An Assessment of the Effect of Human Capital Investment on Industrial Sector Output in Nigeria

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Abstract
The main objective of this research was to empirically examine the effects of human capital investment on industrial sector output in Nigeria from 1990 to 2022. Three specific objectives were examined in the study. Investment in education, investment in research and development and investment in health were used as the proxies of human capital investment (independent variable) while industrial sector gross domestic product was used as the proxy of industrial sector output (dependent variable). Annual times data sourced from Central Bank of Nigeria (CBN) statistical bulletin and World Bank Development indicators were utilized. The study adopted Autoregressive Distributed Lag (ARDL) technique as the main data analysis technique. The findings of this study indicated that investment in education has a positive and significant effect on industrial sector output in Nigeria in both short run and long run, investment in research and development has a positive and significant effect on industrial sector output in Nigeria in the long run while investment in health has a positive and non-significant effect on industrial sector output in Nigeria in both short run and long run. Based on the findings, the study concluded that human capital investment plays a significant role in promoting industrial sector output in Nigeria. The study recommended among others that to boost industrial sector output, the government should foster stronger linkages between research institutions, universities, and the industrial sector. Increased investment in research and development, particularly in areas critical to industrial innovation, can lead to the development of new technologies, processes, and products.

Key words: *Investment in Health, Investment in Education, Investment in Research and Development, Industrial sector output.*

1. Introduction

Nigeria as a developing country has been grappling with the challenge of industrialization for decades. One of the key factors that has been identified as crucial in addressing this issue is the development of human capital (Ogujiuba and Jumare, 2012). The industrial sector plays a pivotal role in the economic development of any nation, serving as a catalyst for job creation technological advancement and generation. In Nigeria the performance of the industrial sector has been a subject of significant interest, given its potential to diversify the economy away from oil dependence and drive sustainable growth. Central to the growth and efficiency of this sector is the role of human capital investment. Human capital, encompassing the education, skills and competencies of the workforce, is a critical determinant of industrial productivity and innovation (Becker 1964).

Investing in human capital equips individuals with the knowledge and skills required to adopt and adapt to new technologies, improve production processes, and foster innovation. In other words, it is expected to generate employment, enhance productive capacity, and improve infrastructure, including critical services such as electricity (world Bank 2019), and lead to increased industrial sector performance. For Nigeria a country with a large and youthful population, enhancing human capital through education, vocational training and health initiatives is essential to unlocking the potential of its industrial sector.

In recognition of the importance of human capital development, the Nigerian government has implemented various initiatives to address this issue. For example, the Universal Basic Education (UBE) program aims to provide free and compulsory education to all children in the country, while the National Health Insurance Scheme (NHIS) aims to improve access to healthcare services (Federal Ministry of Education, 2013; National Health Insurance Scheme, 2021

However, despite various government policies and programs aimed at fostering human capital development, the sector continues to face challenges such as skill mismatches, low productivity and limited technological adoption leading to suboptimal performance (Udoh, 2019). This raises critical questions about the effectiveness of these initiatives and the extent to which human capital investment impacts industrial productivity and overall sectoral performance. This research therefore raised the following questions to understand specifically how education, research and development and work-force health contribute to productivity, innovation and the competitiveness of the sector, which are; How does investment in education affect Industrial sector growth in Nigeria? To what extent does investment in research and development affect industrial sector growth in Nigeria? Does investment in health affect industrial sector growth in Nigeria? This study determined the effect of human capital investment on the output of Nigeria's industrial sector, focusing on the linkages between work-force development, productivity and economic growth. It explores how targeted investments in education, vocational training and health infrastructure can enhance industrial sector competitiveness and sustainability in an increasingly globalized economy.

2. Literature Review

Theoretical Framework

Rostow-Musgrave Theory (1959)

Rostow in his theory of public finance (1959) presented a political theory of the states of growth and the role of public finance in the process while Musgrave provided a macro-economic view point of public expenditure policy for industrialization and development. The public sector is seen to provide social overhead capital in the form of roads, bridges, air, sea ports, transport and communication system, human capital in health and nutrition which is necessary to gear up the economy. The theory opines that in early stage of economic growth, public expenditure in the economy should be encouraged.

It further asserts that during the early stages of growth there exists markets failures and thus the government should massively be involved to deal with these market failures. However, Musgrave argues that as total investment which is a proportion of the GNP rises, their relative share of the public sector investment falls. Rostow on his part claims that once the economy reaches the matured stage, the mix of public expenditure will shift from expenditure on infrastructure to increase on education, health and welfare. Musgrave (1959) theorized three functions for public expenditures: allocating public goods, redistributing income, and stabilizing the economy. The provision of public goods was intended to satisfy social wants and merit wants. In Musgraves subsequent terminology (1969), the former wants (social want) call for public provision because of the technical failure of the market mechanism to allocate goods that are non-rival and non-excludable. Merit wants are individual needs of high importance which should not be left to market allocation. Education, health, and basic nutrition, are cases in point for which the government can guarantee a minimal level of satisfaction through transfers in kind, especially to poor people. This theory is blamed for ignoring its contribution to private sector development, assuming government expenditure is the only driver of economic growth (Muthui et al., 2013). This theory is relevant in the study because it provides a clearer picture of the Nigeria economy and highlights the need for government to spend on education, health and research and development in order to boost industrial sector growth.

New endogenous growth theory

This is another theory on which this paper is anchored. Key proponents of the theory are; Paul Romer (1990), Robert Lucas (1988) and Aghion and Howitt (1992). The emergence of endogenous growth theory in the 1980s resulted as an alternative to the neoclassical growth theory. The new endogenous growth theory is a modern development in economic theory that seeks to explain long term economic growth by focusing on factors that are determined within the economic system itself (endogenous factors), rather than external forces (exogenous factors) like technological advancements occurring randomly, as assumed by the traditional models like the solow-swan model.

The endogenous growth theory has a different perspective on what causes economic growth and economic development. As earlier stated, the Neo-classical theory explains external factors responsible for economic growth and focuses on the importance of technology as a tool to enhance economic growth. The endogenous theory takes a different position and stance. It argues that economic growth and prosperity can be influenced by internal processes such as innovation, human capital and investment capital, rather than external forces. As a result, endogenous growth theorists believe that improvement and efficiency in productivity can be attributed to quicker innovation and increased investment in human capital. Consequently, they emphasize the need for government and private sector institutions to encourage innovation and provide incentives for individuals and business to be inventive. There is also the central role of the accumulation of knowledge as a determinant of growth i.e., knowledge industries such as telecommunications, electronics, software or biotechnology are becoming increasingly important in developed countries.

Proponents of new endogenous growth theory believe that there are positive externalities to be exploited from the development of a high value- added knowledge economy which is able to develop and maintain a competitive advantage in fast growth within the global economy. They are of the opinion that the rate of technological progress should not be taken as a constant in a growth model, government policies can permanently raise a country's growth rate if they lead to more intense competition in markets and help to stimulate product and process innovation. They believe that a key source of technological progress is an increase in returns to scale from new capital investment and private sector investment, and that investment in human capital is an essential ingredient of long-term growth. However, one of the weaknesses of the endogenous growth theory is that it is virtually impossible to authenticate with empirical evidence. Also, the endogenous growth theory has been questioned and queried for being based on postulations that cannot be precisely measured.

Regardless of the shortcomings of the new endogenous growth theory, this study is anchored on it because it has strong implications for the growth of the industrial sector, as it emphasizes the role of innovation, human capital, policies and technological progress- all of which are necessary to drive industrial development.

Conceptual Framework

Concept of Human Capital

Human capital can be defined as the stock of a nation's human skills and expertise at a particular point of time, which consists of the knowledge, skills, and health that people accumulate throughout their lives, enabling them to realize their potential as productive members of society. The subject human capital has gained several interests over the years and has been defined by different scholars. Todaro and Smith (2011) states that human capital is the productive investments embodied in human persons, including skills, abilities, ideas, health and locations, often resulting from expenditures on education, on the job training programs and medical care. As construed by

the organization of economic co-operation and development (OECD), it is the aptitude, abilities, versatility, and other features encapsulated in people that are noteworthy to productive activities (OECD, 1998). In order words, human capital consist of education, health, guaranteed human rights etc. Thus, any investment made on any of these areas is termed human capital investment.

Empirical Literature

Aliyu, et al, (2023), Studied the Impact of human capital development on economic growth in Nigeria (1981-2016). "This aims to investigates the short and long-run impact of human capital development on economic growth in Nigeria using time series data sourced from the central bank of Nigeria statistical bulletin, 1981 to 2016". The study employed Augmented Dickey-Fuller techniques to examine the unit root property of the variables followed by Autoregressive Distributive Lag Model (ARDL) to determine long run relationship or cointegration. The findings from the ARDL model indicates that there is a long-run relationship. In the long-run, life expectancy and public expenditure on health are found to have a significant positive impact on economic growth. While in the short-run, life expectancy, gross capital formation, primary school enrolment and recurrent expenditure on health have a positive impact on economic growth.

Sydney and Araniyar (2021), "examined the effect of government expenditure on the growth of the industrial sector in Nigeria". The study used ex-facto quasi-experimental research design to examine the effect of government policies on the growth of the industrial sector. The aim of the study was to examine the effect of government expenditure on industrial output in Nigeria. A regression analysis was applied in the analysis of the data. Data used in the study are Industrial gross domestic product (IG), Government capital expenditure (GCE), Tax revenue to gross domestic product (TAX), Real Gross Domestic Product (RIR) and Monetary Policy Rate (MPR)**.** The findings, shows that government policy has significant effect on the growth of the Nigerian industrial sector.

Ubong et al. (2020), "analysed the effect of fiscal policy on industrial growth in Nigeria". This paper aims at investigating the influence of government expenditure (a proxy for fiscal policy) on the industrial sector output of Nigeria for the period 1980 – 2018. Data were sourced from the Central Bank of Nigeria Statistical Bulletin. The following data were used industrial sector output (INQ), Government capital expenditure (GCEXP), government recurrent expenditure (RCEXP), Interest rate (INTR), Credit to private sector (CPS) and Exchange rate (EXC). The data were subjected to the Vector Error Correction (VEC) model to estimate both the short-run and long-run estimates. Findings from the VEC revealed that both government capital and recurrent expenditures significantly influences industrial output in the short-run. Also, capital expenditure does not have a significant relationship with industrial sector output in the long-run but recurrent expenditure does. Following the findings,

Iweriebor, et al (2015), "assessed the effect of public spending on the industrial sector in Nigeria". The aim of the study is to assess the effect of public spending on the industrial sector in Nigeria using data covering the period 1980 to 2013. The study employs the unit root test and cointegration test techniques. The dependent variable used was Government expenditure (GEXP) while the explanatory variables are; fiscal balance ratio (FBAL), company income tax (TAX), external debt

(XDEBT), capital input in industrial production (CAP), labour input in industrial production (LAB), industrial capacity utilization (ICU). It was found in the study that public spending has no significant effect on industrial production in the short run. Moreover, government spending has a relatively weak effect on industrial production even in the long run, suggesting a disconnection between public spending and the real sector of the economy.

Paul and Akindele (2016), examined the impact of human capital development on economic growth in Nigeria using time series data spanning from 1980 to 2013 which were sourced from the World Bank Indicator and National Bureau of Statistics. It was set out to explore the relationship between human capital indices (education and health) and economic growth. The study employed ARDL Co-integration analysis to estimate the relationship among the variables used in the study. The study established long-run co-integration among the variables. The findings from the study revealed that there is positive long-run relationship among secondary school enrolment public expenditure on education, life expectancy rate, gross capital formation and economic growth but it is statistically insignificant. The results also showed that there is negative long-run relationship among primary, tertiary school enrolment, public expenditure on health and economic growth.

Godstime and Uchechi (2014), examined the impact of human capital development on national output in Nigeria, a proxy for economic growth, using quarterly time-series data from 1999-2012. The following variables were used in the study; gross domestic product (GDP), total labour force (TLF) and government total expenditure on education (GTEE). Empirical results showed that human capital development, in line with theory, exhibits significant positive impact on output level. This implies that human capital development is indispensable in the achievement of sustainable economic growth in Nigeria, as there is an increase in economic performance for every increase in human capital development. The results further revealed a relatively inelastic relationship between human capital development and output level.

Literature Gap

A review of related empirical studies revealed that a few studies (Aliyu, et al 2023, Paul and Akindele 2016) attempted to look at human capital development and economic growth nexus, as such, they are limited in the sense of leaving out the key index (which is the industrial sector output) that shows the true nature of the industrial sector performance in Nigeria However, this study is focused on human capital investment and industrial sector output in Nigeria. Additionally, this study is an extension of (Godstime and Uchechi 2014) that examined the impact of human capital development on national output in Nigeria, a proxy for economic growth, using quarterly time-series data from 1999-2012. The following variables were used in the study; gross domestic product (GDP), total labour force (TLF) and government total expenditure on education (GTEE). Unlike the other studies that investigated human capital investment on economic growth, this present study seeks to examine the effect of human capital investment using investment in education, research and development and health on industrial sector output measured by industrial sector GDP in Nigeria over the sampled period of 1990 to 2022. Thus, this research is different from all existing literatures on the study in the area of time scope (1990-2022), appropriate variables which includes; Investment in research and development (INVR) and the most recently updated data set.

3. METHODOLOGY

Research Design

This study employed the ex-*post facto* research design. Time series data which spanned from 1990 to 2022 were obtained from the Central Bank of Nigeria (CBN) statistical bulletin and National Bureau of Statistics (NBS).

Model Specification

The model is an extension of the work of Godstime and Uchechi (2014) that examined the impact of human capital development on national output in Nigeria, a proxy for economic growth, using quarterly time-series data from 1999-2012. This present study extended the time scope from 2012 to 2022 and modified the model, with the inclusion of investment in research and development and health as stated in the equation below:

The functional form of the model is stated is as follows:

$$INDQ = f(INVE, INVR, INVH) \quad (3.1)$$

Putting the above functional form of the model in a mathematical form we have:

$$INDQ_t = a_0 + a_1INVE_t + a_2INVR_t + a_3INVHt \quad (3.2)$$

Putting the above mathematical form in an econometric form we have:

$$INDQ_t = a_0 + a_1INVE_t + a_2INVR_t + a_3INVHt + Ut \quad (3.3)$$

Where;

INDQ = Industrial sector Output (Proxied by gross domestic product of the Industrial sector)

INVE = Investment in Education measured by govt expenditure in education

INVR. = Investment on research and development measured by government expenditure in research and development

INVH = Investment on Health measured by government expenditure in health

a_0 = Intercept

a_1, a_2, a_3 = Parameters

u = Stochastic Error Term of the model which accounts for other indices that are not specified in the model

t = Time period

A Priori Expectation: $a_1 > 0$, $a_2 > 0$, $a_3 > 0$.

Specifically, the ARDL model for this study based on the variables in equations (3.3) is provided below:

$$\Delta INDQ_t = \alpha_0 + \sum_{i=1}^{p} \alpha_1 \Delta INDQ_{t-1} + \sum_{i=1}^{q} \alpha_2 \Delta INVE_{t-1} + \sum_{i=1}^{q} a_3 \Delta INVR_{t-1} + \sum_{i=1}^{q} a_4 \Delta INVH_{t-1} + \lambda_1 INDQ_{t-1} + \lambda_2 INVE_{t-1} + \lambda_3 INVR_{t-1} + \lambda_4 INVH_{t-1} + \varepsilon_{1t}$$

α_0 = constant parameter to be estimated; α_1 – α_4 = short-run parameters; λ_1 - λ_4 = long-run multipliers; p = optimal lag for each of the dependent variables; q = optimal lag of the independent variables; Δ = first difference operator; ε_{1t} = error term;

Data Analysis Technique

This study adopted the Autoregressive Distributed Lag (ARDL) model by Pesaran, Shin and Smith (2001) which is under the advanced umbrella of the ordinary least square estimation technique being the best linear unbiased estimator. The ARDL doesn't require that the time series data be of any particular order of integration. Hence, if the models are of different order of integration, say for example 1(0), 1(1) or 1(1), 1(0), the ARDL applies.

4. RESULTS AND DISCUSSION

Unit Root Test

The results of Augmented Dickey-Fuller (ADF) unit root tests are presented in Table 1:

Table 1: Augmented Dickey-Fuller (ADF) Test Results

	ADF at Levels			ADF at First Difference			
Variables	**ADF Statistic**	**5% Critical Value**	**Decision**	**ADF Statistic**	**5% Critical Value**	**Decision**	**Order of Integration**
INDQ	-0.957577	-2.957110	Not Stationary	-4.531300	-2.960411	Stationary	I(1)
INVE	-1.474818	-2.957110	Not Stationary	-3.046374	-2.998064	Stationary	I(1)
INVR	2.108654	-2.957110	Not Stationary	-4.573930	-2.960411	Stationary	I(1)

INVH	- 4.597714	-2.986225	Stationary	-	-	-	I(0)

Source: *Researcher's Computation, from E-views software, 2024.*

The results of the Augmented Dickey Fuller (ADF) unit root test at levels reported in Table 1 showed that only investment in health was stationary at the 5 percent level of significance. This is because in absolute terms, the Augmented Dickey Fuller (ADF) test statistic for investment in health is less than its associated critical value. Thus, the null hypothesis of unit root of investment in health was rejected at level. In other words, investment in health was stationary at order zero [i.e., I(0)]. On the other hand, industrial sector output, investment in education, investment in research and development were not stationary at the 5 percent level of significance, but became stationary after first differencing. It therefore implies that there is a mixed order of integration among the time series in the model.

ARDL Bound Cointegration Test

The result of the ARDL Bounds Cointegration Test for this study is reported in Table 2:

Table 2: ARDL Bounds Cointegration Test Result

Selected Model: ARDL (2, 3, 0, 2)

Test Statistic	**Value**	**K**
F-statistic	4.902067*	3
Critical Value Bounds		
Significance	**Lower Bound [**I(0)]	**Upper Bound [**I(1)]
5%	2.67	3.38

Source: *Researcher's Computation, from E-views software, 2024.*
Note: * implies that F-statistic is greater than upper bound 5% critical value and long run exists between the variables in the model.

The result of ARDL Bounds Test presented in Table 2 showed that the F-statistic (4.902067) is greater than the lower bound (2.67) and upper bound (3.38) at 5% level of significance. Hence, there is sufficient statistical evidence to reject the null hypothesis of no co-integration at 5% level significance and conclude that there exists a long run relationship or cointegration between the variables.

ARDL long run estimation results

The ARDL long run estimation results is presented in Table 3:

Table 3: Autoregressive Distributive Lag (ARDL) Long Run Dynamics Result

	Dependent Variable: INDQ			
	Selected Model: ARDL (2, 3, 0, 2)			
Independent Variables (Regressors)	**Coefficient (Parameter estimates)**	**Std. Error**	**t-Statistic**	**Prob**
LOG(INVE)	0.523577	0.138315	3.785409	0.0013
LOG(INVR)	0.468670	0.182070	2.574119	0.0186
LOG(INVH)	0.102124	0.109711	0.930849	0.3636
C	9.177474	0.194943	47.07768	0.0000

Source: *Researcher's Computation, from E-views software, 2024.*

Investment in Education (INVE) and Industrial Sector Output (INDQ)
From the ARDL long run estimate result in Table 3, investment in education has a positive coefficient value of 0.523577 and a p-value of 0.0013 which is less than 0.05 level of significance.

Investment in Research and Development (INVR) and Industrial Sector Output (INDQ)
From the ARDL long run estimate result in Table 4.5, investment in research and development has a positive coefficient value of 0.468670 and a p-value of 0.01 which is less than 0.05 level of significance

Investment in Health (INVH) and Industrial Sector Output (INDQ)
From the ARDL long run estimate result in Table 4.5, investment in health has a positive coefficient value of 0.102124 and a p-value of 0.3636 which is greater than 0.05 level of significance.

ARDL Short Run estimation Results
The results of the Autoregressive Distributed Lag (ARDL) Error Correction Mechanism results conducted is presented in table 4

Table 4: Autoregressive Distributive Lag (ARDL) Error Correction Result

	Dependent Variable: INDQ			
	Selected Model: ARDL (2, 3, 0, 2)			
Independent Variables (Regressors)	**Coefficient (Parameter Estimates)**	**Std. Error**	**t-Statistic**	**Prob**
DLOG(INDQ(-1))	0.468670	0.154522	3.033036	0.0068
DLOG(INVE)	0.095637	0.033561	2.849651	0.0103

DLOG(INVE(-1))	0.057043	0.030052	1.898131	0.0730
DLOG(INVE(-2))	-0.010491	0.032566	-0.322143	0.7509
DLOG(INVH)	0.001782	0.033479	0.053218	0.9581
DLOG(INVR)	0.057043	0.030052	1.898131	0.0730
CointEq(-1)*	-0.523577	0.107736	-4.859812	0.0001
	Adjusted R^2 = 0.580688; Durbin-Watson stat = 1.783365			

Source: *Researcher's Computation, from E-views software, 2024.*
Note: ** and * implies statistical significance of the coefficient at 1% and 5% respectively.

The results of the ARDL Error Correction are reported in Table 4. The result shows that investment in education has a positive coefficient value of 0.095637 and a P-value of 0.0103 at current period.

Similarly, the results indicates that investment in research and development has a positive coefficient value of 0.057043 and a p-value of 0.0730 at the current period.

In addition, the result shows that at initial level, investment in health has a positive coefficient value of 0.001782. and a p-value of 0.9581 and 0.0730 at lag one, which is greater than 0.05 level of significance.

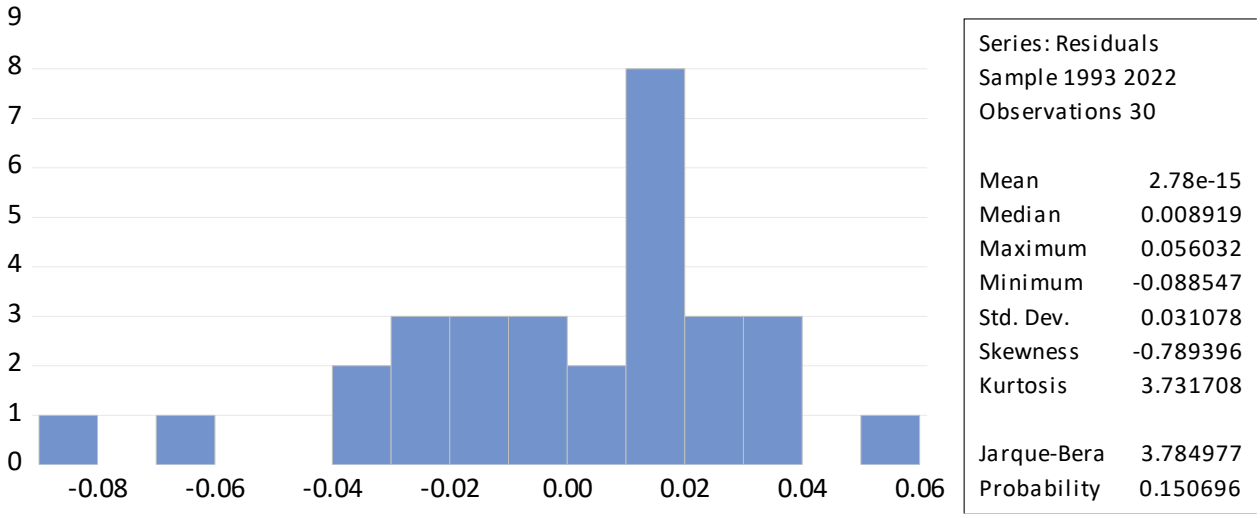
However, the error correction coefficient estimated at CointEq(-1) is highly significant (0.0001) and negative (-0.523577) as expected. This indicates that deviation from the long-term growth rate in Industrial sector output is corrected at the rate of 52% in the following year. That is, the speed of adjustment is 52%

In furtherance, the adjusted R-Square of 0.580688 indicates that about fifty-eight (58) percent of the total variation in Industrial sector output is explained by systematic changes in investment in education, investment in research and development and investment in health while the remaining forty-two (42) percent of the variation is explained by other factors not included in the model. Lastly, the Durbin-Watson stat statistics of 1.783365 shows that the model is free from the problem of autocorrelation.

Post-Estimation Tests

In order to ensure the reliability of the model and further ascertain that the estimated model is adequate for adoption and policy formulation, both residual and stability post-estimation tests were conducted on the Industrial sector output model as follows.

Normality Test



Source: *Researcher's Computation, from E-views software, 2024.*

Figure 4.1: Normality Test Result

The result in Figure 4.1 above shows that Jarque-Bera statistic is 0.177215 and the probability is 0.915205. However, since the probability value (0.915205) of Jarque-Bera statistic is greater than 5%, we do not reject the null hypothesis and conclude that the residuals are normally distributed at 5 % level of significance.

Serial Correlation Test

Table 5: Breusch-Godfrey Serial Correlation LM Test Result

Test	F-Statistic	P-value	Null Hypothesis	Decision
Breusch-Godfrey Serial Correlation LM Test	0.215218	0.8085	**H_0:** No serial correlation	Do not reject H_0

Source: *Researcher's Computation, from E-views software, 2024.*

The results in Table 5 above shows that F-statistic is 0.215218 and the probability value is 0.8085. However, since the probability value (0.8085) of the F-statistic is greater than 5 percent, we do not reject the null hypothesis and conclude that the residuals are not serially correlated. That is, the estimated model is not suffering from serial autocorrelation problem.

Heteroscedasticity Test

Table 6: Breusch-Pagan-Godfrey Heteroscedasticity Test Result

Test	F-Statistic	P-value	Null Hypothesis	Decision
Breusch-Pagan-Godfrey Heteroskedasticity Test	1.002511	0.4752	**H_0:** Homoscedasticity	Do not reject H_0

Source: *Researcher's Computation, from E-views software, 2024.*

The result in Table 6 above shows that F-statistic is 1.002511 and the probability value is 0.4752. However, since the probability value (0.4752) of the F-statistic is greater than 5 percent, we do not reject the null hypothesis and conclude that the variance of the residuals is homoscedastic over the period covered in this study. This implies that the estimated model is free from the problem of heteroskedasticity.

Ramsey RESET Test

Table 7: Ramsey RESET Test Result

Test	F-Statistic	P-value	Null Hypothesis	Decision
Ramsey RESET test	0.069237	0.7954	**H_0:** The model is correctly specified	Do not reject H_0

Source: *Researcher's Computation, from E-views software, 2024.*

The results in Table 7 above show that F-statistic is 0.069237 and the probability value is 0.7954. However, since the probability value (0.7954) of the F-statistic is greater than 5 percent, we do not reject the null hypothesis and conclude that the model is correctly specified. This suggests that the variables included in the model are adequate and sufficient.

Discussion of Findings

Investment in Education and Industrial Sector Output in Nigeria

The results of the study showed that investment in education has a positive and significant effect on Industrial sector output in Nigeria in both short run and long run. This implies that increase in investment in education will lead to significant increase in Industrial sector output in Nigeria in the short run and long run. We therefore reject the null hypothesis of no significant effect of investment in Education on industrial sector output. It can therefore be concluded that investment in education has a positive and significant effect on industrial sector output in Nigeria. This finding is in line with a priori expectation and economic theory. This finding is also in agreement with the finding of Omankhanlen, Onyedikachi and Okoye (2021) who found that the government

expenditure on education has significant positive impact on sustainable industrial development in Nigeria.

Investment in Research and Development and Industrial Sector Output in Nigeria

Evidences that emerged from the results of the study showed that investment in research and development has a positive and significant effect on Industrial sector output in Nigeria in both short run and long run. This implies that increase in investment in research and development will lead to significant increase in Industrial sector output in Nigeria in the short run and long run. we therefore reject the null hypothesis of no significant effect of research and development on industrial sector output. It can therefore be concluded that investment in research and development has a positive and significant effect on industrial sector output in Nigeria. This agrees with a priori theoretical expectation which states a positive relationship between investment in research and development and industrial sector output. This result is supported by the result of Iweriebor, Egharevba and Adegboye (2015) which stated that investment in research and development exert positive impact on industrial development.

Investment in Health and Industrial Sector Output in Nigeria

The results of this study showed that investment in health has a positive and non-significant effect on Industrial sector output in Nigeria in both short run and long run. This implies that increase in investment in health will lead to insignificant increase in industrial sector output in Nigeria in the short run and long run. we therefore accept the null hypothesis of no significant effect of investment in Health on industrial sector output. It can therefore be concluded that investment in health has a positive and non-significant effect on Industrial sector output in Nigeria. This agrees with a priori theoretical expectation, although investment in Health was found not to be significant.

This result is in tandem with the result of Jeff-Anyene, Ezu and Ananwude (2019) which stated that there is a positive relationship between the government expenditure on health and industrial development and growth in Nigeria.

5. CONCLUSION AND RECOMMENDATION

Concluding Remarks

This study determines the effect of human capital investment on industrial sector performance in Nigeria. The empirical results showed that investment in education, research and development and health have joint significant effect on industrial sector performance in Nigeria. Based on the findings, the study concludes that human capital investment plays a significant role in promoting industrial sector performance in Nigeria.

Recommendations

Based on the above findings and conclusions, the following are recommendation are made:

i. The government should prioritize investment in technical and vocational education (TVET) to develop a skilled workforce that meets the needs of the industrial sector. By aligning educational programs with industry demands, particularly in manufacturing, engineering, and technology, Nigeria can create a pipeline of qualified professionals who drive productivity and innovation.

ii. To boost industrial sector growth, the government should foster stronger linkages between research institutions, universities, and the industrial sector. Increased investment in research and development, particularly in areas critical to industrial innovation, can lead to the development of new technologies, processes, and products.

iii. A healthy workforce is essential for sustained industrial sector growth. The government should invest in healthcare infrastructure and services to ensure that workers in the industrial sector have access to quality healthcare. This should include preventive care, occupational health and safety programs, and affordable healthcare services.

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