR	-5.39156	0.0000	S	-	-	-	I(0)
ELCON	-0.59947	0.2744	NS	**-9.68037**	0.0000	S	I(1)
MCS	-0.06797	0.4729	NS	-5.52858	0.0000	S	I(1)
ACWT	6.00794	1.0000	NS	-3.98940	0.0000	S	I(1)
EXCHR	4.56530	1.0000	NS	-6.33169	0.0000	S	I(1)
FDI	-2.76490	0.0028	S	-	-	-	I(0)
INFL	-3.79821	0.0001	S	-	-	-	I(0)

Heterogeneous Unit Root Process

Variables	Level			1st Difference			Integration Order
	IPS Statistics	Prob.	Inference	IPS Statistics	Prob.	Inference	
GDPGR	-6.21177	0.0000	S	-	-	-	I(0)
ELCON	0.22558	0.4108	NS	-11.9337	0.0000	S	I(1)
MCS	-0.02681	0.4893	NS	63.3700	0.0004	S	I(1)
ACWT	0.81532	0.7926	NS	-3.61473	0.0002	S	I(1)
EXCHR	6.91174	1.0000	NS	-7.86595	0.0000	S	I(1)
FDI	-4.04881	0.0000	S	-	-	-	I(0)
INFL	-5.70425	0.0000	S	-	-	-	I(0)

Source: Author's Computation

Both test results showed that gross domestic product growth rate (GDPGR), foreign direct investment (FDI) and inflation were stationary at level. However, electricity consumption (ELCON), mobile cellular subscription (MCSP) access to clean water (ACWT), and exchange rate (EXCHR) were stationary at first difference. It could be inferred therefore from the panel unit root tests that the variables were of mixed order of integration.

4.4 Panel Cointegration Tests

Table 4.4 Pedroni Residual Cointegration Test

Series: GDPGR, ELCON, MSC, ACWT, EXCHR, FDI, INFL				
Alternative Hypothesis: Common AR Coefficients(Within-dimension)				
	Statistic	Prob.	Statistic	Prob.
Panel v-statistic	-3.604950	0.9998	-3.680262	0.9999
Panel rho-statistic	-0.795655	0.2131	-1.478921	0.0696
Panel PP-statistic	-8.921195	0.0000	-11.42652	0.0000
Panel ADF-statistic	-2.740618	0.0031	-2.926246	0.0017
Alternative Hypothesis: individual AR Coefficients (between dimension)				
	Statistic	Prob.		
Group rho-statistic	-0.115506	0.9986		
Group PP-statistic	-14.31439	0.0000		
Group ADF-statistic	-3.909691	0.0000		

Table 4.5 Kao Cointegration Test

	t-Statistic	Probability
ADF	-5.745589	0.0000
Residual variance	16.86475	
HAC variance	8.771100	

Sources: Author's Computation

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4.5 Model Estimation Results

The results of estimation of the specified model are presented in Table 4.6. The estimation used the fixed effect model, random effect model and panel Dynamic Ordinary Least Squares (DOLS). The use of the DOLS was to be sure of the results obtained from the fixed effect and random effects models.

Table 4.6 Model Estimation Results

Dependent Variable: GDPGR

Sample: 1990-2023

	Fixed Effect Model		Random Effect Model		Panel DOLS	
Variable	Coefficient	t-statisti/Prob.	Coefficient	t-statistic/Prob.	Coefficient	t-statisti/Prob.
ELCON	-0.112463	-1.032445/0.3024	0.010914	0.257393/0.7970	-0.238882	-0.8968/0.3711
MCSP	-0.001392	-0.357702/0.7207	-0.002073	-0.579506/0.5625	-0.016321	-1.6922/0.0924
ACWT	-5.6505	-0.159813/0.8731	4.7705	0.473041/0.6364	-0.000461	-0.2555/0.7986
EXCHR	0.000498	1.042177/0.2779	0.000432	1.798870/0.0727	-0.000475	-0.5064/0.6132
FDI	0.123823	2.404822/0.0166**	0.120494	2.449818/0.0146***	1.010718	4.72414/0.0000***
INFL	-5.9105	-0.394415/0.6935	-9.3805	-0.638747/0.5233	0.001460	1.0764/0.2832
GDPGR(-1)	0.387888	9.086187	0.445597	11.05295/0.0000		
C	2859121	3.093173/0.0021	1.815103	4.281936/0.0000		
R^2	0.2878		0.2598		0.667609	
R^{-2}	0.2562		0.2491		0.113625	
F-st.	9.1029		24.4165			
P.(F-st.)	0.0000		0.0000			
D.W sta.	2.1230		2.182033			

Source: Author's Computation

4.5.1 Model Selection Criteria

The study estimated the fixed effect model and random effect model for comparison. The decision between the fixed effect model and the random effect model was based on Huasman's test result presented in Table 4.7. We rejected the null hypothesis that the Random Effect Model was more appropriate based on the probability of the cross-section Chi-Sq. statistic (0.0118) which is less than 5 percent (Onabeyake et al.2024).

Table 8. Result Hausman Test

Null Hypothesis: Random Effect Model is Appropriate

Test Summary	Chi- Sq. Statistic	Chi-Sq. d.f	Probability
Cross-Section Random	18.033036	7	0.0118

Source: Author's Computation

Discussion

The empirical results obtained from the estimation of the fixed effect model showed that the value of the coefficient of electricity consumption was -0.112463 with a probability of 0.7979. The result disagreed in terms of sign with economic theory. The result showed that electricity consumption (ELCON) was negatively related to the economic growth rate (GDOGR). It showed that a one-unit rise in electricity consumption would result into a reduction in nthe growth rate of gross domestic product of about 0.02 units. The result not only disagreed with economic theory, but it was also not significant at the level of 5%. The result was not in agreement with the results from Ashakah (2025) and Ishioro 2023. The variation could be due to variations in policy formulation and implementation. The finding implies that electricity consumption in the selected African countries does not determine economic growth.

Likewise, the coefficient of mobile cellular subscription was -0.001392 with a probability of 0.7207. The result disagreed in relation to sign with economic theory. The result showed that mobile cellular subscription (MCS) was negatively related to the economic growth rate (GDOGR) within the study period. It showed that a one-unit rise in mobile cellular subscription would lead to a decrease in gross domestic product growth rate of about 0.001392 units. The result not only disagreed with economic theory, but it was also not significant at the 5% level. The result is agreement with the findings of Ifoghere and Olele (2024) and disagreement with Calderon and Serven (2018). The finding implies that mobile cellular subscription (MCSP) in the selected African countries does not determine economic growth.

Also, the coefficient of access to clean water (ACWT) was -0.000005605 with a probability of 0.8731. The result also disagreed with economic theory. The result showed that access to clean water (ACWT) was negatively related to the economic growth rate (GDOGR) within the study period. It showed that a one-unit rise in access to clean water would lead to a decrease in the gross domestic product growth rate of about 0.000005 units. The result not only disagrees with economic theory, but it was also not significant at the 5% level. The result agreed with the findings of Ifoghere and Olele (2024). The difference could be attributed to policy variations, too. The implication of the finding is that access to clean water (ACWT) in the selected African countries does not determine economic growth.

The coefficient of exchange rate (EXCHR) was estimated at 0.000498 with a probability of about 0.2979. The result showed that an iimprovement by one-unit in the exchange rate would lead to an about 0.000498 unit rise in gross domestic product growth rate. The result confirmed that the exchange rate and economic growth rate had a positive and insignificant relation within the study timeframe; the exchange rate did not impact positively and significantly on economic growth

in the selected African country within the scope of the study. This explanation is based on the probability value of the estimated coefficient of exchange rate which is greater than 5%.

The coefficient of foreign direct investment (FDI) was estimated at 0.123823 with a probability of about 0.0166. The result showed that a one-unit increase in FDI would lead to about 0.123823 unit rise in gross domestic product growth rate. The result confirmed that FDI and economic growth rate had a positive and significant relation during the period of the study; FDI impacted positively and significant on economic growth in the selected African country during the period of the study. This explanation is also based on the probability value of the estimated coefficient of exchange rate which is less than 5%.

The coefficient of inflation rate (INFL) was estimated at about -0.0000059105 with a probability of about 0.6935. The result showed that a one unit increase in inflation would lead to about 0.0000059105 unit fall in gross domestic product growth rate. Inflation failed to impact on economic growth in the selected African country during the period of the study. This interpretation is also premised on the probability value of the estimated coefficient of inflation rate which is greater than 5%.

The coefficient of the first lag of gross domestic growth rate (GDPGR(-1)) was estimated at 0.387888 with a probability of 0.0000. The result showed that the current GDPGR and its first lag were positively and highly significant at the 1% level. The results showed that an improvement by one unit in the first lag of GDPGR would lead to about 0.387888 unit improvement in the current GDPGR. The economic implication of this is that previous growth rates have potential of growth in subsequent periods.

The value of the constant was estimated at about 2.859121. This showed that assuming all the explanatory variables in the model is zero, economic growth rate would not be zero. That showed that there would be some autonomous effects that could project economic growth in the selected African countries without the presence of the selected variables for the study.

The coefficient of determination (R-square) was estimated at 29%; indicating that about 29% of the systematic variations in the dependent variable – gross domestic product growth rate (GDPGR) in the selected African countries was explained by all the explanatory variables in the model. The F-statistic (9.102925) and the corresponding p-value (0.0000) indicate that a significant relationship exists between the variables included in the model combined. The Durbin-Watson statistic of 2.123056 suggested there was no autocorrelation in the estimated model.

Also, the empirical results obtained from the panel dynamic ordinary least squares (DOLS) confirmed that electricity consumption, mobile cellular subscription, and access to clean water, (which are the variables representing infrastructure development) failed to impact economic growth in the selected African countries within the scope of the study. Likewise, inflation rates and exchange rates failed to impact economic growth in the selected African countries during the period of the study. However, foreign direct investment was confirmed to have a positive and significant impact on growth in the selected African countries within the scope of the study.

Conclusion

The study investigated the impact of infrastructure development (electricity consumption, mobile cellular subscription and access to clean water) on economic growth in the selected African countries using the fixed effect and the dynamic ordinary least square in data analysis from 1990 to 2023. The study found that electricity consumption, mobile cellular subscription, and access to clean water harmed economic growth, and the results suggest that electricity consumption, mobile cellular subscription, and access to clean water are not relevant determinants of economic growth in African countries. The results obtained from the dynamic ordinary least squares (DOLS) estimation technique confirmed the results that infrastructure development did not impact on economic growth in the selected African countries within the scope of the study.

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