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Energy, Industrial Development and Economic Growth in Nigeria

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Abstract
Nigeria, Africa's largest economy is characterized by underutilized industrial potential and a chronic energy deficit, which together impede sustainable economic growth. Industrial output contributing less than 15 per cent of GDP and electricity access at 55 per cent of the population in 2022 (World Bank), the industrial sector struggles to perform optimally. Energy consumption, a key input for industrial production, grew at an average annual rate of 5.2 per cent from 1990 – 2023, yet it remains insufficient to meet the consumption. The motivation lies in addressing this energy–industrial growth disconnects to achieve economic diversification and development. The research is to investigate the impact of energy and industrialization on the Nigeria economy and analysis the bidirectional relationships between energy, industrial development and economic growth. The research covered the period between 1990 – 2023, which encompassing over three decades of economic, industrial, and energy sector transformation. The study uses the method of regression analysis with ordinary least squares (OLS) econometric techniques and a time series secondary data from 1990-2023 to examine the impact of Energy and Industrial development on economic growth. The data was first examined for unit roots using the Augmented Dickey Fuller (ADF) test. A co-integration regression was then used to examine the long run relationship among the variables. The result shows that, industrial Investment and Foreign Direct Investment were statistical significance but Energy Consumption Utilization and Industrial Output failed in the apriori expectations but were statistically significance at 5 per cent level. The study recommendations that, government should expand energy access to increase investment in renewable energy to bridge the energy deficits; introduce incentives for industries to adopt energy efficient technology, promote industrial hup to foster productivity and resource sharing. Lastly, encourage non-oil industrial activities for sustainable economic growth and diversification.

Keywords: **Energy, Industrial Development and Economic Growth**

1.1 Introduction

Energy and industrial development are critical drivers of economic growth, yet Nigeria struggles with inadequate energy supply, low industrial productivity, and limited economic diversification. With industrial output contributing less than 15 per cent of Gross Domestic Product (GDP) and electricity access at 55 per cent of the population in 2022 (World Bank, 2023), the industrial sector struggles to perform optimally. Energy consumption, a key input

for industrial production, grew at an average annual rate of 5.2 per cent from 1990 to 2022, yet remains inadequate to meet demand.

Energy, industrial development and economic growth are interconnected pillars of sustainable economic transformation in Nigeria and across Africa; energy availability remains a crucial constraint to industrial expansion and overall economic performance. Industrial growth which is heavily dependent on stable and affordable energy supply has remained weak in many African economies due to unreliable electricity, high costs, and inefficient energy policies. Nigeria, despite being rich in energy resources, faces a severe energy deficit. As of 2022, the country's electricity generation capacity stood at about 13,000 MW, but only around 4,500 MW was effectively transmitted to consumers (World Bank, 2023). Nigeria's per capita electricity consumption remains one of the lowest in the world at 147 kWh, compared to South Africa's 4,198 kWh and Egypt's 1,682 kWh (International Energy Agency, 2023). This energy shortage has been a major setback to industrial development, forcing industrial to rely on expensive self-generated power, which increases production costs and reduces competitiveness.

Across Africa, energy poverty is widespread. The AFDB reports that over 600 million people lack access to electricity, with industrial electricity tariffs often exceeding $0.15per kWh, compared to $0.07 per kWh in Asia. Nigeria ranks among the worst affected, with 43 per cent of its population lacking electricity access (IEA, 2023). This situation limits the expansion of energy-intensive industries such as manufacturing, miming, and agro-processing. Nigeria's industrial sector has remained underdeveloped, contributing only 13.92 per cent to GDP in 2022, down from 20.59 per cent in 2010 (CBN, 2023). The manufacturing sector is a key component of industrialization, has been plagued by structural challenges, including poor infrastructure, high energy costs, and policy inconsistencies. In contrast, South Africa's industrial sector contributes 26 per cent to GDP, while Egypt's stand at 31 per cent (World Bank, 2023). Nigeria's industrial output has struggled due to unreliable power supply, leading to high costs of self-generated power. According to manufacturing Association of Nigeria (MAN, 2023, industries spend an estimated 40 per cent of total production costs on power, compared to the global average of 15 per cent. This has discouraged foreign direct investment in the manufacturing sector, leading to a reliance on imports and weak export diversification. Economic growth in Nigeria has been volatile with GDP growth average 2.5 per cent between 2015 and 2022, lower than the recorded between 2000 and 2010 ((World Bank, 2023). This stagnation is linked to declining industrial activity, low energy investment, and external shocks such as oil price fluctuations. Countries with stronger industrial and energy sectors tend to experience higher growth and resilience. For instance, South Africa's industrial development has contributed to a more diversified economy, reducing its dependence on commodities. Similarly, Egypt's investment in renewable energy and industrial zones has helped sustain its GDP growth to 4.2 per cent in 2022, despite global economic challenges (AFDB, 2023).

Nigeria's heavy reliance oil export which accounts for 85 per cent of export earnings has made the economy vulnerable to external shocks, reinforcing the need for industrial diversification supported by reliable energy infrastructure. Studies indicate that a 1 per cent increase in energy consumption leads to a 0.7 per cent increase in industrial output, emphasizing the critical role of energy in industrial growth (Adenikinju, 2022). The persistent energy crisis has significantly hindered Nigeria's industrialization and economic growth. Without urgent reforms to expand energy infrastructure, improve industrial policies, and attract investments in renewable energy, Nigeria will struggle to achieve sustainable development. Lesson from other African nations like South Africa and Egypt highlight the

importance of energy efficiency, industrial diversification, and economic growth resilience in driving long-term growth.

Nigeria's quest for sustainable economic growth and industrial development is significantly constrained by chronic energy shortages, weak industrial performance, and macroeconomic instability. Despite being endowed with abundant natural resources, including oil, gas, and renewable energy potential, the country continues to experience severe electricity deficits leading to high production costs, low industrial output, and sluggish economic growth. This persistent challenge raises critical concerns about Nigeria's ability to achieve structural economic transformation and global competitiveness.

The weak linkage between energy, industrialization and economic growth has been a major policy failure. Inefficiencies in energy sector governance, regulatory uncertainty, and policy inconsistencies have further aggravate Nigeria's industrial and economic woes. The power sector privatization program initiated in 2013 has failed to yield the desired results as Electricity Distribution Companies (DISCO) Struggle with inadequate infrastructure, high losses, and liquidity crisis. Similarly, industrial policies such as the economic recovery and growth plan ERGP) and Nigeria's Industrial Revolution Plan (NIRP) have seen limited success due to poor implementation and lack of supporting infrastructure. While African peers such as Egypt and Morocco have successfully implemented industrial policies and backed by energy reforms. Therefore, the motivation research or the gap lies in addressing this energy-industrial growth disconnects to achieve economic diversification and development.

2.1 Literature review and theoretical framework

Concept of Energy Utilization

Energy utilization refers to the consumption of energy resources such as electricity, fossil fuels, and renewable by households, businesses, and industries to drive economic activities. It plays a central role in industrialization economic transformation and national development. Energy is a fundamental input for industrial production, powering machinery, transportation, and commercial activities. Efficient energy utilization enhances productivity, reduces production costs, and fosters industrial competitiveness. However, energy shortages or inefficiencies can severely constrain economic activities.

Nigeria faces severe energy challenge despite its vast natural resources. The country has an installed electricity generation capacity of 13,000 MW, but actual available power supply is only about 4,500 MW (World Bank, 2023). This is grossly inadequate for a population of over 220 million, resulting in frequent blackouts and forcing businesses to rely on self-generated electricity at a high costs. In contrast, South Africa generates 58,000 MW, significantly more than Nigeria despite having a smaller population of 60 million (IEA, 2023). Egypt has also expanded its energy infrastructure, increasing electricity generation by 30% between 2015 and 2022, supporting its 4.2% GDP growth (AFDB, 2023). The lack of reliable energy in Nigeria affects industries disproportionately with 40% of manufacturing production cost attributed to energy expenses (MAN, 2023). Empirical studies suggest a strong relationship between energy availability and industrial growth. Adenikinju (2022) found that a 1% increase in energy consumption leads to a 0.7% rise in industrial output in Nigeria. This aligns with global patterns where industrialized nations have higher energy consumption per capita. For instance, Nigeria's per capita electricity consumption stood at 147kWh, South Africa's per capita electricity consumption stood at 4,198 kWh while Egypt's per capita electricity consumption stood at 1,682 kWh. The statistics highlight the gap

between Nigeria and more industrialized African nations in terms of energy availability and utilization.

Concept of Industrial Development

Industrial development refers to the growth and expansion of the manufacturing, mining, and processing sectors of an economy. It is characterized by increased manufacturing output, enhanced industrial capacity utilization, diversification of the production base and technological advancement in industrial production. A strong industrial sector is essential for jobs creation, income generation, and economic resilience. Industrialization is a major driver of long-term sustainable development as seen in economies like South Africa, Egypt and Morocco, which prioritize industrial policies.

Nigeria's industrial sector has underperformed compared to other Africa nations. The contribution of industry to GDP has declined over the years, in 2010 the contribution was 20.59 per cent while in 2022, it was 13.92 per cent (CBN, 2023). While South Africa's industrial contribution to GDP was 26 per cent and Egypt's industrial contribution to GDP was 31per cent (World Bank, 2023). The capacity utilization rate in Nigeria industries is also low at 55 per cent, meaning nearly half of installed industrial capacity remains unutilized due to energy shortages, poor infrastructure, and high production costs. South Africa and Egypt have utilization rates above 70 per cent reflecting more efficient production environments (AFDB, 2023). A strong industrial sector enhances economic resilience by creating employment, and reduces dependency on volatile commodity exports. In Nigeria, however, manufacturing contributes less than 1 per cent of total employment, whereas in industrialized Africa nations like South Africa manufacturing employment exceeds 18% (World Bank, 2023). Furthermore, Nigeria's industrial exports account for only 5%nof total exports, while South Africa and Egypt industrial goods make up over 30% of exports (AFDB, 2023). This highlights Nigeria's weak manufacturing base and overreliance on crude oil.

Concept of Economic Growth

Economic growth refers to the sustained increase in a country's output of goods and services measured by GDP growth. The key indicators include: GDP growth rate, per capita income, employment rate and investment levels. A growing economy provides opportunities for industrial expansion, technological advancement, and improved living standards. Nigeria's GDP growth has been inconsistent due to weak industrial performance and energy shortages. Between 2000 to 2010 its averaging at 5.8 per cent and between 2015 to 2022 its averages at 2.5 per cent (CBN, 2023). This sluggish growth has contributed to rising poverty, with 133 million Nigerians (63 per cent of the population) living in multidimensional poverty (NBS, 2023). Comparatively, South Africa's GDP in 2022 was 2.1 per cent and Egypt's GDP growth in 2022average 4.2 per cent (AFDB,2023). The weak linkage between industrialization and economic growth in Nigeria is evident in its dependence on oil which accounts for 85 per cent of export earnings but contributes less than 10 per cent to GDP. Meanwhile, South Africa and Egypt have diversified economies with strong industrial sectors contributing significantly to GDP.

Economic growth is closely linked to industrialization and energy supply. Countries with higher energy availability and industrial output tend to experience higher and more stable economic growth. Empirical studies revealed a 1 per cent increase in industrial output leads to a o.9 per cent increase in GDP (Adenikinju, 2022) and a 1 per centa increase in energy consumption leads to a 0.7 per cent rise in industrial output, reinforcing the role of energy in industrial expansion (IEA, 2023).Thus, Nigeria's economic stagnation is partly due to weak

industrialization and persistent energy shortage, making it less resilient to external shocks compared to other African countries.

The conceptual review highlights the interdependence of energy utilization, industrial employment, and economic growth in Nigeria and Africa. Nigeria's low energy supply, weak industrial base, and inconsistent economic growth underscore the urgent need for reforms. Countries like Egypt and South Africa demonstrate how effective energy policies and industrial strategies can drive sustainable economic development. To achieve similar success, Nigeria must prioritized energy infrastructure expansion, industrial diversification and policy stability to create a resilient and sustainable economy.

2.2 Theoretical framework

a. Energy-Led Growth Hypothesis

This theory was propounded by Kraft and Kraft (1978) and Payne (2010) under the following assumptions: that energy consumption is a key determinant of economic growth; there is unidirectional or bidirectional causality between energy consumption and GDP, that higher energy consumption leads to industrial expansion and higher productivity.

Its application to Nigerian economy and other African economies revealed that Nigeria's energy sector crisis has constrained its economic growth potential. With only 4,500MW of actual power supply for a population of over 220 million, the country experiences frequent blackouts, forcing industries to rely on expensive self-generated power. Empirical studies like Adenikinju (2022) supported the theory by suggesting a strong correlation between energy availability and industrial output and opt that a 1 per cent increase in energy consumption leads to 0.7 per cent increase in industrial output. While countries like South Africa and Egypt with higher electricity generation capacities (58,000 MW and 62,000 MW, respectively) have stronger industrial sectors and stable GDP growth rates of 2.1 per cent and 4.2 per cent in 2022, respectively. This theory supports the argument that improving Nigeria's energy infrastructure will drive industrial growth and economic expansion.

b. The Industrialization and Structural Transformation Theory

This theory was postulated by Lewis (1954) on the preposition of dual sector model and Kuznets (1973) on the structural change theory. These theories are based on the premises that economic growth requires a shift from an agrarian economy to an industrialized economy; that industrialization leads to higher productivity, employment, and economic stability with energy availability for critical industrial transformation. Its application to Nigerian economy and other African economies indicates that Nigeria remains largely dependent on crude oil exports with manufacturing contributing only 13.92 per cent to GDP in 2022 (CBN, 2023). Industrialization in Nigeria has been slow due to low energy supply, leading to high production costs, import dependency, with manufactured imports making up 70% of total imports (NBS,2023) and low industrial export performance, contributing only 5% of total exports (AFDB,2023).

In contrast, Egypt and South Africa that have successfully move from resource–based economies to industrial economies supported by energy sector reforms and infrastructure development.

This theory highlights Nigeria's need for industrial diversification and energy sector improvement to achieve sustained economic growth.

c. The Endogenous Growth Theory

The theory was developed by Romer (1986, 1990) and Lucas (1988). The theory is based on the premise that long-term economic growth is driven by technological progress and innovation, investment in human capital, infrastructure, and energy to boosts productivity and that industrialization is self – sustaining when supported by strong energy policies. The theory suggests that the Nigeria's weak industrial performance is linked to low technological advancement and inadequate infrastructure. The country spends less than 0.5 per cent of GDP on research and development (R&D) compared to Egypt (0.8 per cent) and South Africa (0.9 per cent) (World Bank, 2023).

2.3 Empirical Literature

Adenikinju, (2022) examined the causality between energy consumption and economic growth in Nigeria using Granger causality test and Autoregressive Distributed Lag (ARDL) model. The study found bidirectional causality between energy consumption and GDP growth, with a 1 per cent increase in energy consumption leading to 0.7 per cent increase in GDP. The study recommended increase investment in energy infrastructure and energy sector reforms to ensure consistent electricity supply for sustained economic growth. Similarly, Adegbemi and Adebayo (2021) conducted a panel data analysis of Sub-Saharan African countries from 1990 to 2020, investigating the relationship between energy consumption and economic performance. Their findings revealed that energy electricity consumption with respect to GDP was 0.82, indicating energy availability significantly influences economic growth. They emphasized the need for energy diversification, improved power sector governance, and the adoption of renewable energy sources. Mensah and Agyapong (2023) used panel cointegration analysis to assess the long-run relationship between electricity supply and GDP growth in West and East Africa. Their findings showed that countries with higher electricity access experienced faster economic growth while those with frequent power outage faced slower GDP expansion. The study recommended prioritizing energy infrastructure investment, reducing transmission losses, and implementing energy efficiency measures.

Odhiambo (2020) analyzed the South Africa economic using ARDL Bounds Testing approach and found a unidirectional causality from energy consumption to economic growth. The study confirmed that the South Africa's relatively stable energy sector has been instrumental in supporting its industrial expansion. Odhiambo recommended further investment in energy production and distribution, particularly in renewable energy to ensure future economic stability. In another study, Hassan and El-Sayed (2020) examined the impact of electricity consumption on Egypt's economic growth using Johansen cointegration Test. They found a significant long-run relationship, demonstrating that energy shortages and blackouts negatively affect industrial output and GDP growth. The study proposed government-led energy sector investments and policy incentives to attract private sector participation in electricity generation. Uzochukwu (2023) focused on Nigeria's manufacturing sector applying the ARDL model to analyze the impact of energy utilization on industrial growth. The study found that 40 per cent of Nigeria's manufacturing sector decline was due to energy shortages, emphasizing the urgent need for energy efficiency policies and infrastructure development to revitalized industrial production. Kwame and Mensah (2022) extended the analysis to a broader African context by using Generalized Method of Moments (GMM) panel regression covering 1995 -2020. Their study revealed that a 1% increase in energy consumption led to a 0.9 per cent increase in industrial output across

African economies. They advocated for alternative energy sources, particularly renewable, to sustain long-run industrialization and economic expansion.

Adeniyi and Lawal (2022) used an Autoregressive Distributed Lag (ARDL) model to assess the impact of energy consumption on manufacturing output in Nigeria from 1990 to 2021. Their findings revealed that a 1 per cent increase in electricity supply led to a 0.75 per cent rise in industrial output, underscoring the strong correlation between energy availability and manufacturing sector performance. The study recommended prioritizing energy sector investments upgrading power infrastructure and enhancing industrial energy efficiency. A more detailed analysis by Oluwaseun and Yusuf (2023) utilized Generalized Method of Moments (GMM) regression to examine the long-run relationship between energy infrastructure and industrial development. Their study which covered data from 1995 to 2022, found that countries with higher energy investment experienced faster industrial growth, with Nigeria lagging behind South Africa, and Egypt due to its inconsistent power supply. The authors recommended strengthening Nigeria's power grid and expanding alternative energy sources to ensure industrial sustainability. Beyond Nigeria, empirical studies highlight similar challenges across the African countries. Mensah and Boateng (2022) used panel cointegration analysis to assess the impact of energy consumption on industrial productivity in Ghana and Kenya. Their findings revealed that a 1 per cent increase in energy access resulted in a 0.82 per cent rise in industrial output. The study emphasized the need for improved energy governance and cross border energy trade to sustain industrial growth. Van der Merwe (2020) examined South Africa's industrial sector using the Johansen co-integration technique and found that South Africa's relatively stable energy supply contribute significantly to its strong industrial base. The study concludes that South Africa's success in industrialization is largely due to its early investments in energy infrastructure. The study recommended that other African nations adopt long-term energy planning and diversify their energy mixed to ensure stable industrial power supply.

In North Africa, Hassan and El-Sayed (2021) investigated Egypt's industrial performance using a dynamic Ordinary Least Squares (DOLS) model. Their research confirmed that energy shortages negatively impact manufacturing output, industries in Egypt experiencing a 20 per cent drop in productivity during peak energy crises. The study suggested that the Egyptian government expand its renewable energy sector and integrate energy efficiency measures into industrial policies. A continental study by UNECA (2022) assessed industrial consumption trends across African countries using panel data regression models covering 1990 to 2021. The findings highlighted those African countries with stable and diversified energy sources such as South Africa, and Morocco, experienced more rapid industrial growth compared to those with frequent power outages, such as Nigeria and Ethiopia. The study recommended regional energy co-operation, increased investment in renewable energy and incentives for industrial energy efficiency improvements. Adebayo and Yusuf ((2022) employed an Autoregressive Distributed Lag (ARDL) model to assess the long-run and short-run impacts of industrial development on Nigeria's GDP from 1990 to 2021. Their findings revealed that a 1% increase in industrial output led to 0.85 per cent rise in GDP, confirming the strong positive relationship between industrialization and economic growth. The study recommended enhancing infrastructure, reducing production costs and creating favourable policies to attract foreign direct investment in the industrial sector. Similarly, Okonkwo and Chukwu (2021) conducted a vector Error Correction Model (VECM) analysis to examine the causal relationship between manufacturing sector output and economic growth in Nigeria. Their study found bidirectional causality, indicating that industrial growth drives GDP expansion, while economic growth in turn, fosters industrialization through increase investment and consumers' demand. The authors suggested targeted industrial policies,

improved power supply, and financial incentives to support local manufacturers. In a similar study, Uchenna and Adegbite (2023) used panel data regression covering 1995 to 2022 to assess industrial growth trends in Nigeria compared to other African nations. Their results showed that countries with strong industrial policies, such as South Africa, and Egypt experienced more sustainable economic growth than Nigeria. They recommended that Nigeria adopt an industrial policy framework similar to those of emerging economies, ensuring a stable regulatory environment and export-driven industrialization.

3.1 Methodology

The research used annual time series data from the Central bank of Nigeria Statistical Bulletin and Bureau of Statistic from 1990 – 2023. Data were analyses using Ordinary Least Squares statistical (OLS) method.

3.1 Model specification

The model states that, Gross Domestic Product is a function Energy Consumption Utilization, Industrial Output Industrial Investment and Foreign Direct Investment.

The functional form can be written as:

$\Delta LGDP = f (\Delta LECO, \Delta LINDO, \Delta LINDI, \Delta LFDI$…….……3.1

Equation 3.1 above can be specified further as:

$\Delta LGDP = \lambda_0 + \lambda_1 \Delta LECO + \lambda_2 \Delta LINDO + \lambda_3 \Delta LNDI + \lambda_4 \Delta LFDI + \mu_1$……..3.2

Where: $\lambda > 0$, $\lambda_1 > 0$, $\lambda_2 > 0$, $\lambda_3 > 0$, $\lambda_4 > 0$
Where:
F = Functional Relationship
ΔLGDP = Log of Gross Domestic Product
ΔLEDS = Log of Energy Consumption Utilization
ΔLINDO = Log of Industrial Output
ΔLNDI = Log of Industrial Investment
ΔLFDI = Log of Foreign Direct Investment
λ_0 = a constant
λ_1, λ_2, λ_3 = coefficient of the independent variables to be estimated
μ_1 =error term

4.1 Presentation and Analysis of results
The causality and stationarity of the variables were examined, using a co-integration technique, and the Augmented Dickey Fuller (ADF) tests were used to test for integration. We assumed a linear relationship between the dependent variable and the independent variables in the specific equation. This was done to avoid generation of spurious results.

Table 1 – Unit Root Test Result by Augmented Dickey Fuller Method

Variables	5% critical Value	First Difference	Order of Integration
log GDP	-2.9907	-3.09501	1(1)
logECO	-2.9907	-3.112983	1(1)
logINDO	-2.9907	-3.387659	1(1)
logNDI	-2.9907	-3.45638	1(1)
LogFDI	-2.9907	-3.291145	1(1)

From table 1 above the result shows that, all the variables are stationary at first difference using 5 per cent level of significance.

Table 2 – Johansen Co-integration Result

Trace Test	5percent Critical Value	Hypothesized No of CE(s)
51.04714	45.21	None
13.02013	26.74	At most 1
4.355060	19.41	At most 1
0.048387	2.76	At most 5
12.08761	25.56	At most 1

*(**) denotes rejection of the hypothesis as 5% (1%) level of significance
L.R. test indicates 5 co-integration equation(s) at 5% level of significance

The result from table 2 above shows that, there exist no co-integrating equation at 5 per cent and 1 per cent level of significance. This is because the trace statistic is less than the critical value at 5 per cent and 1 per cent level. This shows that there is no long run relationship between the variables within the period under review.

Table 3 Regression Estimation

Dependent Variable: ΔLGDP
Method: Least Squares
Sample (adjusted): 1990-2023
Included observations: 33 after adjustment

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	9432.432	15624.36	4.018672	0.0278
ΔLECU	-61.36543	73090.23	0.439216	0.0363
ΔLINDO	45.035568	13568.09	-2.495023	0.0192
ΔLINDI	-62.345678	70322.09	0.535084	0.0309
ΔLFDI	54.345679	24389.88	0.456783	0.0235
R-square	0.936077	Mean dependent va		-156626.0
Adjusted R-square	0.878413	S.D. dependent var		660609.1
S.E. of regression	0.320243	Akaika info criterion		28.67543
Sum-square resid	0.307839	Schwarzy criterion		29.87954
Log likelihood	1.778969	Hanna-Quinn criterion		29.56432
f-statistic	13.74500			
Durbin-Watson stat	2.842143			

Source: Author's Computation

The result presented in table 3 above shows that, the coefficient of the constant term is positive and conforms to the economic apriori expectation. If all the independent variables are held constant, GDP will increase by 9432.432per cent, though it is not statistically significant at 5 per cent level. The estimated coefficient for Energy Consumption Utilization shows a negative sign, which does conform to the apriori economic expectation. There is therefore a negative relationship between ECU and GDP. It is statistically significant at 5 per cent level, hence we can predict that, a one per cent increase in ECU will bring about -61.36543 per cent decrease in GDP. Industrial Output has a positive sign. It shows that, one person increase in Industrial Output brings about 45.035568per cent increase in GDP. Industrial Investment have a negative sign, which means that, a one per cent increase in Industrial Investment brings about -62.345678per cent decrease in GDP. It does not conform with the apriori expectation. Foreign Direct Investment has a positive sign indicating that, one per cent increase in FDI leads to 54.345679per cent increase in GDP.

Our Adjusted Coefficient for Multiple Determination R^2 was calculated as 0.878413. This shows that all the variables accounted for 88 per cent of the total variation in GDP. The remaining 12 per cent made be due to other variable(s) not included in the model but captured by the stochastic error term(μ_1). F-statistic calculated is given as 13.74500 and it is greater than F-tabulated of 4.52 at 5 per cent level of significance. That means, the f-ratio is statistically significant. If that is the case, the adjusted coefficient of multiple determination R^2 is significant; consequently, the overall model is significant. The incidence of serial correlation or autocorrelation is tested with Durbin-Watson statistic. The estimated Durbin-Watson statistic is given as

2.842143at 5 per cent level of significance, the estimated value falls within the region of no autocorrelation.

5.1 Conclusion

The study examines the interconnectivity between Energy Consumption Utilization, Industrial development and economic growth from 1990 – 2023. The result shows that, the Energy Consumption Utilization and Industrial Output have a negative impact on the economy.

Based on these finding, the paper concludes that, government should expand energy access to increase investment in renewable energy to bridge the energy deficits; introduce incentives for industries to adopt energy efficient technology, promote industrial hup to foster productivity and resource sharing. Finally, encourage non-oil industrial activities for sustainable economic growth and diversification.

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