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IMPACT OF GOVERNMENT EXTERNAL FINANCING ON ENERGY INFRASTRUCTURE IN NIGERIA

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Abstract
Successive governments in Nigeria have relied on borrowing to finance critical public sector investment programmes especially for energy infrastructure; despite this financing strategy however, a large gap still exist between energy infrastructure supply and its demand. This study examined the impact of government external financing on energy infrastructure in Nigeria. The specific objectives were to: to determine the impact of government multilateral external financing on energy infrastructure growth in Nigeria, to evaluate the impact of government bilateral external financing on energy infrastructure growth in Nigeria., to investigate the impact of government domestic financing on energy infrastructure growth in Nigeria, and to ascertain the impact of external debt servicing on energy infrastructure growth in Nigeria. The researcher adopted the ex post facto research design and used time series data covering from of 1991-2021. The ordinary least squares regression (OLS) technique was employed to estimate the parameters. The findings indicated that government multilateral external financing has significant positive impact on energy infrastructure growth in Nigeria, government bilateral external financing has significant positive impact on energy infrastructure growth in Nigeria, government domestic energy infrastructure financing has significant positive impact on energy infrastructure growth in Nigeria, external debt servicing has significant negative impact on energy infrastructure growth in Nigeria. Based on the findings, the study recommended that the energy sector should be improved upon to ensure that electricity energy consumption is not hindered by way of constant blackouts, government should explore more bilateral external financing to enhance funding for energy infrastructure growth, here is need for increased domestic energy infrastructure financing in order to aid the growth of the economy, the debt servicing should be repositioned in such a way as to reduce its negative effect on providing financing for energy infrastructure growth.
Keywords: External Financing, energy, infrastructure

INTRODUCTION
Industrial, office and domestic economic and non-economic activities run on energy. From

factory operations, transportation, down to domestic lighting is powered by energy. Energy is the capacity to do work and satisfy some economic and non-economic wants and of concern here is the electrical and mechanical type of energy. The availability or not of energy in any economy has wide ranging implications. Intermittently, factories shut-down operations, offices and households are thrown in into blackout, hitches arise in communications network, and transportation becomes difficult arising from shortage in production, absence or shortage in supply or non-affordability of energy. These could be referred to as crises in the energy sector. Global growth makes it a necessity for every national economy to require more energy for the operations of its different economic sectors, this is in line with its functions as the driver of most economic activities (Hamisu, Gizem, Solomon, Bekum & Sarkodie (2020). Energy is an important element of economic growth and it is linked to capital and labour (Abdoli & Dastan, 2015). Energy is considered one of the necessities in daily life as a result of its relationship with human development that comprises health, population, agricultural productivity, education, industrial production, the living standard of different nations in the world (Asumadu-Sarkodie & Owusu, 2017).

Scholars have proposed that a relationship holds between energy and the aggregate economic output of any economy. Energy demand is closely proportional to national output, not only in manufacturing and construction but also in farming, fishing, food processing and goods distribution (Tuvel, 2019). Thus every economic success in a developing country like Nigeria spurs increases in demand of and reliance on electricity energy and if the relative production and supply of electricity are inadequate, potential instability will be the consequence. The world over, energy crisis does not go without leaving a mark on the people and the economy as a whole. In developing countries, the insufficient economic growth is caused by either the lack of public infrastructure itself (such as energy) or the absence of basic frameworks for its operations and maintenance. Further to the decay of electricity infrastructures, disruption in the transmission lines has remained a long issue in electricity supply in Nigeria since the country operates on-grid solutions (Karimo, & Ogbonna, 2017). The challenge here is that the High tension transmission lines are located and pass through sparsely settled territories thereby making the early detection of disruptions difficult as well as making electric power transmission to industrialized areas too expensive considering present technology.

The issues of aging infrastructures like gas turbines, pipeline and Refinery facilities form a significant component of current concerns in the energy sector. It is no longer news that a very large proportion of industrial automobile and domestic energy fuels are imported and not refined here in Nigeria despite the presence of three refineries. Every industrial plant experience wear and tear and age, the refinery facilities in Nigeria are operating below installed capacities because they were built many years ago and are already approaching the end of their productive life but, the politics of petroleum has blinded successive governments from seeing the need for new ones (Ogundipe, Akinyemi & Ogundipe, 2016). As long as Nigeria's domestic fuel energy needs depend on imports, then the sight of an end to energy crisis is far away. Of all the component sectors of the economy, manufacturing sector no doubt is the highest user of energy but crisis in the energy sector has had its toll on the sector. Nigeria has Africa's largest population and economy, but Nigerians consume 144 kwh per capita annually, only 3.5% as much as South Africans (Rafindadi, & Ozturk, 2017). Nigeria, as one of the largest economies on the continent, has substantial installed generation capacity of more than 13.5 GW. Compared to the country's

peak demand of 8.25 GW, generation should be able to adequately address the national demand (Abula & Ben, 2016). Yet in 2019 the available capacity only amounted to 3.7 GW. In terms of contribution to growth, the manufacturing sector accounted for 0.32% of the total GDP growth rate 6.46% in 2009 and contributed 4.17% of the real GDP in the same year (NBS, 2021). The reason adduced for this abysmal performance of this sector over the years is constraints linked to pervasive growth-inhibiting factors which includes crisis in the energy sector. Insufficient power generation, high transmission and distribution losses as well as lack of synergy between the supply of gas and power generating companies constitutes some of the related energy issues which has trickled down to the manufacturing and other sectors.

1.2 Statement of the Problem

As is with many sub-Sahara African countries, Nigeria has found it difficult to meet the electricity demands of its ever-increasing population. Various government reforms to salvage the situation in the energy sector have yielded little or no impact. The sector keeps falling behind expectation, for example, in 2009, only less than half of the country's population had access to electricity (Tatlı, 2017)). As of 2018, about 80million Nigerians still lack access to electricity supply in their homes (Okafor, 2018). Even after more than 5years of privatizing the energy sector, the story still remains unchanged. Investors who acquired the six generating companies and the 11 distribution companies still grapple with the same problems that have bedeviled the sector over the years. The installed generation capacity is 12,910.40 MW, with the available capacity, transmission wheeling capacity, and the peak generation ever attained at 7,652.60MW, 8,100MW, and 5,375MW, respectively (Hamisu, Gizem, Solomon, Bekum & Sarkodie, 2020). Due to the challenges of the energy sector, peak generation of 5,375MW has hardly been sustained

Nigeria operates on-grid electricity and automobiles run on fuel. The energy crises in Nigeria take its root from a wide range of issues. There is no significant number of operators in the energy sub-sector owing to over regulation and too much government intervention. The electricity generation companies (Gencos) in Nigeria are mostly government owned with the usual government inefficiency in management and operation. The unbundling of the national electric power author (NEPA) has yet to yield the desired impact since the private sector only participates in distribution (Ayadi & Ayadi, 2018). Union-organized industrial actions by electricity and petroleum sector workers are a very critical issue perpetuating energy crises in Nigeria. The singular action of these unions usually renders the government helpless unless reaching a truce. For instance, petroleum and Natural Gas Senior Staff Association of Nigeria (PENGASSAN) alone or in conjunction with its sister unions like NUPENG, PTD, IPMAN, etc can cripple energy supplies.

Disruption in the transmission lines has remained a long issue in electricity supply in Nigeria since the country operates on-grid solutions. The challenge here is that the High-tension transmission lines are located and pass through sparsely settled territories thereby making the early detection of disruptions difficult as well as making electric power transmission to industrialized areas too expensive considering present technology. There are divergent schools of thought regarding the impact of debt accumulation, energy and related infrastructure and the

growth of the aggregate economy. Some scholars hold that a continuous rise in public debt burden over a longer period put serious threats to economic performance if the debts incurred are not properly channeled to productive investments especially on energy infrastructure which have regenerative capacity. However, other scholars submit that the effect of public debt on growth is not outright in the negative but depends upon its nature and utilization. Hence, they hold the view that public debt accumulation has positive bearing on the economy. Muhammad, Sarwar, Adil, Hafsah and Israr (2021), Zaidi (2015), Molina (2020), Amassoma (2011), Berben and Brosens (2007), Tchereni (2013) and Mbate (2013) are some of the studies which results revealed that public debt accumulation negatively affects economic performance. Conversely, other scholars have found a positive linear relationship between public debt and economic growth. Hence this study aims to investigate the impact of government external financing on energy infrastructure in Nigeria.

1.2 Objectives of the Study

The broad objective of this study is to investigate the impact of government external financing on energy infrastructure in Nigeria. The specific objectives are:

1. To determine the impact of government multilateral external financing on energy infrastructure growth in Nigeria.
2. To evaluate the impact of government bilateral external financing on energy infrastructure growth in Nigeria.
3. To investigate the impact of government domestic financing on energy infrastructure growth in Nigeria.
4. To ascertain the impact of external debt servicing on energy infrastructure growth in Nigeria

A country is in energy crises if it has abundant energy resources or access to them, the technology and capability to produce, manage and market energy products but ends up not having enough to satisfy its needs; importing rather than exporting some energy products and paying higher prices for scarce and substandard products" (Bakirtas & Akpolat, 2018)). It can be drawn from the above that the term energy crises have a wide sphere of concern. It is a set of conditions which are not desirable owing to or arising from the absence, inadequacy, costly and or short- in-supply of energy resources. Therefore, energy crises is any significant bottleneck or rise in price that affect supply of energy resources to an economy especially those economies like Nigeria that operate on-grid electricity and use fuels in vehicles.

Administrative personnel also experience discontentment with work where energy resources are unaffordable, not available or are insufficient to ventilate and light offices and power office technology. Loss of time both individually and collectively is inevitable in any energy crisis as a result of difficulties in transportation and communication. Automobiles in Nigeria run on fuel energy and difficulties with access to fuel energy tell hard on Nigerians. Communication and radio masts need electric energy to function, so that electricity blackouts are accompanied by communication blackouts. The effects of the crisis on individuals aggregate on the economy a whole as almost all sectors of the economy are enmeshed in the crisis (Balcilar, Bekun & Uzuner, 2019). In the transportation sector for instance, according to NBS (2012) the sector experienced

relative freeze in real growth declining slightly to 6.83% in 2009 from 6.97% in 2008 thereby decreasing the share of the transport sector in the GDP from 2.71% in 2008 to 70% in 2009.

Strategic steps have to been taken to better or ameliorate the energy situations in the county. These steps should be government's deliberate efforts backed by very strong will for implementation. Energy audits are the first necessary step that can be taken in response to the energy crisis situation. Conducting energy audits is directed at monitoring usage. Energy and fuel rationing is always the first immediate response to energy crisis situation especially with situations that were precipitated by insufficient energy resources. Rationing directs the available quantities towards areas that are most at risk or productivity areas. Development of alternative energy sources is one sure way of provisioning for incidents of energy crisis (Balsalobre-Lorente, Shahbaz, Roubaud & Farhani, 2018). At present, our most explored energy sources are oil and gas and complementary hydroelectric sources. We are yet to substantially explore the potentials of coal, nuclear power and solar energy sources as alternative and reliable energy sources. It is imperative therefore, that these sources be invested in. By far, the greatest promise for increasing the available supply of high-grade energy is to be found in the field of atomic or nuclear power (Tuvel, 2019).

Deregulation of the energy sector will clear out all the inhibiting laws that prevent private participation in the generation, transmission and distribution of energy. As a matter of urgency, the bottlenecks preventing the passage of the problem industry bill into law should be straightened. The content of that bill promises great fortunes for fuel and gas energy in Nigeria. This should also be replicated in the entire energy sector so that the entire undeveloped alternative sources could be aligned into the stream. Proactive measures should be put in place to detect and arrest expected union-organized industrial actions which has the sole capacity to induce energy crisis in the twinkle of an eye and paralyze the entire economy. These could be done through a routine round-table discussion of relevant government energy agencies and industry participants with a view to collecting proper information data that will aid proper decision making.

2.0 REVIEW OF RELATED LITERATURE

Energy Infrastructure

The Industrial Revolution went into full swing in late eighteenth century when breakthroughs were achieved in converting other forms of energy into work (Bekun, Emir & Sarkodie, 2019). Hence energy can be defined as a property of matter that can be converted into work, heat or radiation. Energy is one of the most important inputs for economic development. Energy infrastructure refers to the combination of human and physical resources used to create, transmit, transform and distribute electrical power in places around the world. Energy infrastructures include many components: generation, transmission, and distribution of electricity; physical networks of oil and natural gas pipelines; oil refineries; and other transportation elements such as marine and rail transportation Energy is derived from a wide range of sources which implies a wide range of crisis solution and occurrence may not usually be multi-source as is the case in Nigeria.

Private automobiles and public transport systems increase mobility problems and needs with potentials to trigger hike in petroleum prices which usually unsettle the economy in Nigeria.

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Table 1.0 domestic petrol consumption of selected African countries (in 000 bpd)

Year/country	2010	2015	2018	2021
Africa	3537.336	3446.525	3608.903	3600.71
Angola	104.4358	107.0874	111.8954	112
Libya	331.2339	182.1691	238.0126	242
Nigeria	283.0765	287.4165	279.1908	280
S. Africa	584.0363	616.1876	638.3504	612

Source: index mundi

Average percentage domestic petroleum usage of total production in Nigeria for selected years between 2010 and 2021 is 11.435%. This stems from the fact that crude petroleum forms a large part of foreign exchange in Nigeria. Natural gas is a special case because; the laws of supply, demand and price have not been allowed to operate for this energy component in Nigeria. For many years, the price of natural gas has been kept at a high level, to the consequence that more and more users are shifted to petroleum fuel.

Table 3.0: dry natural gas consumption by selected African countries in (bcf)

Year/country	2010	2015	2018	2021
Africa	3576.774	3908.629	4491.68	4573.434
Angola	25.92121	26.55668	26.8394	17.48093
Libya	249.4652	191.937	202.355	229.0884
Nigeria	177.6345	190.701	505.1811	544.1277

Source: index mundi

From the figures above it can be deduced that the average percentage domestic natural gas usage of total production in Nigeria between 2010 and 2021 stood at 27.07%. This indicates the underutilization of gas resources. Tuvel notes that coal has the capacity to support an economy for hundreds of years. But the fraction of energy in Nigeria presently furnished by coal is negligible despite huge evidence of deposit reserves of coal at specific locations across the country. The electricity utility power based on coal has been far below other sources of energy. The inhibiting factors to its usage could be traced to very high capital demands and the environmental difficulty. Hydropower furnishes a significant percentage of total energy supply nationwide with improvements and development of the Kainji and Mambilla. Tuvel also notes that 'by far the greatest promise for increasing the available supply of high-grade energy is to be found in the field of nuclear power.' The main systems used in Britain are gas-cooled reactors, and water-cooled reactors in the USA (Chen & Fang, 2018). The rising tide of opposition to the use of nuclear power is singularly linked to safety issues. Solar energy contributes to the development of solar water heaters for domestic use, with wide utilization in space programs. A large percentage of energy demand in Nigeria is mainly for lighting and cooling in residences and smaller buildings supplied by petroleum fuel. solar energy can furnish the demand for

lighting energy thereby saving the portion furnished by petroleum fuel for other uses.
The seeming two-way causation between energy (electric power) and the modern economy has passed scholarly debates. Energy demand is closely proportional to national product output, not only in manufacturing and construction but also in farming, fishing, food processing and goods distribution (Tuvel, 2019). Thus, every economic success in a developing country like Nigeria spurs increases in demand of and reliance on energy and if the relative production and supplies of energy are inadequate, potential instability will result. The world over, energy crisis does not go without leaving a mark on the people and the economy as a whole; industrial and economic activities are run on electricity which run machines and manufacturing plants and other industrial lighting facilities. Thus, to successfully run modern industrial economy energy infrastructure is indispensable. Top among the problems with business activities in Nigeria is the epileptic power supply resulting from decaying or inadequate energy infrastructure. The energy solutions available to Nigeria (gas plants, Dams and Coal) have not been significantly explored and utilized; with the existing deposits of gas resources, it is necessary to expand the national inventory of gas plants (Turbines). The on-grid energy model which the Nigerian economy greatly rely on (gas driven turbines and Dams) recurrently throws the nation into darkness with the consequence that the business sector suspends or delay production of goods and services whenever (and certainly) the national grid collapses or develops faults in-between the transmission lines. Looking in the direction of solar solution may significantly enhance and contribute to efficiently functional energy infrastructure for economic production and social services. This study emphasizes the adoption of a dual energy model (on-grid and off-grid solutions) in energy infrastructure development.

External Financing

External financing or external debt according to World Bank (2004) is defined as debt owed by the government to non-residents repayable in terms of foreign currency, food or service. It is a source of financing capital formation of an economy. Ayadi and Ayadi (2018) opined that the amount of capital available in most developing countries treasury is grossly inadequate to meet their economic growth needs mainly due to their low productivity, low savings and high consumption pattern. The reported financial inadequacies lead countries to source for supplementary financing. DMO Nigeria (2016) noted that external debt is one major source of aid to developing nations. But the rate at which they borrow depends on the links among foreign and domestic savings, investment and economic growth so that the borrowing countries can increase their capacity output with the aid of foreign savings (Ijirshar, Fefaand Godoo, 2016). It is required that the borrowing nation should be able to invest the borrowed fund wisely especially in financing development projects like railway construction, electricity generation plants, road construction and any other major capital project of the economy. However, Elfaki, Poernomo, Anwar & Ahmad (2018) have pointed out that external debt can only be productive if well managed by making the rate of return higher than the cost of servicing the debt.

2.2 Empirical review

Hamisu, Gizem, Solomon, Bekum and Sarkodie (2020) examined the electricity consumption and economic growth nexus in a trivariate framework by incorporating urbanization as an additional variable. Using the recent novel Maki cointegration test, Ng-Perron, Zivot-Andrews, and Kwiatkowski unit root tests along with FMOLS, DOLS and the CCR estimation methods, we relied on an annual frequency data from 1971-2014. Results from FMOLS, DOLS and the

CCR regression confirm the electricity consumption-driven economic growth. This is desirable as Nigeria is heavily dependent on energy (electricity) consumption. A unidirectional causality from urbanization to electricity consumption and economic growth was found but the long-run empirical findings revealed urbanization impedes growth — a situation that has policy implications. The study highlights that though urbanization is a good predictor of Nigeria's economic growth, however, the adjustment of the energy portfolio to meet the growing urban demand will curtail the adverse and far-reaching impact of urbanization on the economy.

Eke and Akujuobi (2019) empirically investigated the effect of public debt on economic growth in Nigeria, covering the period 1981-2018. Employing a co-integration approach, the study revealed prominent among others that a significant short-run relationship exists between Nigeria's public debt and economic growth. Also, the study further showed that whereas both the domestic debt and the external debt variables were statistically significant, only the latter failed the a priori expectation test and thus, exerts a negative contribution to economic growth in Nigeria. On the basis of the findings, the study concluded that most of the external borrowings in Nigeria end up being misappropriated. Hence, the recommendation is that there should be proper ways of monitoring public borrowings with special emphasis on all external debts contracted with a view to ensuring that misappropriation is drastically reduced, if not eradicated

Ubi-Abai and Ekere (2018) analyzed effect of government borrowing on investment growth in Nigeria. The study adopted the econometric techniques of dynamic panel General Method of Moment for data analysis. The findings of their work showed that inter-state borrowing has significant positive negative effect on investments in Nigeria. The reason for the negative result could be attributed to the outflow of capital in the form of interest payments and servicing of the bilateral debt which may assume non-monetary implications in terms of clauses in the agreement which if implemented could harm domestic investments in the country. Alenjandro and Ifeana (2017) examined the impact of government debt on gross domestic product in 16 Latin American economies including Bolivia, Argentina, Chile, Brazil, Costa Rica, Colombia, Dominican Republic, Mexico, Honduras, Panama, Nicaragua, Peru, Paraguay, Venezuela and Uruguay for the period 1960-2015 using Two-Stage Least Squares (2-SLS) in the analysis. The variables employed in the analysis include the initial level of GDP per capita, the growth rate of GDP per capita, gross government debt as a share of GDP, investment rate proxied as gross fixed capital formation as a share to GDP and population growth rate. The results indicated that debt has a positive impact on GDP growth but declines to close to zero beyond public debt-to-GDP ratios between 64% and 71% up to this threshold, additional debt has a stimulating impact on growth.

2.3 Theoretical Framework

It is important to understand the relationship between government financing and energy infrastructure. Hence the theoretical framework adopted by this study is the Feedback Hypothesis. Feedback Hypothesis was used in Ozturk (2010) Shahbaz (2015); and Kocak & Sarkgunesi 2017). The Feedback Growth Hypothesis sees energy consumption as a direct influence on economic growth in presents of the control for capital and labor. The Feedback Hypothesis posits bidirectional causality between energy consumption and economic growth meaning that a mutual relation exists between energy consumption and economic growth. In this situation, energy conservation policy seeks to reduce energy consumption may negatively affect economic growth and these changes are likewise reflected back to energy consumption.

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The functional model according to the theory is:
***GDP = f (Energy consumption)* … 1**

An investigation on the link between energy consumption and economic growth is not a thing of recent studies. It dates back to the 1970s with the pioneer work of Kraft & Kraft (1978), where a unidirectional causality from GNP growth to energy consumption were observed in the United States for the period of 1947-1974. Since then, numerous scholars have carried out further test to determine the relationship between energy consumption and economic growth. Renewable energy sources have begun replacing traditional energy sources in these past years due to the challenges of energy security, the risk of extinction of traditional energy sources environmental problems as well as greenhouse gas emission.

3.0 METHODOLOGY

The study adopted *ex post facto* design to measure the impact of explanatory variables on the explained variable. This design is adopted in this work so as to relate the past values of the model variables to explain present output and estimate future output. The model was estimated using time series data and the Ordinary Least squares econometric method. The use of the OLS technique draws from a number of strengths which it possesses than other methods; this method has been used in a wide range of economic relationship empirical observation with satisfactory results and as well is an essential component of most other econometrics technique (Iyke, 2015).

Sources of Data

This research employed data sourced from NNPC data archives, the Central Bank of Nigeria (CBN) statistical bulletin (2021), the ministry of Petroleum resources publications and the Nigerian Bureau of Statistics (NBS). The data are time series of the model variables for the period 1991-2021.

Model specification

The model used for this study in the linear form is stated below as:
EGI= f (GMEX, GBEX, GDEF, EXDS) … (2)

The econometric form is:

$$\mathbf{EGI_t = \alpha 0_t + \alpha 1 GMEX_t + \alpha 2 GBEX_t + \alpha 3 GDEF_t + \alpha 4 EXDS_t \mu t_t \ldots (3)}$$

Where:
EGI= Energy Infrastructure
GMEX =government multilateral external financing
GBEX = government bilateral external financing
GDEF = government domestic energy financing
EXDS = external debt servicing
ut = Stochastic error term.

The apriori expectations of the variables: GMEX, GBEX and GDEF are expected to have

positive (+). The apriori signs show that positive coefficient of government external financing variables would encourage energy infrastructure development.

4.0 RESULTS AND DISCUSSION

The previous session dealt with the theoretical frame- work and methodology of the study. A model which represents the subject matter of the study has been specified and was used to justify the relationship between external financing and energy infrastructure. Stationarity is important because many useful analytical tools and statistical tests and models rely on it. Unit root tests can be used to determine if trending data should be first differenced or regressed. Moreover, economic and finance theory often suggests the existence of long-run equilibrium relationships among non-stationary time series variables. It usually implies that the statistical properties of a time series (or rather the process generating it) do not change over time. Hence, in order to ensure the policy forecasting reliability and suitability of the data employed in this, it was subjected to unit root diagnostic test and the summary of the result is presented below:

4.1.1 Unit Root Test

Table 1: Unit root test result

ADF Test @ Level

Series	**ADF**	**5% C.V**	**P-value**
EGI	-5.396825	-3.568325	0.0006
GMEX	-4.066028	-3.568325	0.0014
GBEX	-4.497531	-3.568325	0.0080
GDEF	-6.790154	-3.568325	0.0000
EXDS	-5.124063	-3.568325	0.0000

Source: Author's computation 2023

The result in table 2 above shows that (@ level), all of the model variables achieved stationarity; hence, they are integrated of order 1(0). The study concluded stationarity based on the fact that following the rule for unit root testing, p-value of the individual (ADF test statistic) of the variables is less than the 5% significance level. The implication of stationary process or series is that the model employed can be relied upon for policy analysis and decision making. Having shown that the variables are stationary at the 5% level, Tables 2 below tests for linear relationship of the variables. The major aim of this test is to find out whether a linear combination of variables that are integrated of the same order is stationary and to ascertain the strength and magnitude of the relationship between the dependent and independent variables. The result of the correlation test is presented in table 2.

Table 2: Correlation Test Result

	EGI	GMEX	GBEX	GDEF	EXDS
EGI	1.000000				
GMEX	0.827399	1.000000			
GBEX	-0.024722	0.108834	1.000000		
GDEF	0.351606	0.280132	-0.306955	1.000000	
EXDS	0.851582	0.987805	0.061482	0.337712	1.000000

Source: Author's computation 2023

The correlation test result in table 4 above shows the correlation movements of the dependent variable and the independent variables. The relationship appeared positive across board except the government bilateral external financing variable which turned up negative. Also, the strength of the correlation differed. The strength was highest between the energy infrastructure and the debt servicing variable followed by the government external financing. This implies that the external financing indicator variables have mixed (direct-positive) and (inverse – negative) relationship with infrastructure growth.

Regression Analysis

The coefficient of determination from the ordinary least squares (OLS) regression is of good fit. This is shown by the Adjusted R-square (0.564837). Using this means that 56.48% variation in the dependent variable (economic growth) is explained by the independent variables (external debt financing). The table below is the ordinary least squares regression result:

Table 4.0 OLS regression Result

Dependent Variable: EGI
Method: Least Squares
Date: 12/12/22 Time: 09:02
Sample: 1991 2021
Included observations: 31

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GMEX	4.941264	0.129826	3.317837	0.0000
GBEX	0.057627	0.026122	2.206105	0.0361
GDEF	0.634221	0.306701	2.067880	0.0484
EXDS	-0.171397	0.132496	-1.293599	0.2068

R-squared	0.546982	Mean dependent var	335.3007
Adjusted R-squared	0.496647	S.D. dependent var	273.0665
S.E. of regression	193.7336	Akaike info criterion	13.49076
Sum squared resid	1013383.	Schwarz criterion	13.67579
Log likelihood	-205.1068	Hannan-Quinn criter.	13.55107
Durbin-Watson stat	2.719804		

Source: Authors' computation 2023

From the result obtained, it is seen that the present period, government multilateral external financing, domestic energy infrastructure financing and the bilateral are highly correlated with

economic growth. It is seen that the variables also passed the significance test (using the standard error (see full result in appendix) at 5% level of significance. In the present period, the energy consumption variables have met the apriori expectation which states that external financing has positive impact on energy infrastructure. The DW measures for the presence of autocorrelation in the model. However, it is noticed that the model is free from autocorrelation since the DW Statistic observed in the model is 2.019804 which is approximately 2. This means that the model is reliable in explaining the energy infrastructure growth in Nigeria.

Summary of Findings, Conclusion and Recommendation

This study aimed at investigating the impact of external financing on energy infrastructure growth in Nigeria. The specific objectives were to determine the impact of government multilateral external financing on energy infrastructure growth, investigate the impact of government bilateral external financing on energy infrastructure growth, examine the impact of domestic energy financing on energy infrastructure growth, and to ascertain the impact of external debt servicing on energy infrastructure growth. While reviewing the relevant literatures on the relationship between external financing and energy infrastructure growth, the study adopts the feedback growth theory as theoretical framework. The study adopted the *ex post facto* research design using past values to explain present and future outcomes. The major findings of the study are: government multilateral external financing has significant positive impact on energy infrastructure growth in Nigeria; government bilateral external financing has significant positive impact on energy infrastructure growth in Nigeria; government domestic financing has significant positive impact on energy infrastructure growth in Nigeria; and external debt servicing has significant negative impact on energy infrastructure growth in Nigeria.

In conclusion, the study investigated the impact of external financing on energy infrastructure growth in Nigeria. The study reviewed relevant empirical and theoretical literature. Based on the results from the various tests carried out in the analysis, the study thereby concludes that external financing has mixed (positive and negative significant) impact on energy infrastructure growth in Nigeria. Based on the findings, the study makes the following recommendations:

1. The energy sector should be improved upon to ensure that electricity energy consumption is not hindered by way of constant blackouts.

2. Government should explore more bilateral external financing to enhance funding for energy infrastructure growth.

3. There is need for increased domestic energy infrastructure financing in order to aid the growth of the economy.

4. The debt servicing should be repositioned in such a way as to reduce its negative effect on providing financing for energy infrastructure growth.

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