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Contributions of Electricity and Gas Sub-Sector to Economic Growth in Nigeria: A Linear Approach

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ABSTRACT: Industrial policies were developed to stimulate and provide opportunities for prospering industrial activities following the decline of investment in the agricultural sector. This followed the discovery of crude oil in Nigeria. Electricity, gas, steam and air-conditioner, an industrial sub-sector is very crucial and requisite channel for industrial development, whether for automated, machines services or computer manufacturing processes. Failure in energy and power supply, as well as gas flaring remains a fundamental problem in Nigeria's development. This study examined the impact of electricity and gas sub-sector of industrial sector on economic growth in Nigeria using data from 1980 to 2020. Vector error correction mechanism was used to determine the impact of the independent variables on the dependent variable. In the short run, our study shows the existence of positive, non-significant impact of electricity and gas output on economic growth. However, in the long run there was positive significant impact of electricity and gas output on economic growth in Nigeria within the period of study. The implication of the result is that adequate production and utilization of electricity and gas will spur economic activities that will generate economies of scale; since every component of the economy (industry, urbanization, modernized farming, etc) extensively demand for electricity and gas. Also, efficiency of electricity and gas would reduce energy bills for poor households, helps the nation to tackle greenhouse gas emissions. The continues gas flaring and consistent power cut in electricity in Nigeria affected industrial sector in Nigeria. This study showed that there is positive significant impact of electricity and gas on economic growth if there is intentional implementation of power policy with conscious disciplinary actions to control defaulters and make substantial investment that would stimulate industrial activities to spur economic growth.

KEYWORDS: Electricity, Energy, Gas, Economic growth, Positive, Significant.

INTRODUCTION

The success of the agricultural sector failed at the discovery of crude oil. This led to developing lots of industrial policies that could stimulate and provide opportunities for industrial activities to thrive. Post 1960, import substitution strategy was adopted by the government of Nigeria to reverse problems of deficit balance in trade and fasten industrialization. From the first to fourth national development plan (1962-1968) and (1981-1985), Nigeria development objectives focused on rapid industrialization. Example, the Manufacturing sector in the third national development plan (1975-1980) got the highest allocation of 16.2 percent of budget plan, while industrial policies and strategies of the plan focused on expansion of indigenous equity participation in enterprises of foreigners, integration, linkages and diversification of industrial resources. Again, the policies had content of industrial product, provision of financial and adequate manpower resources to promote research using technology. The technical inclusion encouraged the small and medium scale industries; public sector participation and, control of huge industrial products.

Post-independence also witnessed increased prominence through import substitution, thereafter in 1970s existed huge foreign exchange flooded with export of crude oil that provided opportunity for government investments in activities of manufacturing industry. The next policy was the indigenization policy programme which enabled Nigerians to control many firms that were in existence in the country. Export promotion, duty reliefs, provision of loans and tax holidays were other strategies with incentives

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adopted by government in order to stabilize industrial activities. The efforts stimulated large percentage of foreign exchange earnings and federal allocated revenue through crude petroleum and natural gas.

In view of the industrial sub-sector, Nigeria with her huge landmass and population needs adequate, effective and efficiently distributed power to qualify among the industrialized nations. Energy is very crucial and requisite tool for industrial development, whether for automated, machines services or computer manufacturing processes. But, failure in energy and power supply remain a fundamental problem in Nigeria's development, as well gas flaring. According to the work of Ajugwo (2013), Nigeria flares 17.2 billion m^3 of natural gas per year, concurrently with the exploration of crude oil in the Niger Delta, leading to increased level of gas flaring that equates to nearly 1/4 of the current power utilization of African continent. The government of Nigeria has since implemented various energy and power reform agenda that included privatization, yet there has not been any remarkable improvement in power supply. These efforts have continued to increase the cost of energy and power supply in Nigeria much more than what an average Nigerian can afford.

In addition, the challenges in the sector has led to high importation of generators that is also cost intensive but guarantees supply of power when needed. The dysfunctional power supply poses impediments to industrial activities. Example, Nigeria had about 90 percent of the total gas supply used by power sector, while 4 percent goes to industrial activities, 3% to chemical feedstock which is grossly inadequate to drive economic activities to an optimal level. Comparing power utilization in United States of America for residences, industrial productions, power plants and chemical feedstock stands at 45%, 25%, 17% and 13% of entire gas supplied, respectively. In the Eastern Europe, consumption for residential 45 percent, industry 30 percent, power sector 13 percent as others took 12 percent of the entire gas supplied (Douglas, 1996). It is obvious from these findings that countries that have few natural resources maximize utility and are efficiently productive than Nigeria that are endowed with many resources. These informed the need to understand the effect of electricity and gas sub-sector on economic growth in Nigeria particularly from 1981 to 2020; and provide information on the impact of the sector to overall economic growth.

A country is perceived to have experienced growth when there exists sustained measurable increase in the country's per capita output or income, followed by expansion or increase in human resources, consumption, investment and trade (Todaro & Smith, 2011). Based on this, the Federal government of Nigeria has been spending heavily on power transmission infrastructure which has the capacity of stimulating industrial sector through cost reduction. Though this sector is privatized to Power Holding Company of Nigeria, the money spent on this already privatized power company by Federal government renders the aim of stimulating economic growth through industrial sector unproductive. By this misplaced priority, many businesses crumble and new ones find it very difficult to thrive, hence decrease in productions (supply) with increasing demand and high price.

Following the approiri expectation that increase in the utilization of electricity and gas, leads to increase in economic activity in a country which results to a greater economy. This study observed using trends that the variables examined do not toe in the pattern of direction with economic theory. Between 1982-1991, electricity and gas output decreased from 10.70% to 0.00%, while unemployment rate that supposed to decrease, increased from 4.3% to 4.5%. Electricity and gas output increase to 11.53% in 1992 and further declined to 2.00% between 1992 and 2000, while unemployment increased from 3.1% to 13.7%. Observing other periods between 2001 to 2010, electricity and gas output, GDP growth rate and unemployment rate increased from 1.85% to 2.96%, 5.92% to 8.01%, 13.7% to 21.1% and respectively. Again, from 2011 to 2020, electricity and gas output and GDP, decreased from 39.51% to -7.82% and 5.31% to -1.8%, respectively, but unemployment rate increased from 18.5% to 33.3%, (CBN, 2020).

The challenges in inadequate power supply and high cost of generating set which inhibited many production processes crippled anticipated significant and positive outcomes in the industrial sector. This effect has also impeded other economic benefits such as, affordable cost of production, efficient performance of infrastructural facilities, access to business fund, employment, foreign exchange, over dependence in foreign investment, etc. Nigerian government has made several policy reforms toward factors that stimulates industrial activities through electricity and gas sub-sector; which has the capacity to generate employment and fast track other economic progress. Yet, poverty, unemployment, inequality is still very high, and the economy remains unstable with frequent decrease in gross domestic product and economic development at large. Therefore, the study objective examined the effect of electricity and gas sub-sector on economic growth in Nigeria from 1981 to 2020 and answer the research question, is there any significant impact of electricity and gas output on economic growth in Nigeria?

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LITERATURE REVIEW

Contextually, National Integrated Industrial Development (NIID) of 2007 was developed by the United Nations Industrial Development Organization (UNIDO) in collaboration with the Federal Ministry of Industry and other stakeholders. The framework comprised of four integrated programmes which are, (i) industrial governance and public private sector partnership, (ii) strengthening industry's institutional support base, (iii) a cluster development initiative to grow the small and medium enterprises (SME's) and (iv) environmental and energy. The environmental and energy framework addresses the challenges of low power generation and utilization through rural renewable energy; and rural private sector agro-industrial development (CBN, 2013). Unfortunately, bureaucratic bottleneck in terms of policy implementation could not allow the policy to achieve much success. Example, the slow pace of work at various national integrated power project sites, fallowed proposed sites, slow pace in the disbursement of loans for SMEs and paper operationalization of cluster concept among others, are strong evidence to the policy failure.

Theoretically, the classical view, Leontief (1986), introduced an Input – Output model that represents inter-industry relationships in an economy, showing how output from one industrial sector may become an input to another industrial sector. Supporting this theory, Romer (1990) explained a growth model driven by technological change which emanates from purposeful investment decisions made by profit-maximizing agents. The technological innovation and inclusion are so distinguished, in that it is neither a conventional good nor a public good, a nonrival and partially excludable good. He concluded that having a large population is not sufficient to generate growth. So, while accepting the Solow model's result that technological progress is what determines long-run growth in output per worker, Romer attempted explaining the determinants of technological progress (Karl, 2014). Hence, the output of electricity and gas sector has the capacity to generate inputs for either manufacturing, water supply, construction or mining sub-sector of industrial sector and at large stimulate growth in the economy.

Empirically, many works have been done on electricity, gas and energy in the past. Aderemi, Ilori and Akinbami (2021) examined energy consumption paradigm, identified sources of energy wastage, then assessed the effectiveness of the strategies employed to reduce energy waste in the food industries. Carmen, Ana and Blanca (2019) investigated the socioeconomic impact of renewable distribution generation technologies on Spanish economic sector and households, employing an input-output price model. The authors found that the integration of RDG units in the electricity market project is better for the Spanish households and economy. Kayode, Agbetuyi, Owolabi, Obiakor and Fagbuaro (2018) reviewed the power sector reform in Nigeria and their challenges. The researchers revealed that there is a paradigm shift from centrally generated electricity to generation of power at the distribution level (embedded generation). Aladejare (2014) examined the reform process in Nigerian electricity power sector aiming at sustainable growth and development of the country, then revealed that growth in the electricity sector should yield the desired growth and developmental benefits to the economy through job creation, reduction in electricity tariffs, improve service standard and increase export earnings, among others.

In the verge of establishing the impact of sustainable gas utilization in Nigeria, Ojide, Salami, Fatimah, Gazi and Oke (2012) used distributed lag model and found that utilization of Nigerian natural gas impacts positively on the economy given three-year time lag. The result further showed insignificant structural change on the level of flaring gas. The authors recommended the need for government to always employ Regulatory Impact Analysis (RIA) to evaluate its policy implementations. This study will differ in the work of these authors in terms of scope and methods.

Oyedepo (2012) reviewed a set of energy policy interventions that contributes to sustainable economic, environmental, and social development of some Africa's populated nations like Nigeria. The author revealed that energy efficiency reduces energy bills for poor households, helps the nation to tackle greenhouse gas emissions, etc. Sambo, Garba, Zarma and Gaji (2010) empirically analyzed electricity generation and the present challenges in power sector in Nigeria. The authors revealed that adequate power supply is inevitable prerequisite to any nation's development. But Nigeria has low funding capacity for adequate power supply, transmission and distribution because funding electricity is capital intensive. The authors found again that Nigeria has estimated 176 trillion cubic feet of proven natural gas reserves which consists mainly of methane (70% - 95%), positioning the country as one of the top ten natural gas endowments nations in the world and the largest endowment country in Africa.

Akinlo (2009) investigated the causal relationship between energy consumption and economic growth for Nigeria during the period 1980–2006, using Hodrick–Prescott (HP). The results of the research showed a long run and unidirectional causality

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between real gross domestic product and electricity consumption. Einstein Worrell and Khrushch (2001) established the baseline energy consumption for steam systems using detailed analysis of boiler energy use to evaluate 16 individual measures in steam generation and distribution in United State. Findings from the research showed economic potential of U.S at 18-20 percent of total boiler energy use, leading to energy savings of 1120 to 1190 TBtu which is equivalent to 12 - 13 MtC reduction of CO2 emissions. The reviewed papers focused on electricity consumption and waste, energy policy, electricity generation among others; while this study has interest on knowing how the electricity and gas output (electricity, gas, steam and air-conditioner) influences the growth of Nigerian economy.

Important to note that very few works have been done on electricity and gas sector, a gap this study filled, increasing the body of knowledge.

METHODOLOGY

Using STATA analytical tool version 17.0 with respect to the outcome of the unit root test, a linear function was generated to answer the question of significance impact of electricity and gas sub-sector on economic growth in Nigeria. Other preliminary relationship analysis was also obtained to support the outcome of the analysis.

The function is stated as;

$$GRGDP_t = b_0 + b_1 logREGS_{t-1} + b_6 logFDI_{t-1} + b_7 UNEM_{t-1} + \varepsilon_t$$

Where, GRGDP means growth rate of GDP, while REGS is real electricity & Gas sector; FDI remains foreign direct investment and UNEM means unemployment. The real values for REGS was used instead of nominal value, following deflation process.

RESULT

Table 1: Unit Root Test

Variables	T-stat. @Level	5% crt.val	Pval.	T-stat. 1st diff	5% crt.val	Pval.
GRGDP	-2.471	-3.548	0.3426	-5.242	-3.552	0.0001
log_REGS	-2.211	-3.548	0.4836	-4.014	-3.552	0.0084
log_FDI	-1.866	-3.548	0.6719	-5.563	-3.552	0.0000
UNEMP	-2.319	-3.548	0.4234	-4.100	-3.552	0.0063

Source: computed, 2022

Table 2: . Johansen Cointegration Test

```
Johansen tests for cointegration
Trend: Constant                                  Number of obs  = 38
Sample: 1983 thru 2020                           Number of lags =  2
-------------------------------------------------------------------------------
                                                                    Critical
Maximum                                             Trace           value
   rank  Params          LL  Eigenvalue         statistic             5%
      0      20   -272.08802           .           48.5482          47.21
      1      27   -261.07711     0.43983           26.5263*         29.68
      2      32   -252.98481     0.34683           10.3418          15.41
      3      35   -248.11126     0.22625            0.5946           3.76
      4      36   -247.81394     0.01553
-------------------------------------------------------------------------------
* selected rank
```

Source: System generated, STATA 17.0

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Table 3: Short-run Equilibrium - VECM Test

	Coefficient	Std. err.	z	P>|z|	[95% conf.	interval]
D_DGRGDP						
_ce1						
L1.	-.0040476	.0029766	-1.36	0.174	-.0098816	.0017864
DGRGDP						
LD.	-.5028709	.1407869	-3.57	0.000	-.7788081	-.2269336
Dlog_REGSA						
LD.	2.857455	1.777762	1.61	0.108	-.6268941	6.341804
Dlog_FDI						
LD.	-.7576409	.7370934	-1.03	0.304	-2.202318	.6870356
DUNEMP						
LD.	-.1031043	.2284736	-0.45	0.652	-.5509044	.3446958
_cons	.4270091	.7585938	0.56	0.574	-1.059807	1.913826

Source: System Generated, STATA 17.0

Table 4: Long-run Equilibrium - VECM Test

Cointegrating equations

Equation	Parms	chi2	P>chi2
_ce1	3	25.07435	0.0000

Identification: beta is exactly identified

Johansen normalization restriction imposed

beta	Coefficient	Std. err.	z	P>|z|	[95% conf.	interval]
_ce1						
DGRGDP	1	.	.	.	.	.
Dlog_REGSA	179.0844	58.71133	3.05	0.002	64.01234	294.1565
Dlog_FDI	.4397982	38.10352	0.01	0.991	-74.24172	75.12132
DUNEMP	-57.2782	11.69442	-4.90	0.000	-80.19883	-34.35756
_cons	-11.76316	.	.	.	.	.

Source: System generated, STATA 17.0

DISCUSSION

Table 1 indicated that all variables were stationary after first difference as can be seen in their probability values at 5% level of significance. Table 2 explained the relationship among the tested variables, showing a longrun correlation with 1 cointegrating vector as can be seen in the asterics rank 1 where the trace statistics is greater than the critical value 48.5482>47.21.

The short run equilibrium (table 3) revealed a positive and non-significant impact of electricity and gas industrial output on economic growth in Nigeria. This means that this sector has potentials to boost economic growth but did not significantly contribute output to the growth of Nigerian economy within the period of study. This result is in line with the current situation in the country and could be attributed to the incessant insufficient and low-quality energy supply and use coming somehow from gaps in electricity and gas outputs. Another supposed reason while electricity and gas output have no significant impact in economic

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growth might be due to constant waste of energy through gas flaring that should generate power sources for industrial and domestic consumption. This is supported by opinions in the work of Ajugwo (2013), revealing that the wasted gas through the air, creating harmful air pollutants, would have served the cooking needs of 320 million people not served by modern fuels. The finding implies that economic activities is impeded as most industrial activities rely or depend on this sector to thrive, as the effect inhibits economic growth as large through low productions, high cost of goods and services, increased importations, cripple small businesses, etc, while most food/other productions are through power generating sets.

However, the gas that flares incurs both economic and health damages, reducing the quantity of power generation elements and causing toxics for the populace that should contribute to increased production in the country. Low funding for energy also could cause non-significant impact of this sector on the Nigerian economy. This is supported by Sambo, Garba, Zarma and Gaji (2010) who revealed that Nigeria has low funding capacity for adequate power supply, transmission and distribution, despite being positioned as one of the top ten natural gas endowments nations in the world and the largest endowment country in Africa. Unfortunately, foreign direct investment has negative and non-significant impact on the economy in this model, implying that foreign investors have insufficient funding investment in electricity and gas sector. Thereby, increasing the importation and dependence on generating sets which is not adequate and sustainable for increased productivity.

In the long run (table 4), electricity and gas output exhibited a positive and significant relationship with economic growth in Nigeria. This means that this industrial sub-sector has the capacity to contribute to enlarged economy in the long run. The implication of the result is that adequate production and utilization of electricity and gas will spur economic activities that will generate economies of scale; since every component of the economy (industry, urbanization, modernized farming, etc) extensively demand for electricity and gas. Another implication of this finding is that efficiency of electricity and gas would reduce energy bills for poor households, helps the nation to tackle greenhouse gas emissions, etc. This assertion is supported by Oyedepo (2012) and Aladejare (2014) who revealed that a reformed electricity and gas industry stimulates job creation, reduction in electricity tariffs, improve service standard and increase export earnings, reduce inflation and importation of generating sets, among others.

Unemployment in the long run indicated a negative, but significant impact on economic growth in Nigeria. The result showed the obvious inefficiency in electricity and gas sector which causes low productivity and in turn results to unemployment of active workforce that has the capacity to spur production and increase the growth of the economy. Also, at this point, these unemployed persons would increase the hoodlums that pose insecurity in the country, which has the tendency of discouraging foreign investors; as it is the present case of Nigeria.

CONCLUSION

Improved electricity service standard with affordable tariffs is possible in Nigeria, if the different stakeholders would be responsible to the effectiveness of the sector. The paper concludes that electricity and gas sub-sector of industrial sector contributes to the growth of Nigeria economy in the long run, hence the importance of practical implementation of reformed energy and gas policies.

RECOMMENDATION

Based on the findings and discussion, the following suggestions are made;

1. Government should intentionally vote adequate fund via annual budget and timely release the fund for power/energy. This is to avoid high importation of generating set and reduce cost of production and consumption at large.
2. Government to enforce control on gas flaring through adequate disciplinary actions for defaulters and/or recycle the flared gas into other useful energy source (Domestic/Cooking gas).

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