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Impact of the Power Sector on the Economic Growth of Nigeria (1980-2020)

Enya Fred Ota

Head, Department of General Studies,
Ihechukwu Madubuike Institute of Technology, Amuda-Isuochi, Abia State, Nigeria

Abstract:

This study examined the impact of power sector on the Nigerian economy over a period of 1980 to 2020. The study used time series data collected from central bank of Nigeria statistical Bulletin 2019 edition. The study employed unit root, Granger causality, co-integration test, and Error correction Model technique. Findings revealed that Government expenditure and Electricity supply both have positive impact on the economy while Human capital formation has negative impact on the economy. However, both human capital formation and Electricity supply had significant relationship with the economy whereas Government expenditure has negative relationship with the economy. The study recommends that the Nigerian Bulk Electricity Trading Company (NBET) should be streamlined in such a way that there should be sustainability in the power industry by meeting its obligations to act as a bulk-buyer and manage counter party risks in the power sector.

Keywords: Power, economy, growth, electricity, industry, human capital

1. Introduction

1.1. Background to the Study

Power Sector in Nigeria bases its resources on electricity supply and its utilization. It is seen as an indispensable part of economy development due to the fact that business, households even the government and the general public require power in their day-to-day operation and activities. It constitutes a substantial part of the operational cost of most businesses in Nigeria.

In other words, power is considered a force multiplier that can improve productivity and unlock massive potentials in the economy. Power also enhances the security architecture of the country. Nigeria being a funny country, despite all the massive investments in the power sector, from the period under review, Nigeria still produces less electricity on its national grid. Mismanagement has indeed constrained the country in creating a functional value chain capable of producing reliable electricity supply.

It is highly commendable to say that certain progress has been made with electricity tariffs, the privatization of power holding company of Nigeria, PHCN into 18 independent entities and the establishment of the power regulator, the Nigeria Electricity Regulatory commission to monitor and regulate activities of distributing companies – Discos and Power Generating Companies – GENCOs.

It is therefore the intention of the study to investigate if power sector has any significant contribution to the growth of the Nigerian economy and recommend policy options that could add to improve the pace of economic progress through the powersector.

Thus, in the quest for optimal growth and efficient management of resources and utilization, the economy should be put on the part of sustainable growth and development hence, adequate supply of power becomes central to the reduced transformation of the nation's economy.

In Nigeria, power serves as a pillar of wealth creation and the nucleus of operations and engine of growth for other sectors of the economy and it also compliments other sectors of the economy. In the power sector, the Nigeria Bulk Electricity Trending Plc (NBET) has an obligation as a bulk buyer in the electricity market by acting as a risk – manager. World bank 2020 Electricity demand is estimated at 20,700 Kwh which is grossly inadequate. (IEA, 2019 – Int'l Energy Agency).

Out of this, about 55% of the world population has access to electricity and for that only about 30% of its needs are currently met.

To meet the target, private sector investment in the supply chain is required including generation, transmission and distribution networks.

Hydro power is a functional source of electricity generation in Nigeria through the Kainji Dam. It is evident that some neighbouring African countries such as Ghana, Togo and Niger Republic source power from Nigeria. In these neighbouring countries, power supply is constant and more efficient than in Nigeria.

Nigeria is also endowed with mineral deposits like coal which is also a major source of power but Nigeria is unable to tap and utilize this source of power. On this ground, is the reason for this study.

1.2. Statement of the Problem

Having established the fact that a lot of funds have been sunk into the power sector especially in 1999 during Obasanjo government, yet there has not been any significant result in the power generation and distribution. There is still epileptic power supply and how voltage in the sector. As a result of this, there are a lot of disruptions in the business activities of households, firms and even the government at all levels.

This has forced these economic agents to resort to alternative power supply. These costs add to cost of production which nonetheless makes goods and services to be costlier.

It is also interesting to note that so many firms have wound up because they could not meet up with these expenditures. This scenario is worrisome because it affects human activity, retards productivity and also discourages innovation.

It is also funny to state that Nigeria as a country cannot generate enough power for the populace irrespective of the huge/abundant water resources. Again, there is always this question why countries that depend solely on Nigeria for power supply will have constant power supply than Nigeria.

It has also been the target of the Federal Government to reach the production rate of 20,000 mw from a current production, of about 4,000 mw. However, these targets are dependent on increased revenue from various tariffs that would be used to finance this project. This resistance casts doubt to the actualization of this goal. This however creates obstacle to the achievement of growth via the power sector.

Objectives of the Study

The main objective of this study is to find the impact of power sector on the growth of the Nigeria and economy.

Specifically, the study will:

- Investigate if the government expenditure on power sector has contributed significantly to the growth of the Nigerian economy.
- To estimate the relationship between the power sector and the economic growth in Nigeria.
- To estimate if the power sector has enough skilled – workers needed to drive the power sector.

1.3. Research Questions

The study was guided by the following research questions.

- Has government expenditure on power sector contributed significantly to the growth of the Nigerian economy?
- What is the relationship between the power sector and the Nigerian economy?
- Does the power sector have well trained skilled workers who can actually drive the power sector?

1.4. Research Hypotheses

The research formulated the following research hypotheses in order to answer the research questions.

- Ho1: Government expenditure on power sector does not contribute significantly to the growth of the Nigerian economy.
- Ho2: There is no relationship between the power sector and the Nigeria economy.
- Ho3: The power sector does not have well trained skill workers that can drive the power sector.

1.5. Scope of the Study

The study looks at the power sector focusing on electricity from 1980 – 2020.

1.6. Significance of the Study

Power sector is one of the key drivers of the every economy and any problem in the sector will affect other sectors of the Nigerian economy. It is therefore important to highlight the benefits accruable from the sector and unveil constraints that militate against it with a view to proffering workable solutions to the problems. It will also suggest policy strategies that will be useful in periods of alternative power substitution.

1.7. Limitations of the Study

The study was limited by access to data but however CBN Bulletin and NBS were of immense importance in achieving this work.

Inflationary pressure impacted very well on the cost of printing and purchase of data for internet subscription especially now the economy is gradually picking up from the COVID-19 experience.

2. Literature Review

Nigeria is a leading African country with abundant human and natural resources including water resources for the generation of hydro-power and a major source of hydro power to neighboring African countries such as Niger Republic and Ghana, still find it difficult to serve her citizens efficiently in the provision of power and gas supply. Nigeria is constrained by poor policies on power, market failures in the industry associated with unfriendly industrial policies that hamper growth of the sector. Inability to meet up with supply due to insufficient Mega Watts of electricity,

overdependence on foreign investment in the industry with a corresponding foreign exchange disparity, all combine to pose serious obstacle to the full realization of laudable power sector reforms and agenda.

2.1. Conceptual Literature Review

Power is viewed as essential component of Nigeria's national life and a fulcrum through which every economic activity revolves. Both private and public businesses, households depend on it. Power sector in Nigeria is part of the utility component of the economy. Power sector in Nigeria is strategically centered on electricity. Electricity supply is energized by hydropower through the availability of water as a natural resource.

2.2. Power Sector Reforms in Nigeria

Okoro S, (2017). Before the privatization of National Electricity Power Authority, NEPA, power sector faced numerous challenges, such as, poor power supply, funding problems etc. It was poorly monopolistic and there was to need break the chain of public sector monopoly in the industry, hence privatization in moving it forward. An increase in employment, reduction in the crime rate and an improvement in power services as the benefits to be derived from privatization. In 2001, the federal government launched a set of reforms in the power sector which led to the privatization and unbundling of electric generation, GENCOs and electricity distribution companies, DISCOS in 2013.

Four stages of the development in the reform, led to competitive, efficient, private-sector led power sector regulated by Nigerian Electricity Regulatory Commission (NERC) while the ministry of power performs oversight function. The stages are;

- Interim Period (2013) allocation of sector cash deficits across all participants before tariff review.
- The Transitional Electricity Market (TEN) with IMBET as active bulk-buyer from GENCOs and DISCOs.
- The Medium Term Electricity Market. All contracts to be handled by DISCOs and GENCOs, NBET seizes to exist at this stage.
- The market between electricity buyers and sellers at all levels and creation of spot electricity market.

Nigeria has installed capacity of 13,400 MW of power generation with 8, 000 MW available. But due to constraints in gas supply 4,000 MW has been dispatched on average over the two years. The lack of constant electricity has affected consumers' willingness to pay and has contributed to short fall, hence sector cash deficits.

The sector therefore, faces numerous challenges such as, infrastructure, liquidity that requires urgent attention. The FG recently launched the Nigerian Public Sector Recovery Program: 2017-2021 as a framework to improve the financial capacity of NBET and improve the viability of the distribution companies in country. Several interventions are required to actualize this laudable program, ranging from;

- Financial intervention to be able to fund past and future deficits in the industry.
- Technical Intervention. A minimum of 4,000 MW daily distributions is ideal to ensure stability to the national grid.
- Governance Intervention Qualified personnel and manpower to improve the system and for efficiency and transparency. The application of these reforms in the power industry will certainly stimulate growth at the long run.

2.3. Reasons for Regulation

Lenzen M, (2016). The essence of regulation is among other things to check price and output due to the belief that the industry is inherently monopolistic. Due to undue power and influence by the companies in the industry, it becomes imperative for the government to come up with regulatory policies by way of utility regulation. This is in view of the fact that there should be government intervention to put into control the activities of economic agents in the provision and distribution of electricity to avoid exploitation of consumers by the companies. Technologically, regulation is also done in the area of water flow in hydro plants for efficiency. The issue of regulation is essential in the power sector in Nigeria in the following ways; to correct the problem of inadequate or poor quality of service and poor financial performance under public ownership. It is evident that during the days of National Electricity Power Authority, NEPA which was publicly driven, there was inefficiency and poor performance. Fashola, 2016 pointed out that upon the regulation and privatization of the entity, little improvement was recorded though, the present challenges borders on estimated billing.

However, the issues relating to prevention of private monopoly by government and individuals; exorbitant prices and inefficiency in production and distribution have not been resolved. The essence of regulation is to set standards and limits in order to guide the activities of the economic agents. In Nigeria this is done through the National Electricity Regulation Commission that monitors the operations of the industry as established by the government. The question borders on how the policy has contributed to economic growth in Nigeria through the power sector.

2.4. Theoretical Literature Review

2.4.1. Theory of Regulation

By creating new frontiers for competition in the Bulk Power purchase. In historic times, Kings built bridges, canals and others but in modern time ownership and operation of infrastructure is undertaken by the governments, the role of regulation was ignored. This theory is therefore, saying that government should be involved by setting standards or limits for effective operations in the electricity industry. There was market failure in certain sectors of the economy with the particular reference to power sector, emphasizes on electricity.

- There was market failure in power due to ineffective competition.

- Due largely to externality and information barrier. Consumers do not have enough information about the services provided to them. Estimated billing and other issues are not explained to the consumers; hence market failure in the electricity industry. Conflicts and friction characterize the operations in the industry resulting from exploitation.

2.4.1.1. Portfolio Theory to Electricity Sector

Real option theory (RO) is used to enhance projects under uncertainty, by modeling the flexibility that managers possess to adjust the projects in response to changes in their environment. It can be used to tackle the current problems bedeviling the power sector by enhancing the value of electricity generating projects, especially, renewable energy projects. This requires the involvement of electrical engineers specialized in the design of Electricity Generating Projects and Renewable Energy Projects.

The prospects of the power sector depend on managerial ability of the experts in the engineering and technical aspects, since the business is full of uncertainty and solely depends on technical-know-how. The ability of managers and engineers to adapt to customer requirements and needs are paramount in the industry. Technical faults emanate often time, therefore, it requires proper planning and adjustments in the system to live up to consumers expectations. Basically, Read option Theory is imperative in the Nigeria power sector. It helps to create alternatives during periods of power interruptions, government interventions through policies. This when systematically applied will lead to improved output.

2.4.2. Electricity Pricing Theory

Jeremi J. (2010). This theory is based on the marginal cost concept. Electricity tariff depends on supply. Managers in this private enterprise should place their charges at a point where the Marginal Costs equals Marginal Revenue or where the Average Cost equals price. This will certainly resolve the issue of exploitation as envisaged. The dramatic increase in the cost of consumer electricity in recent times which triggers the growing importance of pricing policies in maximizing the net economic benefit of consumption and avoiding waste. The Real Option Theory has not been vigorously pursued in Nigeria. The marginal cost pricing is now recommended as an important criterion that should be considered in determining electric power tariffs. The long run marginal cost approach will create room for adjustments to reflect the various economic, social and engineering objectives and constraints faced by policy-makers in the energy sector. The long-run cost here is used as a bench-mark to judge other economic and social objectives. Since at long-run all factors are assumed variable, it is a planning curve. The costs associated with maintenance of equipment, running costs and sentimental costs are all variables. It therefore, helps the entrepreneur in the power industry to plan the future expansion of output. Increases in the electricity demand should command an increase in output (supply) all other factors assumed constant. An optimum level of output supposed to be produced to reduce cost and reduce price of tariff. However, this principle has not been fully practiced in electricity industry. Tariff should be a function of output such that when you generate more power, marginal costs continue to reduce while long-run profit is guaranteed leading to economy of large Scale production.

2.4.3. Restructuring and Legislation Theory in the Utility Industry

This theory is saying that expected growth will, other factors held constant, depend on individual company's approach under given structural influence. Mizrahi S. posits that the understanding of the training and pace of specific reforms in order to loosen the structural problems that are akin to the industry is quite vital. How transformative are the entrepreneurs in the industry, such is a necessary condition to achieving this change. To achieve this, a comparative analyses of the developed and developing countries are usually made. The on-going process of re-structuring and reform in the industry in Nigeria is related to this theory.

It is believed that growth via the power sector depends largely on the transformative initiatives of the operators or investors in the industry. However, the profit-maximizing approach to the investors limits the workability of the theory in Nigeria. The automated metering device posed to be a major transformation in the industry, yet, it has not been fully realized as more than 80% of electricity users in Nigeria do not have access to the automated metering system. These accounts for the reason why the sector are still plagued with problems of poor electricity (power) supply outrageous bills that are inconsistent with supply.

2.5. Empirical Literature Review

Akintola W, (2012). Power plays a fundamental part in the economic growth process of any economy. Several studies have shown a significant relationship between electricity use and economic growth. Studies have also shown that insufficient and unreliable or costly access to power can be obstacles to business and hinder growth. For instance, the industrialization program of the 1970's which saw the development of certain manufacturing industries in the northern Nigeria was hampered by certain factors, such as costly and unreliable access to power supply poor access to finance among other factors. Electricity supply is one of the most significant cost elements in the production process or line, as such, lack of reliable and affordable electricity can be attributed to the failure of industrialization in Nigeria. The Electricity Power Sector Reform (ESPR) Act which led to the privatization of the electricity assets in Nigeria was meant to offset some of these challenges.

The major source of electricity generation in Nigeria is fossil fuels, through hydro and gas thermal plants. The Power Holding Company of Nigeria is coexisting with independent power producers. World Bank, 2014: About 41% of businesses in Nigeria generate their own power to augment the general power supply to their business. In 2013 the generation and distribution companies were handed over to private owners with Federal Government retaining minority

stake. The Electricity Trading Company of Nigeria is still 100% owned by the Federal Government but the company is presently under a management contract with Manitoba Hydro International.

Nigeria generates 126kwh per capita. That is why the country lags behind compared to other countries. Considering the country's GDP and global trends, electric consumption should be five times higher than what we presently have.

For instance, Ghana has 2.9 times higher than Nigeria (361kwh) and south Africa is 31 times higher than Nigeria (3,926 kw/h). Nigeria electrification rate is just at 45% and this is really low.

The ugly situations forcing households and many businesses and industries operating in Nigeria to rely on privately owned generators to provide their own power supply. This generators can provide electricity but not as the grid-based supply. Power generated this way is far more expensive than the grid based supply.

Three stages are involved in the delivery of power supply to the consumers; viz.

- Generation at power plant which requires source primary electricity, like water and gas.
- Transmission to the distribution companies and
- Distribution to the end-user.

Aminu I, (1971), there is a debate between affordability as reflected in the electricity billing and charge compared to supply. It is therefore, on the opinion of the researcher that electricity consumption and supply are not commensurate. This also constitutes major obstacle in the industry leading to economic sabotage and exploitation of the masses through estimated billing.

An Empirical Survey of Electricity Sector Reform in Developing Countries. Country institutions and governance play important role in the success or failure of reforms. Reforms supposed to increase operational efficiency and access to new customers to boost revenue of the industry. Implementation of reforms is based on ideology and economic theory rather than economic evidence.

Steiner, 2001, observed that the majority of DECD countries have stepped forward in reforming electricity sector under a paradigm shift from state ownership to private ownership, public regulation and market-led structures. This technological progress in some countries has made other countries to follow suit. From Nigeria perspective, reforms in the power sector supposed to change the market structure, have a direct impact on the behavior of the operators and consequently on the performance of the sector, reduce the issue of vested interest that stem the achievement of set goals. Example, horizontal market power in England electricity generation market is as a result of duopoly and vertical market power arising from joint ownership of generation of power results to high, voltage transmission. However, as Soto, (1999) pointed out there is short-coming arising from inadequate restructuring exercise in Nigeria; increases the need for future intervention and regulation. This will reduce uncertainty in the industry and proper structure.

Institutionally, and Electricity Act or Law is usually embarked upon by developed countries. It is recognized as a requisite for implementation of reform. Independent regulatory agencies are established to oversee the sector and protect the rights of consumers. However, Nigeria with such regulatory institution like, National Electricity Regulatory Commission, NERC' that oversees the national electricity supply and demand has not been reformed is a matter of empirical testing than theoretical debate. What is needed is a comprehensive result reflected in output.

Chang, (2013) pointed out that in all developed economies, the state and interventional policies play active role and there is reason why a more liberalized economy will Achieve higher allocative efficiency or that higher allocative efficiency will necessarily lead to higher economic growth. The network business of electricity sector is dependent on how the sector is structured and regulated. It is always important to compare existing reform with previous reform. Empirical studies tend to focus on simple comparisons of pre-and post-reform situation using financial and operating performance. It is a network business because it connects other subsectors such, as gas, water supply for effective functioning.

3. Research Methodology

3.1. Research Design

According to Nlewedim (2012), research design is the step undertaken for the purpose of collecting, ordering and analyzing data for the purpose of answering research questions. It is the plan and structure of the investigation and to obtain answers to the research questions. For the purpose of this study, Ex-post-facto research is used. This is a research that is carried out after the events have taken place and the data and already in existence. This research therefore made use of secondary data.

3.1.1. Method of Data Collection

The study used secondary data for its analysis.

3.1.2. Source of Data Collection

The study sourced data from Central bank of Nigeria Statistical Bulletin, 2020 edition World Bank World Development Indicators

3.2. Method of Data Analysis

Time series tools of analysis were adopted using E-view Econometric Package.

3.2.1. Model Specification

The model is specified thus:

$$GDP = f(GEXP + HCAF + ELSS)$$

$$= Y = b_0 + b_1GEXP + b_2HCAF + b_3ELSS + \mu_t$$

3.2.2. Variables in the Model

The model is specified thus:

$$GDP = f(GEXP + HCAF + ELSS)$$

$$= Y = b_0 + b_1GEXP + b_2HCAF + b_3ELSS + \mu_t$$

Where GEXP = Government expenditure on power HCAF = Human Capital Formation

ELSS = Electricity Power Supply GDP = Gross Domestic Product

μ_t = error term and b_1 , b_2 and b_3 are the parameter estimates of the model which are also equal coefficient of the explanatory variables and b_0 is the constant.

3.3. Economic Apriori Expectation

This confirms if the parameters are consistent with the economic theory adopted in the study. That is to say that economic growth should be supported by electricity supply, well trained personnel (human capitalformation) and should be in tandem with the expenditure of government in the power sector.

3.3.1. Decision Criteria

The null hypotheses are tested at 5% level of significance.

- Decision: If T_{cal} or F_{cal} is greater than T_{tab} or F_{tab} , H_0 is rejected hence accepting the alternative hypothesis.

4. Data Presentation, Analysis and Interpretation

4.1. Data Presentation

This section employs various statistical tools to analyse the data and results of the regression in the study. This includes Unit Root test, linear deterministic trend, Granger causality test and Error Correction Model.

Year	Real GDP N' Billion	Govt. Exp. On Power N' Billion	Electricity Supply Per Capita (kWh per capita)	% of Skilled Labour
1980	15,860.92	0.032	27.70929	97.90
1981	15,258.00	0.034	31.9361	97.50
1982	14,985.08	0.038	17.56747	96.10
1983	13,849.73	0.033	36.63413	96.55
1984	13,779.26	0.040	32.47676	96.22
1985	14,953.91	0.052	33.42292	96.14
1986	15,237.99	0.053	31.10451	96.10
1987	15,263.93	0.059	30.86921	95.50
1988	16,215.37	0.217	36.16635	95.20
1989	17,294.68	0.481	33.81732	93.62
1990	19,305.63	0.434	34.95031	93.60
1991	19,199.06	0.449	36.7026	88.33
1992	19,620.19	0.931	38.82364	90.46
1993	19,927.99	1.596	39.11794	89.59
1994	19,979.12	1.137	39.37545	89.20
1995	20,353.20	1.628	41.82501	88.50
1996	21,177.92	0.159	44.46808	87.79
1997	21,789.10	0.754	47.91743	87.60
1998	22,332.87	1.127	44.82042	87.40
1999	22,449.41	0.000	51.92	87.10
2000	23,688.28	14.230	58.11285	86.90
2001	25,267.54	4.808	61.46904	86.40
2002	28,957.71	6.119	68.26225	87.40
2003	31,709.45	48.903	64.62289	85.20
2004	35,020.55	24.555	70.32254	86.60
2005	37,474.95	22.026	73.78895	88.10
2006	39,995.50	31.935	75.08917	87.70
2007	42,922.41	43.065	79.7181	87.30
2008	46,012.52	86.502	86.3524	85.10

Year	Real GDP N' Billion	Govt. Exp. On Power N' Billion	Electricity Supply Per Capita (kWh per capita)	% of Skilled Labour
2009	49,856.10	230.516	87.87319	80.30
2010	54,612.26	435.039	95.44247	78.90
2011	57,511.04	60.300	91.53531	76.10
2012	59,929.89	90.300	93.12128	75.20
2013	63,218.72	141.099	96.75561	75.09
2014	67,152.79	95.100	100.2251	74.00
2015	69,023.93	95.100	102.8353	70.10
2016	67,931.24	100.986	105.8056	69.50
2017	68,490.98	128.466	108.776	67.86
2018	69,799.94	137.915	111.7464	66.22
2019	71,387.83	178.915	114.7168	64.58
2020	75,489.84	180.826	126.8134	72.04

Table 1: Time Series Data

Source: Central Bank of Nigeria Statistical Bulletin, 2020 Edition
World Bank World Development Indicators

4.2. Data Analysis

4.2.1. Unit Root Test

The study carried out a test of unit root to determine the stationarity of all the employed variables using Augmented Dickey Fuller (ADF) unit root test. The tests were conducted to avoid spurious regression. The results of the test are presented below in Table 2.

Variables	T-stat @ Level	Prob Value	5% Critical Value	Order of Integration	Remark
RGDP	-0.043902	0.9483	-2.941145		Not Stationary
GEXP	-1.019273	0.7363	-2.943427		Not Stationary
ELSS	-0.987993	0.7481	-2.938987		Not Stationary
HCAF	-1.994940	0.9998	-2.938987		Not Stationary
At 1st Difference					
RGDP	-3.478764	0.0141	-2.941145	1(1)	Stationary
GEXP	-5.955623	0.0000	-2.954021	1(1)	Stationary
ELSS	-12.69743	0.0000	-2.941145	1(1)	Stationary
HCAF	-5.843742	0.0000	-2.941145	1(1)	Stationary

Table 2: ADF Test

- Decision: The study shows that the calculated T-stat is much less than the critical value of 5% level of significance. From these results, the study reveals that both RGDP, GEXP, ELSS and HCAF have t-stat values which are less than their critical values of 5% level of significance.

However, at first difference the whole variables RGDP, GEXP, ELSS and HCAF were stationary. This is because their calculated T-stat were much more in negative than their critical values as shown in the ADF. This implies that all the variables were integrated to Order One 1(1). This is why the study proceeds to determine the evidence of co-integration among the variables.

Null Hypothesis: LNRGDP has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=9)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-0.043902	0.9483
Test critical values: 1% level	-3.615588	
5% level	-2.941145	
10% level	-2.609066	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LNRGDP) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-3.478764	0.0141
Test critical values: 1% level	-3.615588	
5% level	-2.941145	
10% level	-2.609066	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LNGEXP has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-1.019273	0.7363
Test critical values: 1% level	-3.621023	
5% level	-2.943427	
10% level	-2.610263	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LNGEXP) has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=9)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-5.955623	0.0000
Test critical values: 1% level	-3.646342	
5% level	-2.954021	
10% level	-2.615817	

*MacKinnon (1996) one-sided p-values.

Table 3: Stationarity Test

4.2.2. Co-integration

The result of the co-integration test indicates one co-integration vector. This means that the explanation variables GEXP, ELSS, HCAF have long run relationship with the dependent variable RGDP being the proxy for further analysis. It captures both the long run equilibrium and short run dynamic relationships associated with the above results.

Date: 04/28/21 Time: 06:52
Sample (adjusted): 1982-2019

TO assumption: Linear deterministic trend
Series: LNRGDP UG EX9 LNELSS2 LNNCAr
Lags interval in first differences: 1 4p 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace χ^2 (n)	0.05 Critical Value	Prob
None *	0.628026	57.59145	47.85613	0.0000
At most 1	0.376879	22.97890	29.79707	0.2471
At most 2	0.161297	6.423372	19.45471	0.6455
At most 3	0.007598	0.206537	3.841466	0.6054

*denotes rejection of the hypothesis at the 0.05 level

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

H0: at most r	Eigenvalue	Max Eigen χ^2 (n)	0.05 Critical Value	Prob
None *	0.628026	24.61255	27.58434	0.0000
At most 1	0.376879	18.15552	21.13162	0.1540
At most 2	0.161297	6.158446	14.26460	0.0032
At most 3	0.007598	0.206537	3.841466	0.6054

Max-eigenvalue test indicates a cointegration rank of at the 0.05 level

*denotes rejection of the hypothesis at the 0.05 level

MaskKinnon-Haug Multivariate (1995) procedure

* Cointegrating Equations:

Equation	Log likelihood	163.5602
Long-run cointegrating relationships (standard error in parentheses)		
LNGEXP	1.000000	
LNRGDP	-0.004278	
LNELSS	-1.31248e	
LNNCAr	-0.41244	
Q(LNEXP)	-0.229292	
Q(LNRGDP)	-0.004278	
Q(LNELSS)	-1.31248e	
Q(LNNCAr)	-0.41244	
Q(LNEXP)	-0.229292	
Q(LNRGDP)	-0.004278	
Q(LNELSS)	-1.31248e	
Q(LNNCAr)	-0.41244	

Table 4: Co-integration Test Result

4.3. Granger Causality Test

Null Hypothesis	Observation	Probability	Remark	Type of Granger Causality
LNGEXP does not Granger cause LNRGDP		0.0449	No Granger	None
LNRGDP does not Granger cause LNGEXP		0.1612	Causality	Uni-directional
LNELSS does not Granger cause LNRGDP		3.E-05	No Granger	Uni-directional
LNRGDP does not Granger cause LNELSS		0.6741	Causality	Bi-directional
LNRGDP does not Granger cause LNHCAF		0.8014	No Granger	Uni-directional
LNHCAF does not Granger cause LNRGDP		0.1545	Causality	Bi-directional
LNELSS does not Granger cause LNGEXP		0.0870	No Granger	Uni-directional
LNGEXP does not Granger cause LNELSS		0.0954	Causality	Bi-directional

Null Hypothesis					Observation	Probability	Remark	Type of Granger Causality
LNHCAF	does	not	Granger	cause		0.9988	No Granger	Uni-
LNGEXP						0.6272	Causality	directional
LNGEXP	does	not	Granger	cause			Granger Causality	Bi-directional
LNHCAF								
LNHCAF	does	not	Granger	cause		0.8238	No Granger	Uni-
LNELSS						0.5109	Causality	directional
LNELSS	does	not	Granger	cause			Granger Causality	Bi-directional
LNHCAF								

Table 5: Pairwise Granger Causality Test Result

- Decision: Reject H_0 if $p < 0.05$

The pairwise granger causality test revealed unilateral causality running from LNGEXP to LNRGDP. It can also be seen that the only causality runs from the explanatory variable GEXP to the dependent variable RGDP. This implies that policies on power with respect to the growth of Nigerian economy is influenced by government expenditure.

4.4. Error Correction Mechanism

This study employed error correction mechanism methodology since the variables were integrated of the same order. The result is shown below:

Dependent Variable: D(LNRGDP)				
Method: Least Squares				
Date: 04/28/21 Time: 06:54				
Sample (adjusted): 1983 2019				
Included observations: 36 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	32.70402	1.643831	19.89500	0.0000
D(LNGEXP)	0.035310	0.017534	2.013772	0.0528
D(LNELSS)	0.737527	0.143168	5.151480	0.0000
D(LNHCAF)	-1.228343	0.306524	-4.007334	0.0004
ECM(-1)	-0.175355	0.050996	-3.438603	0.0086
R-squared	0.977066	Mean dependent var		31.06017
Adjusted R-squared	0.974107	S.D. dependent var		0.571059
S.E. of regression	0.091891	Akaike info criterion		-1.808186
Sum squared resid	0.261761	Schwarz criterion		-1.588253
Log likelihood	37.54735	Hannan-Quinn criter.		-1.731424
F-statistic	33.01790	Durbin-Watson stat		0.954069
Prob(F-statistic)	0.000000			

Table 6: Error Correction Model

$R^2 = 0.977066$, $R^2 = 0.974107$, $DW = 0.9450$

F-Stat = 33.0179, Prob (F-Stat) = 0.000000

The equation from the ECM result shows thus:

$LNRGDP = 32.704 + 0.035310 \text{ GEXP} + 0.7375 \text{ ELSS} - 1.2283 \text{ HCAF}$.

Where 32.704 is the constant term, 0.035310 is the coefficient of Government Expenditure, 0.7375 is the constant of Electricity supply and - 1.2283 is the coefficient of human capital formation.

The ECM met the apriori expectation of being negatively signed and statistically significant.

4.5. Test of Hypothesis

4.5.1. Hypothesis 1

- H01: There is no significant relationship between the power via Electricity supply sector and the Nigerian economy.

Looking at the ECM result, the power sector in form of electricity supply has statistically significant relationship with economic growth proxied as RGDP. This is because the P-value is 0.0000 which is less than 0.05. Hence we reject the null hypothesis of no significance and accept the alternative hypothesis and conclude that power sector via electricity supply has a positive impact on the economic growth of Nigeria.

4.5.2. Hypothesis 2

- H02: Government expenditure on power sector does not contribute significantly to the growth of the Nigerian economy. From the result of ECM is statistically insignificant since the p-value of 0.05 even though its contribution is 0.0353. With this we can accept the null hypothesis that government expenditure on power sector does not contribute significantly to the growth of the economy.

4.5.3. Hypothesis 3

- H03: The power sector does not have adequate skilled workers in the sector for the generation and distribution of power.

From the ECM results, the HCAF has a negative relationship with the economy but statistically significance. This implies that the experience and activities of the workers do not yield any result to the economy. However, the p-value of 0.0004 is less than 0.05 thereby rejecting the null hypothesis and accept the alternative hypothesis that the power sector has adequate skilled workers in the power sector.

The finding is in line with the work of Oguoma et al 2020 on impact of power on the Agriculture Output. According to them that Nigerian power sector boasts of skilled workers yet they don't possess the technical know-how to fix the problem of power in this country.

4.6. Discussion of Findings

From the ECM result, the coefficient of determination is seen to be 97.7% variations in economic growth is explained by the explanatory variables: Government expenditure, electricity supply and Human capital formation on the power sector while 13% of the variations in GDP are caused by other variables not captured in the model. Since the coefficient of determination is above 70%, then the model is fit for the study. However, when adjusted, the coefficient of determination slightly came down to 97.4% which is of further justification of the goodness of fit.

From the unit root test result, it was discovered that all the variables: RGDP, GOVEXP, ELSS and HCAF were all stationary at 1st difference and all significant with probability values of less than 0.05. They gave rise to Error Correction Model Test due to 1(1) order of integration.

The study conducted Granger causality test and was observed that there is a uni-directional granger causality between RGDP and Government Expenditure on power. It was the same with RGDP which granger caused Electricity supply in uni-directional manner.

On the other hand bi-directional Granger causality existed between the variables shown thing: HCAF Granger caused RGDP and RGDP Granger caused HCAF, ELSS Granger caused GOVEXP whereas

4.6.1. GOVEXP Granger Caused ELSS.

HCAF Granger caused GOVEXP whereas GOVEXP Granger caused HCAF and HCAF Granger caused ELSS whereas

4.6.2. ELSS Granger Caused HCAF

It was observed that there was an existence of Granger causality between LNRGDP and LNGEXP with probability value of 0.1612. This means that the economy (RGDP) influences Government expenditure. In other words, the economy depends on the extent to which Government expends her revenue on the power sector.

In another vein, Electricity supply Granger causes the LNRGDP. This means that electricity supply which all other economic activities depend on goes a long way to impact on the RGDP and RGDP also influences the Electricity supply. This is caused a bi-directional Granger causality.

Human capital formation on the other hand which only considered the skilled labour influences the economy with prob value of 0.8014 and also RGDP influences Human capital formation with a prob value of 0.1840. It tells the extent to which experts in the power generation firms and electricity distribution companies generate and distribute the available power we are using and in a great way drive the economic activities which also grow the economy.

Electricity supply was seen to influence Government expenditure with probability values of 0.0870 and in turn Government expenditure also influences Electricity supply with prob value of 0.0954. From the study, the F-statistics of 33.01790 with p-value of 0.000000 which is less than 0.05 shows that the influence of explanatory variables on the dependent variables is statistically significant. This implies that all the variables used to emphasize the behaviour of power sector jointly impact on the economic growth in Nigeria.

The DW value of 0.954069 indicates absence of auto correlation among the residuals. Meanwhile, it is observed from the result that Government expenditure contributes to the growth of the economy by 2.01377 and this contribution was statistically significant. This is not in conformity with the work conducted by Niser 2000 that concluded that government expenditure on power has not been adequate to trigger economic growth in Nigeria. Electricity supply from the ECM result contributes significantly to the Nigerian economy.

5. Summary of Findings, Conclusion and Recommendations

5.1. Findings

- From the ECM results, the probability result shows that Government expenditure on power has an insignificant result. This means that all the funds Nigerian government has been releasing to improve the power sector may be going into private pockets. This is also evident to the fact that Government expenditure only contributes 0.03 to the growth of the economy.
- Electricity supply however has a very significant result with 0.0000 p- value. This means that electricity industry in Nigeria determines to a large extent the economic growth process.
- The study also has the probability value of the Human capital formation (skilled labour) shows to be very significant but negative Relationship with the economy. This could mean that with the advent of ICT. The manpower available to the power sector have little or nothing to do with generation and distribution of power in the economy.
- There is a long run effect of the explanatory variables and reforms in the power sector reflect positively on the economy.
- Finally it was seen in the result of the study that Economic growth also contributes significantly to the growth of the power sector Reforms and regulatory policies of the government tend to influence the power sector to a great extent.

5.2. Conclusions

Power sector in Nigeria has been on the Mercy of God based on the fact that there has not been a lasting solution to its problems. Undoubtedly, power sector happens to be the key driver of the economy because every economic activity revolves around it. Even though the problems of the power sector have not been solved, the result of this study shows a significant positive contribution to the Gross Domestic Product.

This could be due to the large reforms and privatization exercises and government regulatory policies which aims to streamline the activities of investors in the power sector.

We should also move our attention to the alternative power supply because power is a key multiplier that drives all other sectors of the economy.

5.3. Recommendations

Based on the findings of this study, the following recommendations are made:

- Further investments in the power sector should be properly monitored and followed up by a yet to be established body. This body can ensure that every investment in the power sector follows the due process and ensure it gets to the proper destination.
- The Nigerian Bulk Electricity Trading Company (NBET) should be streamlined in such a way that there should be sustainability in the power industry by meeting its obligations to act as a bulk-buyer and manage counter-party risk in the power sector.
- The absence of directorate or board of directors or long-term leadership team within the Nigerian Electricity Regulatory Commission (NERC) presents potential stumbling blocks to effective reform implementation in the short and medium terms. In other words, the NERC should be reorganized and reformed to be more autonomous to be able to provide a veritable framework and platform for the industry to flourish. This will go a long way to boosting economic growth via the power sector.
- More security architecture should be provided around the equipment used for the generation and distribution of power to reduce the high rate of vandalization in Nigeria. This could also reduce the enormous investments in the power sector and these funds channeled to other sectors of the economy.
- Opportunities for off-grid power projects particularly in the renewal space should receive priority attention.
- The use of coal as alternative source of power or energy should be encouraged, this will argument gas supply.

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