Econometric Analysis of Nigeria Economy: A Case Study of Her Industry

O.A. Oyegoke; B.A. Ogunwole; and O. Asabi

Department of Statistics, Osun Stae Polytechnic, Iree, Nigeria.

E-mail: akomolafeayotade@gmail.com
odunayo4mine@gmail.com

ABSTRACT

This research investigated econometric analysis on the impact of industry on the Nigeria economy. This study used secondary data covering a period of 20 years (2002-2021) in the econometric analysis. Data was sourced for the same period for manufacturing, electricity, construction and total Gross Domestic Product (GDP), obtained from the Central Bank of Nigeria (CBN) Statistical Bulletin.

Econometric analysis was carried out on the data, and the estimation of the model and various test was carried out using SPSS software. From the statistical analysis and test carried out on the data, the findings indicated that manufacturing and construction play significant roles in influencing the country's economic growth, contributing positively. On the other hand, electricity does not seem to have a statistically significant impact.

(Keywords: *econometric analysis, gross domestic product, GDP, Central Bank of Nigeria, secondary data, industry*)

INTRODUCTION

Industry is a group of productive enterprises or organizations that produce or supply goods, services, or sources of income (Britannica). The industrial sector, according to the Central Bank of Nigeria (2020), consists of crude petroleum and natural gas; solid minerals (including coal mining, metal ores, quarrying and other mining activities) and manufacturing (including oil refining, cement production, food beverages and tobacco; textiles, apparel and footwear; wood and wood products; pulp, paper and publishing; non-metallic products; domestic/industrial plastic and rubber; electrical and electronics; basic metal, iron and steel; motor vehicle and miscellaneous assembly.

The impact of industry on economic development has been widely studied. Very few countries have been able to grow and accumulate wealth without investing in their industries. Industrial development therefore is the application of modern technology, equipment and machineries for the production of goods and services, alleviating human suffering and to ensure continuous improvement in their welfare. Modern industrialization processes are characterized by high technological innovations, the development of managerial and entrepreneurial talents, and improvement in technical skills which normally promote productivity and better living conditions (Fashola, 2004).

Developing countries such as Nigeria still need more industries, specifically in manufacturing, to promote economic growth and development to an optimal level. Developing countries especially need adequate resources to promote the production and exportation of goods by industries to achieve the desired economic growth and development (Olusegun, 2021).

Djeudo (2013) suggested that in achieving industrialization in Nigeria, the government must continue to create enabling environments that are conducive to the private sector and formulate good policies that enhance innovativeness. An investigation by the World Bank (2018) has revealed that the pattern of growth in the Nigerian economy has not gained significant input from the industrial sector and policy development.

This policy structure was an alternative framework to address the weaknesses and ineffectiveness of previous development planning efforts. The motives of these policies were to achieve economic growth, full employment and balance of payment equilibrium. Economic growth is, however, a long-term expansion of the total productive potential of the economy (Kleynhans and Pradeep, 2013).

The growth of an economy implies the expansion of all sectors of the economy, high levels of productivity, high standards of living and overall achievement of all the macroeconomic objectives of an economy such as high levels of employment, reduced inflation, and high outputs (Unugbro, 2010). The Nigerian government attempted to improve the growth of the economy by implementing some industrial policies like disinvestment, privatization, commercialization, devaluation, and SAPs. The main aims of these policies were to address the problem of economic growth, unemployment, the balance of payment deficit, technical progress and technology transfer. After several attempts to stabilize the economy by different governments, the country still experiences fluctuating growth.

LITERATURE REVIEW

Obasan, *et al*. (2010) examined the role of industrial sector in the economic development of Nigeria. The study used time series data covering the period of 1980 – 2008. The study employed Real Gross Domestic Product (RGDP) as the dependent variable and Manufacturing Output (MOT); Exchange Rate (EXR); Inflation Rate (INFR); Interest Rate (IR); and Government Expenditure (GEXP) as independent variables. The data obtained were analyzed using Ordinary Least Square Method. The study found that there is an empirical correction between the degree of industrialization and economic growth in Nigeria, and there is a positive relationship between the two. Dan et al (2011), examined the impact of industrialization on economic growth of Nigeria.

The study utilized time series data covering the period of1980 – 2010. The study employed per capita output (Per capita GDP) as the dependent variable and Per capita output of the previous year; Capital/industrial output; capital/industrial out of the previous year; Labor/industrial as the independent variables. The data obtained were analyzed using co-integration and Vector Error correction model. The study found result shows that capital-industrial output ratio decreases per capita GDP; the labor /industrial output ratio also contributes negatively to per capita GDP which means that industrialization has a negative impact on economic growth in Nigeria.

In another effort, Adenomon and Oyejola (2013) examined the impact of the agricultural and industrial sectors' output on Nigeria's economic growth for the period 1960 to 2011. The empirical results from of their study using the VAR and SVAR approaches showed that the agricultural and industrial sectors' outputs accounted for about 58% and 32%, respectively, of Nigeria's GDP within the period. The authors therefore recommended that relevant policy measures should be faithfully implemented for the industrial sector to be well positioned to contribute positively to the growth of the Nigerian economy.

Muhammed, Muhammed, and Alege (2014) found industrialization and sustainable development in Nigeria from 1981 to 2012 using the OLS technique. The study adopted unstructured interviews and other secondary sources of data collection. It was confirmed from the study that industrialization is directly and significantly related to sustainable development.

Obioma, *et al*. (2015) examined the effect of industrial development on economic growth in Nigeria from 1973 to 2013. The result showed a positive but insignificant impact of industrial output on economic growth, whereas savings have a positive and significant impact on the economy. The result also showed a negative effect of inflation on economic growth, while a positive and significant impact of net FDI on economic growth was found.

Bennett, Anyanwu, and Kalu (2015) conducted a study on the effect of industrial sector output on economic growth in Nigeria for the period 1973 to 2013. The PC Give 8.00 analytical technique was employed to analyze the data of their study. The empirical results thus obtained revealed that industrial sector output exhibited a positive but insignificant effect on Nigeria's economic growth. They therefore recommended the initiation and implementation of those policies that are thought germane to increased industrial sector output and, hence, economic growth.

Ou (2015) also investigated the effect of industrialization on the economic development of Nigeria. The time-series data for the period 1973 to 2014 was used, employing mainly National Statistical Bulletin data. They used GDP as the dependent variable, and FDI, industrial output, total savings and inflation represent the independent variables. The result revealed a positive but insignificant relationship between industrial output and economic growth.

Gylych and Enwerem (2016) examined the impact of industry on the economic growth of ten Economic Community of West African States (ECOWAS) countries from 2000 to 2013. The ordinary least squares (OLS) estimation technique was adopted to process the data of their study. Their empirical results revealed that industry exerted a negative impact on the economic growth of these countries in the long run. They therefore strongly recommended that the appropriate authorities of these countries should take immediate steps to introduce necessary policies that would help to protect their infant industries thereby enhancing the industrial sector outputs that would certainly enthrone economic prosperity in their respective countries.

Senibi, *et al.* (2017) examined the impact of the industrial sector output on the Nigerian for the period 1981 to 2013. The study utilized the co-integration and granger causality techniques to estimate the results of their study. Their findings showed that a negative but significant long run impact existed between industrial sector output and Nigeria's economic growth. The Granger causality tests of their work revealed that a one-way causality running from industrial output to economic growth thus existed. Hence, they strongly recommended that frantic efforts should be made by appropriate authorities to promote an enabling environment that would induce higher industrial output that will lead to a rapid and sustainable economic growth in Nigeria.

Afolabi and Ogoh (2017) found the relationship between industrial output and economic growth in Nigeria from 1981 to 2014 by utilizing the ARDL approach. The ARDL result found that the long-term coefficient of industrial output and agricultural value-added (AVA) was significant and directly related to economic growth. The study concluded that an increase in industrial coupled with agricultural output increases its value-added to the economy.

Ugwu, Asogwa, and Ugwuanyi (2017) examined the impact of external capital on Nigeria industry. They noted that one of the major sources of investible resources in most developing countries is made of foreign direct investment, foreign aid and external debt. Employing the Ordinary Least Squares (OLS) method on annual time series data for the period between 1982 and 2013. The results obtained shown that in the short-run, FDI has an inverse and insignificant effect on manufacturing output and also foreign aid inflow and external debt have inverse but significant reduction in manufacturing output. The study therefore recommended that government should make the business environment more investor friendly and ensure appropriate utilization of borrowed funds.

Using Time Series Analysis

Mandara & Ali (2018) examined the impact of industrialization on the Nigerian economy for the period 1981 to 2015. These authors utilized the ARDL model of the econometrics to evaluate the data of their study. Some of their findings showed that industrial output exerted a positive and significant impact on economic growth. Furthermore, the ECM result of their study revealed that the disequilibrium that occurred due to shocks was appropriately corrected in the sixteenth quarter at about 6 per cent per quarter. Hence, they recommended that the enactment and implementation of certain statutes and policies aimed at strengthening industrial development in Nigeria becomes imperative.

Abdu and Anam (2018) examined the effect industrial sector output on the Nigerian economy spanning from 1981 to 2016. The STATA estimation technique was employed to analyze the study's data. The results that emanated from their estimation exercise revealed that industrial output in Nigeria exerted a positive and significant impact on economic growth during period covered by their study. The authors therefore recommended, amongst others, that policy makers should as a matter of importance and urgency introduce and implement policies that are aimed at developing the industrial sector and, invariably, the overall Nigerian economy.

Attiah (2019) examined the impact of industries and the service sectors on the economic growth of developed and developing countries from 1950 to 2015. The study utilized data from 50 countries (40 developing and 10 advanced economies). The results of the empirical study show that total industries as a ratio to GDP was significant and has a direct relationship with economic growth. The significance of the positive relationship is more pronounced for poorer countries. The study also found no effect on the service sector. The impact of the industries and service sectors in the growth acceleration periods showed that the effects of industry were higher in periods of growth acceleration.

Sahar (2020) investigated the effect of industrialization on economic growth from 1976 to 2015 in Pakistan using autoregressive distributed lag (ARDL). In the study, the dependent variable is GDP, while the explanatory variables are industrial output, inflations, foreign direct investment (FDI) and savings. The results of the ARDL bounds tests revealed that there is a long-term relationship between industrial output and economic growth or GDP. This study also revealed a direct relationship between industrial output and GDP in Pakistan.

Elfaki, Handoyo, and Ibrahim (2021) employed the ARDL approach to determine the short- and long-term relationship between financial development, industrialization, trade openness, energy consumption and economic growth in Indonesia from 1984 to 2018. The result shows that there is co-integration among the variables and industrialization, trade openness, financial development and energy consumption assist in economic growth in the long run.

Khan and Majeed (2022) investigated the effect of urbanization and industrialization in achieving economic growth without emission in Pakistan from 1980 to 2018 by employing the Johansen Joselius co-integration and impulse response function (TRF) techniques to determine the impact of the decoupling drivers. The study found industrialization and urbanization as the two factors of economic growth and carbon emission.

METHODOLOGY

For the purpose of this research, we shall be taking a look at the Ordinary Least Square (OLS) method for estimating the parameters and also considering multi-collinearity, heteroskedasticity, and autocorrelation as the statistical tool in analyzing the economic phenomenon. The specification of model involves the expression of the relationship between variables in mathematical form. That is, to specify the model with which the economic phenomenon will be explored empirically.

In this study, it is assumed that the impact of industrial sector on economic development is determined by manufacturing, electricity and construction industries. Hence, Gross Domestic Product (GDP) is assumed to be dependent variable, which depends on the Manufacturing (MAN), Electricity (ELE) and Construction (CON)
The model is specified thus:

$$Y_t = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + u_i$$

$$TGDP = \beta_0 + \beta_1 MAN + \beta_2 ELE + \beta_3 CON + u_i$$

Where:

TGDP =Total Gross Domestic Product;
MAN = Manufacturing;
ELE = Electricity
CON = Construction;
u_i = Random Error;
β_0 is the intercept,
while β_1, β_2, β_3 are the coefficients.

Method of Evaluation

An evaluation of the model consists of deciding whether the estimated coefficients are theoretically meaningful and statistically satisfactory. The evaluation of this model shall be based on two criteria: Statistical criteria and Econometric criteria.

Statistical Criteria, The First Order Test: This aims at the evaluation of the statistical reliability of the estimated parameters of the model. In this case, T–statistic, F–statistic, coefficient of the determination (R^2), are used for the first order test

Econometric Criteria, The Second Order Test: The second order tests aim at investigating whether the assumptions of the econometric method employed are satisfied or not, in any case. They determine the reliability of the statistical criteria and establish whether the estimates have the desirable properties of unbiasedness and consistency. Three tests would be conducted here: Autocorrelation, Heteroskedasticity tests, Multicollinearity test and Normality test.

DATA PRESENTATION, ANALYSIS AND INTERPRETATION

Table 1: Data Presentation.

Year	X_1(Manufacturing)	X_2 (Electricity)	X_3(Construction)	Y (GDP)
2003	3203.24	119.88	831.21	33346.62
2004	3169.21	140.27	774.86	36431.37
2005	3242.2	149.39	868.59	38777.01
2006	3268.55	156.35	981.45	41126.68
2007	3271.65	163.7	1109.31	43837.39
2008	3369.71	169.35	1254.3	46802.76
2009	3491.29	174.32	1404.5	50564.26
2010	3578.64	179.47	1570.97	55469.35
2011	4216.19	250.39	1817.83	58180.35
2012	4783.66	286.97	1989.46	60670.05
2013	5826.36	328.76	2272.38	63942.85
2014	6684.22	300.21	2568.46	67977.46
2015	6586.62	272.43	2680.22	69780.69
2016	6302.23	231.57	2520.85	68652.43
2017	6288.9	269.62	2545.99	69205.69
2018	6420.59	289.29	2605.29	70536.35
2019	6469.83	275.23	2652.54	72094.09
2020	6291.59	267.25	2448.72	70800.54
2021	6502.26	340.92	2524.39	73382.77
2022	6661.39	333.39	2638.93	75768.95

Source: Central Bank of Nigeria.

Data Analysis

Table 2: Descriptive Statistics.

	Mean	Std. Deviation	N
Y	58367.3830	13962.46412	20
X3	1903.0125	726.34621	20
X2	234.9380	71.45052	20
X1	4981.4165	1513.47042	20

Estimation of Regression Equation

$$Y_t = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + u_i$$

$$GDP = \beta_0 + \beta_1 MAN + \beta_2 ELE + \beta_3 CON + u_i$$

Where:

GDP =Gross Domestic Product
MAN = Manufacturing;
ELE = Electricity;
CON = Construction;
u_i = Random Error
β_0 is the intercept, while β_1, β_2, β_3 are the coefficients.

Table 3: Fitted Model.

Model		B	Std. Error	T	p-value	Decision
1	(Constant)	23924.652	2171.881	11.016	.000	Significant
	X3	22.805	3.052	7.472	.000	Significant
	X2	26.664	15.294	1.743	.100	Insignificant
	X1	-3.055	1.366	-2.236	.040	Significant

The fitted model of the study from the result generated by SPSS is:

$$Y_t = 23924.652 - 3.055X_1 + 26.664X_2 + 22.805X_3$$

The result of the model shows that the regression coefficients of constant, β_3, β_1 are significant, with P-value 0.000, 0.000, and 0.40 which is less than 0.05 level of significant while β_2 is insignificant to the model.

Analysis of Variance (ANOVA)

Table 4: ANOVA[a.]

Model		Sum of Squares	Df	Mean Square	F	P-value	Decision
1	Regression	3639711320.436	3	1213237106.812	301.677	.000[b]	Significant
	Residual	64346359.428	16	4021647.464			
	Total	3704057679.864	19				

a. Dependent Variable: Y
b. Predictors: (Constant), X1, X2, X3

Analysis of variance test (ANOVA) revealed that all the regression parameters are significant to the model with P-value 0.000 which is less than 0.05 level of significant.

Test of Relationship between Y and X's

Table 5: Karl Person Correlation Test.

Correlations					
		X1	X2	X3	Y
X1	Pearson Correlation	1	.891**	.975**	.947**
	Sig. (1-tailed)		.000	.000	.000
	N	20	20	20	20
X2	Pearson Correlation	.891**	1	.906**	.916**
	Sig. (1-tailed)	.000		.000	.000
	N	20	20	20	20
X3	Pearson Correlation	.975**	.906**	1	.987**
	Sig. (1-tailed)	.000	.000		.000
	N	20	20	20	20
Y	Pearson Correlation	.947**	.916**	.987**	1
	Sig. (1-tailed)	.000	.000	.000	
	N	20	20	20	20

**. Correlation is significant at the 0.01 level (1-tailed).

There is a linear relationship between Y and each of X_1, X_2, and X_3 explanatory variables with the correlation coefficient of 0.947, 0.916 and 0.987, respectively, while he P-values are significantly less than 0.05 for the correlation coefficients.

Heteroscedasticity Test

To test for the existence that the error term is homoscedasticity, Spearman Rank Correlation test is used. The Test results are;

Table 6: Spearman Rank Correlations.

			X1	X2	X3	Y
Spearman's rho	X1	Correlation Coefficient	1.000	.884**	.959**	.920**
		Sig. (1-tailed)	.	.000	.000	.000
		N	20	20	20	20
	X2	Correlation Coefficient	.884**	1.000	.838**	.866**
		Sig. (1-tailed)	.000	.	.000	.000
		N	20	20	20	20
	X3	Correlation Coefficient	.959**	.838**	1.000	.925**
		Sig. (1-tailed)	.000	.000	.	.000
		N	20	20	20	20
	Y	Correlation Coefficient	.920**	.866**	.925**	1.000
		Sig. (1-tailed)	.000	.000	.000	.
		N	20	20	20	20

**. Correlation is significant at the 0.01 level (1-tailed).

Interpretation: The spearman rank correlation coefficient for X_1, X_2, and X_3 are 0.920, 0.866 and 0.925 respectively. Since, there are high rank correlation, we conclude that heteroscedasticity exists.

Multicollinearity

The preliminary test can help to detect multicollinearity by examining the coefficient of correlation from the analysis. Correlations among the pair of explanatory variables gives the sign for the incidence and presence of multicollinearity.

Table 7: Multicollinearity Correlations.

		X1	X2	X3
Pearson Correlation	X1	1.000	.891	.975
	X2	.891	1.000	.906
	X3	.975	.906	1.000
Sig. (1-tailed)	X1	.	.000	.000
	X2	.000	.	.000
	X3	.000	.000	.
N	X1	20	20	20
	X2	20	20	20
	X3	20	20	20

From the table above, it was observed that the correlation between X_1 and X_3 is high; this shows that is presence of multicollinearity in the data.

To confirm the existence of multicollinearity Farra Glauber Chi-Square test will be used.

Farrar Glauber Chi- Square Test

$$X^2 = -\left[n - 1 - \frac{1}{6}(2k+5)\right] \text{In } |D| \sim X^2_{\frac{1}{2}k(k-1)df}$$

Where D= the determinant of all possible correlation between the explanatory variables; n= numbers of observations, and k= numbers of explanatory variables.

$$D = \begin{bmatrix} 1 & 0.891 & 0.975 \\ 0.891 & 1 & 0.906 \\ 0.975 & 0.906 & 1 \end{bmatrix}$$

$|D| =$0.00879 $= -4.734$

X^2 = 81.28 then, $X^2_{tab} = X^2_{\propto,\frac{1}{2}k(k-1)}$ $= X^2_{0.05,\frac{1}{2}3(3-1)} = X^2_{0.05,3}$ =7.815

Hypothesis: H_0: X's are orthogonal versus H_1: X's are not orthogonal

This shows that Since $X^2_{cal} > X^2_{tab}$ we reject H_0 and conclude that X's are not orthogonal, which shows that there is existence of multicollinearity.

Test for the location of Multicollinearity

To check for the location of multicollinearity, the Farrar Glauber F- test will be adopted.

$$F = \frac{\frac{R_i^2}{k-1}}{\frac{1-R_i^2}{n-k}} \sim F_{\propto,(k-1),(n-k)}$$

H_0 : $R^2_{X_iX_jX_k} = 0$ (no multicollinearity) versus

H_1 : $R^2_{X_iX_jX_k} \neq 0$ (multicollinearity exist)

Test Statistics

$$F_i = \frac{R^2/(k-1)}{(1-R^2)/(n-k)} \sim F_{(k-1),(n-k)df}$$

This is based on the output generated by SPSS to calculate R_i^2 of each of an explanatory variable.

Table 8: Model Results.

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1054.006	288.615		3.652	.002
	X2	.954	2.705	.045	.353	.729
	X3	1.946	.266	.934	7.313	.000

a. Dependent Variable: X1

$X_1 = f(X_2, X_3) = \beta_2 X_2 + \beta_3 X_3 + u_i = 0.954X_2 + 1.946X_3 + u_i$

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.975[a]	.950	.945	355.99556

a. Predictors: (Constant), X3, X2

b. Dependent Variable: X1

from model summary the R^2 for X_1 is 0.950

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	56.773	31.570		1.798	.090
	X1	.008	.022	.161	.353	.729
	X3	.074	.045	.749	1.638	.120

a. Dependent Variable: X1

$X_2 = f(X_1, X_3) = \beta_1 X_1 + \beta_3 X_3 + u_i = 0.008X_1 + 0.074X_3 + u_i$

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.907[a]	.823	.802	31.80214

a. Predictors: (Constant), X3, X1

b. Dependent Variable: X2

From model summary the R^2 for X_2 is 0.823

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-474.088	128.702		-3.684	.002
	X1	.390	.053	.812	7.313	.000
	X2	1.850	1.129	.182	1.638	.120

a. Dependent Variable: X3

$X_3 = f(X_1, X_2) = \beta_1 X_1 + \beta_2 X_2 + u_i = 0.390X_1 + 1.850X_2 + u_i$

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.978[a]	.957	.952	159.35543

a. Predictors: (Constant), X2, X1

b. Dependent Variable: X3

From model summary the R^2 for X_3 is 0.957

$$F_i = \frac{R^2/(k-1)}{(1-R^2)/(n-k)}$$ where k=3 and n = 20 then,

$$F_1 = \frac{0.950/(3-1)}{(1-0.950)/(20-3)} = \frac{0.475}{0.00294} = 161.56$$

$$F_2 = \frac{0.823/(3-1)}{(1-0.823)/(20-3)} = \frac{0.4115}{0.0104} = 39.57;$$

$$F_3 = \frac{0.957/(3-1)}{(1-0.957)/(20-3)} = \frac{0.4785}{0.00253} = 189.13$$

$$F_{tab} = F_{\propto,(k-1),(n-k)} = F_{0.05,(2,17)} = 3.59$$

Table 9: Results: If $F_{cal} > F_{tab}$, reject H_0 and Conclude that Multicollinearity Exist.

Dependent/Independent Variable	R_i^2	F_{cal}	$F_{cal} = F_{0.05,(2,17)}$	Decision Based on H_0 Hypothesis	Conclusion
$X_1/X_2, X_3$	0.950	161.56	3.59	Reject	Multicollinearity exist
$X_2/X_1, X_3$	0.823	39.57	3.59	Reject	Multicollinearity exist
$X_3/X_1, X_2$	0.957	189.13	3.59	Reject	Multicollinearity exist

Farrar Glauber T-Test

This test is used to detect the variables responsible for multicollinearity

$$T = \frac{(r_{ij.k})/\sqrt{n-k}}{\sqrt{1-r_{ij.k}}} \sim t_{\frac{\propto}{2},(n-k)}$$

Hypothesis : H_0: X_i and X_j are not responsible for multi-collinearity

H_1: X_i and X_j are responsible for multi-collinearity

The partial correlation coefficients of the variables were obtained using SPSS

$r_{12.3} = 0.085$, $r_{13.2} = 0.871$, $r_{23.1} = 0.369$

$$\begin{matrix} X_1 \\ X_2 \\ X_3 \end{matrix} \begin{bmatrix} X_1 & X_2 & X_3 \\ 1 & 0.085 & 0.871 \\ 0.085 & 1 & 0.369 \\ 0.871 & 0.369 & 1 \end{bmatrix}$$

$$t_{ij} = \frac{(r_{ij.k})/\sqrt{n-k}}{\sqrt{1-r_{ij.k}^2}}$$

$$t_{12} = \frac{(r_{12.3})/\sqrt{20-3}}{\sqrt{1-r_{12.3}^2}} = \frac{(0.085)/\sqrt{20-3}}{\sqrt{1-r_{12.3}^2}} = \frac{0.085/\sqrt{17}}{\sqrt{1-0.085^2}} = \frac{(0.085)/\sqrt{17}}{\sqrt{0.9928}} = \frac{0.0206}{0.9964} = 0.0207$$

$$t_{13} = \frac{0,871/\sqrt{17}}{\sqrt{1-0.871^2}} = \frac{(0.871)/\sqrt{17}}{\sqrt{0.2414}} = \frac{0.2112}{0.4913} = 0.4299$$

$$t_{23} = \frac{0,369/\sqrt{17}}{\sqrt{1-0.369^2}} = \frac{(0.369)/\sqrt{17}}{\sqrt{0.8638}} = \frac{0.0895}{0.9294} = 0.0963$$

Table 10: Results: If $t_{cal} < t_{tab}$, accept H_0 and Conclude that X_i and X_j are Not Responsible for Multi-Collinearity, Otherwise Reject H_0.

Partial Correlation	$r_{ij.k}$	t_{ij}	t_{tab}= $t_{0.975,(17)}$	Decision based on H_0 hypothesis	Conclusion
$r_{12.3}$	0.085	0.0207	2.11	Accept	X_1,X_2 not responsible for multicollinearity
$r_{13.2}$	0.871	0.4299	2.11	Accept	X_1,X_3 not responsible for multicollinearity
$r_{23.1}$	0.369	0.0963	2.11	Accept	X_2,X_3 not responsible for multicollinearity

Consequently, X_1, X_2, and X_3 were not individually responsible for multicollinearity. While the variables individually did not account for multicollinearity, they could collectively be responsible for multicollinearity.

SUMMARY

The summary of findings provided insight into the impact of different industries on Nigeria's economic growth, with a focus on Manufacturing (X_1), Electricity (X_2), and Construction (X_3) in relation to Gross Domestic Product (GDP, Y). The descriptive statistics shed more light on the impact of different industries on Nigeria's economic growth, as measured by GDP (Y). The mean GDP which stood at 58,367.38 reflect a substantial degree of variability in economic performance.

Notably, Manufacturing (X_1) with an average value of 4,981.42, Electricity (X_2) with an average value of 234.94 and Construction sector (X_3) exhibited an average value of $1,903.01. The regression analysis conducted provided valuable insights into the relationship between Gross Domestic Product (GDP) and the industry sectors of Manufacturing (X_1), Electricity (X_2), and Construction (X_3). The estimated regression equation was expressed as:

$$Y_t = 23924.652 - 3.055X_1 + 26.664X_2 + 22.805X_3$$

The regression model implied that Manufacturing and Construction significantly influenced Nigeria's economic growth, while Electricity did not play a statistically significant role.

The ANOVA table indicated that the regression model was statistically significant, which implied that at least one of the regression coefficients in the model was significantly different from zero, suggesting that the industrial sectors collectively had a substantial impact on Nigeria's economic growth.

The Karl Pearson correlation test was employed to explore the relationships between the economic growth indicator (GDP - Y) and the three industry-related explanatory variables: Manufacturing (X_1), Electricity (X_2), and Construction (X_3). The correlation coefficients and associated p-values revealed the strength and significance of these relationships. The correlation coefficient between GDP (Y) and Manufacturing (X_1) was found to be 0.947, signifying a strong positive linear relationship.

The p-value was less than 0.05, indicating that this correlation was statistically significant at the 0.01 level. This implied that as the manufacturing sector grew, there was a substantial positive impact on Nigeria's economic growth. Similarly, the correlation coefficient between GDP (Y) and Electricity (X_2) was 0.916. Furthermore, the Construction sector (X_3) exhibited the highest correlation coefficient with GDP (Y) at 0.987, showing a strong positive relationship. This indicated that the growth of the construction industry significantly contributed to the overall economic growth of Nigeria.

The Spearman Rank Correlation test results assessed the presence of heteroscedasticity and revealed strong correlations among the variables X_1 (Manufacturing), X_2 (Electricity), X_3 (Construction), and Y (GDP) in Nigeria's economic growth. All the correlation coefficients were statistically significant at the 0.01 level, indicating strong relationships between the variables. Findings suggested that there was a high degree of rank correlation among the economic variables, and that heteroscedasticity existed.

Heteroscedasticity referred to the situation where the variability of the error term was not constant across all levels of the independent variable. This had important implications for the validity of the regression model and may have warranted further investigation into the nature and causes of this heteroscedasticity.

The test for multicollinearity, the Pearson correlation coefficients between the pairs of variables being close to 1, indicated a strong linear relationship between the corresponding variables. Specifically, the high correlation of 0.975 between Manufacturing (X_1) and Construction (X_3) suggested the presence of multicollinearity. To further investigate and confirm the presence of multicollinearity, the study proposed employing the Farrar Glauber Chi-Square test. This test was crucial for assessing the statistical significance of multicollinearity.

CONCLUSION

From the statistical analysis and test carried out, the findings indicated that Manufacturing and Construction play significant roles in influencing the country's economic growth, contributing positively. On the other hand, Electricity does not seem to have a statistically significant impact. The positive correlation between GDP and Manufacturing suggests that as the manufacturing sector grows, Nigeria's economic growth tends to increase substantially. Similarly, the positive association between Electricity industries and economic growth implies that advancements in the electricity sector contribute positively to Nigeria's economic development. Additionally, the presence of autocorrelation, indicating potential patterns over time, suggests the need for addressing temporal dependencies in the data.

Despite these challenges, the regression model's high predictive power, as indicated by the 98.3% R Square value, underscores the collective influence of Manufacturing, Electricity, and Construction on Nigeria's economic growth. In simpler terms, the combination of these variables significantly contributes to predicting changes in the country's economic growth.

RECOMMENDATIONS

Based on the analysis of the impact of different industries on Nigeria's economic growth, several recommendations can be made to enhance the economic development of the country:

(i) Given the positive impact of the manufacturing and construction sectors on economic growth, there is a need to explore strategies that promote diversification within these industries. Encouraging the development of various manufacturing sub-sectors and supporting innovative construction projects can contribute to a more resilient and robust economy.

(ii) As the construction sector demonstrates a significant positive relationship with economic growth, prioritizing infrastructure development becomes crucial. Investing in critical infrastructure projects such as roads, bridges, and utilities can not only stimulate economic activity in the short term but also provide a solid foundation for sustained growth in the long term.

(iii) To further boost the manufacturing sector, there should be a focus on adopting advanced technologies. Embracing automation, digitalization, and modern manufacturing practices can enhance efficiency, reduce production costs, and make Nigerian industries more competitive on a global scale.

(iv) While electricity was not found to have a statistically significant impact in the current analysis, it remains a crucial factor for economic development. Encouraging investments in sustainable and reliable energy sources can address potential limitations and positively impact economic growth.

(v) Since multicollinearity was identified as a challenge in the analysis, continuous monitoring and mitigation strategies should be put in place. This involves careful consideration of the variables included in economic models to prevent high correlations that could distort the results.

(vi) The presence of multicollinearity, particularly the strong correlation between manufacturing and construction, calls for careful consideration. Policymakers and researchers should explore policy interventions or structural adjustments that can reduce the interdependence of these variables, promoting a more balanced economic landscape.

REFERENCES

1. Abdu, M. and E.B. Anam. 2018. "Evaluation of the Nigerian Industrial Sector and Economic Growth in the Face of Sustainable Development Goals". *International Journal of Advanced Research in Public Policy, Social Development and Enterprise Studies*. 3(1): 49-59.

2. Adenomon, M.O. and B.A. Oyejola. 2013. "Impact of Agriculture and Industrialization on GDP in Nigeria: Evidence from VAR and SVAR Models". *MPRA Paper No. 75268*. 1-32.

3. Attiah, E. 2019. "The Role of Manufacturing and Service Sectors in Economic Growth: An Empirical Study of Developing Countries". *European Research Studies*. 22(1): 112–128.

4. Bennett, K.O., U.N. Anyanwu, and A.U. Kalu. 2015. "The Effect of Industrial Development on Economic Growth (An Empirical Evidence in Nigeria 1973-2013)". *European Journal of Business and Social Sciences*. 4: 127-140.

5. Central Bank of Nigeria, 2020, *Central Bank of Nigeria Annual Statistical Bulletin*. Central Bank of Nigeria: Abuja, Nigeria.

6. Dan, R.U. and L.Z. Wanjuu. 2011. *Impact of Industrialization on Economic Growth in Nigeria*. Chapter 11.

7. Elfaki, K.E., R.D. Handoyo, and K.H. Ibrahim. 2021. "The Impact of Industrialization, Trade Openness, Financial Development, and Energy Consumption on Economic Growth in Indonesia". *Economies*. 9(4): 174.

8. Fashola, M.A. 2004. *A Scheme for Nigeria's Optimal Industrial Development in Industrialization, Urbanization and Development in Nigeria (1950-1999)*. M.O.A. Adejugbe (ed). Concept Publications Limited.

9. Ibbih, J.M. and B.A. Gaiya. 2013. "A Cross-Sectional Analysis of Industrialization and Growth in Africa". *International Research Journal of Arts and Social Sciences*. 2(6): 150–167.

10. Iheoma, E. and G. Jelilov. 2017. "Is Industrialization has Impact the on Economic-Growth; ECOWAS Members' States Experience?". *The Journal of Middle East and North Africa Sciences*. 3: 8-19.

11. Muhammad, S.A., A.M. Muhammed, and S.O. Alege. 2014. "Industrialisation and Sustainable Develoment In Nigeria". *The International Journal of Social Sciences and Humanities Invention*. 1(3): 142–154.

12. Obasan, K.A. and O.A. Adediran. 2010. "The Role of Industrial Sector in the Economic Development of Nigeria". *Journal of Management and Society*. 1 (2): 9-16.

13. Obioma, B.K., U.N. Anyanwu, and A.O. Kalu. 2015. "The Effect of Industrial Development on Economic Growth: An Empirical Evidence in Nigeria (1973–2013)". *European Journal of Business and Management*. 7(13): 20–35.

14. Parveen, S., A.Q. Khan, and S. Farooq. 2019. "The Causal Nexus of Urbanization, Industrialization, Economic Growth and Environmental Degradation: Evidence from Pakistan". *Review of Economics and Development Studies*. 5(4): 721–730.

15. Sahar, Q. 2020. “Relationship between Industrialization and Economic Growth: An Empirical Study of Pakistan”. *International Journal of Management, Accounting and Economics*. 7(12): 32–46.

16. Senibi, K.V., A. Aiyepeku, O. Odutola, I. Ndaman, O. Eseoghene, T. Ogunlusi, and M. Eldad. 2017. “Industrial Sector Investment and Industrial Growth in Nigeria: A Granger Causality Analysis”. *International Journal of English Lit and Social Sciences (IJELS)*. 2(4): 1-9.

17. Sule, A. 2017. “External Financing and Industrialization in Nigeria (1985 - 2016)”. Selected paper for the Nigeria Economic Society Annual Conference on Industrialization Growth in Nigeria.

18. Sutikno, S. and M. Sri-Wahyudi. 2017. “The Impact of Industrialization on the Regional Economic Development and Community Welfare”. *Journal Ilmu Ekonomi*. 6(2): 231–246.

19. Tamuno, S.O. and S.G. Edoumiekumo. 2012. “Industrialization and Trade Globalization: What Hope for Nigeria?”. *International Journal of Academic Research in Business and Social Sciences*. 2(6): 157-170.

20. Ugwu, J.O., F.O. Asogwa, and R.O. Ugwuanyi. 2017. “The Relative Impact of External Capital on Manufacturing Output in Nigeria”. *Journal of Economics and Sustainable Development*. 8(8): 158-167.

21. Unugbro, A.O. 2010. *Nigeria Economic System: Past, Present and Future*. Mindex Press: Benin, Nigeria.

22. Wang, Q. and M. Su. 2019. “The Effects of Urbanization and Industrialization on Decoupling Economic Growth from Carbon Emission – A Case Study of China”. *Sustainable Cities and Society*. 51,

23. World Bank. 2022. *World Bank Development Indicators*. Washington D.C.

SUGGESTED CITATION

Oyegoke, O.A., B.A. Ogunwole, and O. Asabi. 2024. “Econometric Analysis of Nigeria Economy: A Case Study of Her Industry”. *Pacific Journal of Science and Technology*. 25(2): 161-174.

Pacific Journal of Science and Technology