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Analysis of Human Capital Development, Information Technology (ICT) and Economic Growth Nexus in Nigeria

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ABSTRACT: The study examined human capital development, information technology, and Economic Growth in Nigeria from 1991 to 2021. The Augmented Dickey-Fuller and Phillips Perron test indicated that real gross domestic product, information technology, and secondary school enrolment are stationary at first difference. At the same time, growth capital formation is stationary at level. Tertiary school enrolment is also stationary at first difference in the ADF test while it is stationary at a level in the PP test. The ARDL model showed that growth capital formation has a positive but statistically significant effect on the gross domestic product in Nigeria. The labor force has a positive but statistically significant effect on the real gross domestic product in Nigeria. Information technology has a positive but statistically significant effect on the real gross domestic product in Nigeria. Tertiary school enrolment has a positive but statistically significant effect on the real gross domestic product in Nigeria. Secondary school enrolment has a positive but statistically significant effect on the real gross domestic product in Nigeria. The study recommends that for Nigeria to enhance its economic growth, there is a need to implement specific policies that facilitate investment in ICT in the country by empowering youth on the different aspect of information technology to become self-reliant and achieve higher economic growth.

KEYWORDS: Human capital development, Information technology, Economic growth

JEL Classification O15, L86, O40

1 INTRODUCTION

Despite Nigeria's wealth of natural and human resources, the country's economy has long been underdeveloped and has remained so. Nigeria, Malaysia, Indonesia, Taiwan, Singapore, and South Korea all had comparable GDP growth rates, per capita incomes, and undeveloped political systems in the 1960s and early 1970s. (World Bank Development Report). Because of the way their economies have been run, the so-called "Asian Tigers" have managed to escape poverty and underdevelopment. They are now thriving both economically and technologically as a result of significant and ongoing investments in the development of human capital. The Nigerian economy, on the other hand, has grown slowly.

According to available data, the GDP expanded by 7.5 percent between 1970 and 1997. Between 1980 and 1987, the rate fell to 0.5 percent. The rate improved from 1988 to 1991, reaching 5.6 percent. Many policy and reform initiatives were implemented to enhance the creation and exploitation of human capital in Nigeria in response to a variety of issues, including brain drain, low absorption capacity, underemployment, falling educational quality and relevance, and professional shortages.

The Millennium Development Declarations and Goals (2000), the National Economic Empowerment and Development strategy (NEEDS, 2005), the Universal Basic Education (2004), the Dakar framework for Action/Education for All (1990), the National Policy on Education 1977 (revised in 1981, 1998, and 2004), and the Sustainable Development Declarations and Goals (2015) were among them. Between 1988 and 2018, public spending on health and education also increased steadily. According to CBN annual reports from 1988 to 2018, public spending on education increased from an average of 1.5% of GDP in 1981 to 1991 to 2.4% to 15% of GDP in 2018 and 6.4% on average between 1999 and 2018.

Between 1988 and 2018, public spending on health and education also increased steadily. According to CBN annual reports from 1988 to 2018, public spending on education increased from an average of 1.5% of GDP in 1981 to 1991 to 2.4% to 15% of GDP in 2018 and 6.4% on average between 1999 and 2018. Along with government funding, households account for about 25% of all

national education spending. 1989–2018 National Education Index, United Nations Educational, Scientific, and Cultural Organization (UNESCO).

The knowledge, abilities, and health that people invest in and collect over the course of their lives—all of which help them reach their full potential as contributing members of society—make up human capital (World Bank, 2021). A higher standard of life through access to quality healthcare, education, employment opportunities, and skill development contributes to the development of human capital, which is essential for eradicating severe poverty and fostering more inclusive societies. It takes more than just skills, health care, and quality education to develop human capital. This is because the conditions that surround, precede, and follow a human being's conception all affect and define the type of human capital that the kid will develop into in the future.

Major health care indicators in Nigeria show that the effects of health sector reforms are being seen slowly. As per the 2008 Millennium Development Goals midpoint assessment, the infant mortality rate decreased from 113 per 1000 in 1990 to 57.701 per 1000 in 2021. Between 1999 and 2021, the maternal mortality ratio deteriorated from 289 to 1047. Between 2001 and 2021, access to basic sanitation increased somewhat, from 24.5% to 11%. Additionally, the percentage of people with access to safe drinking water increased somewhat from 15.7% in 2001 to 26.5% in 2021.

Since the launch of Global Systems of Mobile Communications (GSM) networks, Nigeria's telecommunications industry has seen substantial changes in terms of investments, coverage, and regulatory environment.

This was made possible by the sector's deregulation, which brought in large players including Globacom, Mobile Teleco mmunication Network, Visafone-Mobile, and Etisalat.

Following the liberalisation process, the telecommunications industry grew rapidly. In comparison to December 2011, the sector's subscriber strength increased by 18.1% to 113,195,951 lines as of December 2012, with 418,166 connected fixed lines and 112,777,2785 mobile lines. In addition, the teledensity increased from 68.1 lines per 100 people in 2011 to 80.9 lines per 100 people in 2012 (CBN, 2012).

In both developed and emerging nations, the necessity to increase and enhance services serves as justification for privatising the telecommunications industry. Policymakers now find it extremely unpleasant that a modern economy cannot run properly without a strong communication sector, and that building such a system necessitates capital investment spending on a scale that few countries can either do or efficiently manage (Leila, 2019).

Higher levels of private investment have a bigger impact on economic growth because of the increased technical spill over on the whole economy. "In many cases the biggest gains from private provision come through increased investments to meet increasing demands and serve previously unattended consumers," according to a 2003 World Bank report on private participation of infrastructure in developing countries, illustrating the importance of high telecommunication private investment.

According to the World Bank research, where competitive regimes have been introduced, the outcomes have been notably outstanding in the telecommunications sector (Leila, 2019). This study's primary goal is to investigate how Nigeria's economic growth and information technology are affected by the development of human capital.

2 LITERATURE REVIEW

2.1 Theoretical Literature

According to Romer (1986), the best way to think of human capital as an intangible asset is as a store of embodied and disembodied knowledge, which includes knowledge about education, health, entrepreneurship, and innovation. Learning skills are developed through research and development initiatives, informal knowledge transfer, and investments in education, job training, and health. Human capital is the culmination of an individual's unique set of skills, knowledge, and talents, according to Sheehan (2012). Nonetheless, from the standpoint of traditional economic theory, human capital is viewed as a labour commodity that is exchangeable through buy and sell transactions. This traditional paradigm heavily emphasises how capital exploits labour. However, human capital development refers to the information, expertise, skill, and health that one acquires through education, training, and medical care, which is different from the meaning that is typically associated with the term labour.

2.2 Empirical Literature Review

The impact of human capital development in Kaduna State's public tertiary education was investigated by Afang, Kumai, and Kwaji (2023). All public tertiary institutions in Kaduna State, including Ahmadu Bello University Zaria, Kaduna State University, Nuhu Bamalli Polytechnic Zaria, and Kaduna Polytechnic, comprised the study's population. Gidan Waya of Kaduna State College of Education and National College of Education Zaria. Each public entity received twenty-five questionnaires. The sample size was determined by administering 150 questionnaires and retrieving 112 from the responders. Thus, the importance and influence of human capital development in Kaduna State's public tertiary education system will undoubtedly improve learning and growth in

all spheres of human endeavour. The Nigerian government should build a sufficient human capital with global skills and e-learning techniques, along with appropriate training partnerships with other domestic companies, technical training institutions, and research institutes abroad, according to the findings. Additionally, in order to meet the 26% UNESCO criterion, the federal and state governments must immediately increase their education spending by raising staff wages and costs.

This will promote national progress, boost output, and advance knowledge. Johnson, Olabisi, and Folake (2021) used the Error Correction Model and Ordinary Least Squares methodology to investigate how Nigerian telecommunications affects economic growth. The results demonstrate that, in the short-term equilibrium, labour employed, capital stock, real investment in telecommunication, and electricity supply are statistically important to economic growth in Nigeria. The study suggests that effective and well-coordinated policies on labour productivity, price control, investment encouragement, and steady electricity supply can achieve positive economic growth. Chimbo (2020) looked into how ICT affects economic growth and whether energy use and the development of human capital are two ways that ICT affects economic growth in Africa. Pooled OLS and the dynamic GMM yielded results that indicated that ICT had a non-significant positive influence on economic growth in Africa, while fixed effects, random effects, and pooled OLS and the dynamic GMM revealed a significant positive relationship running from ICT towards economic growth. From 1990 to 2019, Chika and Cookey (2020) examined whether returns on human capital helped the Nigerian economy.

Returns on intellectual capital (RITC) and intellectual property (RIPR) are proxied by return on human capital. Our study's reasoning is based on Paul's theories of human capital and Romer Growth, and we use residual diagnostic techniques and Autoregressive Distributive Lag (ARDL) for data analysis. The findings show that while RIPR does not significantly boost RGDP, RITC does. This suggests that the Nigerian economy is not as affected by the two human capital metrics. We therefore draw the conclusion that returns on intellectual capital, rather than returns on intellectual property, are more important in boosting the Nigerian economy. Therefore, among other things, we advise that the government defend citizens' intellectual property by fortifying and revitalising the organisations tasked with carrying out these duties in order to maintain and intensify the war against piracy. Using a Generalised Method of Moments (GMM), Nasab and Aghaei (2019) investigated the connection between ICT investments and economic growth in the geographic arrangement of OPEC member nations

According to the projections, ICT investments in OPEC member nations have a major impact on economic growth. This suggests that these nations must put in place particular laws that encourage ICT investment if they hope to boost economic growth. Using a panel Generalised Method of Moment (GMM) growth model, Bahrini and Qaffas (2019) assessed the effect of information and communication technology (ICT) on the economic growth of a subset of developing nations in the Sub-Saharan Africa (SSA) and Middle East and North Africa (MENA) regions from 2007 to 2016.

The econometric model's results indicate that, aside from fixed telephones, the primary drivers of economic growth in developing nations in MENA and SSA are other ICTs like mobile phones, Internet use, and broadband adoption. Using a panel-GMM growth model, Sepehrdoust and Ghorbanseresht (2019) examined the effects of financial development and information and communication technology (ICT) on the emerging economies of the petroleum exporting nations (OPEC). According to the econometric model's conclusions, economic growth increased by.048 and.050 percent for every 1% increase in the financial development index and ICT variables, respectively. Additionally, the influence of factors like inflation (negative), growth in the active labour force (positive), investment growth (positive), and gross fixed capital formation growth (positive) on the nations' economic progress.

Akinwale, Sanusi, and Surujlal (2018) investigated how ICT related to and affected Nigeria's economic development. The results of the autoregressive distributed lag (ARDL) analysis show that ICT and economic growth cointegrate, indicating a long-term relationship between the two. The findings imply that a strong political will is required to support an enabling environment and to advance the sector's ease of doing business in order to draw in private and foreign investment. This is because doing so would enhance the secure internet server, boost mobile usage in rural areas, and improve the performance of other economic sectors that would support Nigeria's economic growth.

Adekojo, Ebiefie, and Akinyem (2016) used time series data from 1981 to 2013 to examine the relationship between capital production and economic growth in Nigeria. The Harrod-Domar model was used to Nigeria in the research project. The Auto Regressive Distributed Lag Models (ARDL) approach was examined in the paper. According to the study's findings, capital formation and economic growth in Nigeria are significantly correlated.

The findings supported the Harrod-Domar model, which established a direct relationship between the saving ratio and/or capital formation and the growth rate of national income (i.e., the more an economy can save and invest out of a given GNP, the greater the growth of that GDP). Adetiloye and Adeyemo (2012) conducted a study on Nigerian population growth, capital formation, and domestic investment. The time series data was analysed using the power regression and growth regression methods. The study's findings indicate that bank loans, government spending, and capacity utilisation all contribute to Nigerians' rising incomes. The

findings also indicate a negative correlation between capital formation and population growth rates. The investment rate can stimulate economic growth using the curve estimation approach, albeit slowly and linearly. This study demonstrates that Nigeria's per capita GDP growth rate is not aided by the rate of investment. Alika, Iyere Joseph, and Stan Aibieyi (2014) emphasised the concepts, methods, and management dynamics of human capital. The methods used and discovered in the study have their roots in business economics theory, which, when used well, can influence employee performance and result in organisational success. According to the report, organisations that are ready for significant business cannot overlook management principles, which are ingrained in management dynamics. The definitions of human capital and the explanation of its methods for comprehending the nature, status, and significance of human capital in all areas of life serve as the primary foundation for the study's findings. Kanu and Ozurumba (2014) used the multiple regressions technique to investigate the relationship between capital production and Nigeria's economic growth.

However, the long-term VAR model estimate shows that total exports, gross fixed capital formation, and the lagged GDP values have positive long-term correlations with Nigeria's economic growth. While GDP was found to have a unidirectional causal relationship with export (EXP), gross fixed capital formation (GFCF), import (IMP), and total national saving (TNSV), it was also determined that there is an inverse relationship between imports (IMP), TNSV, and economic growth.

2.3 Literature Gap and Value addition

The majority of the reviewed literature looked at how information technology and human capital development affected economic growth in Nigeria and other nations. However, none of them combined the two topics. In light of the aforementioned, the current study looked at how Nigeria's economic growth and information technology-related human capital development interacted between 1991 and 2021.

3 METHODOLOGY

3.1 Theoretical framework

The human capital theory model, which is based on Romer (1990), will be employed in this investigation. According to the idea, as the equation illustrates, human capital has an impact on growth in addition to labour and capital.

$Y_t = f(K_t\ L_t\ H_t)$…….. (3.1)

Where *Yt* is output, *Kt* is capital , L_t is the labour and *Ht* is human capital. Introducing technology explicitly into the model (Equation 3.1), we have the following:

$Y_t = f(K_t\ L_t\ H_t\ T_t)$…….(3.2)

$RGDP_t = \alpha_0 + \alpha_1 GCF_t + \alpha_2 GEE_t + \alpha_3 LFR_t + \alpha_4 IT_t + \alpha_5 TSE_t + \alpha_6 SSE_t + \varepsilon_t$ ……(3.3)

The above equation is the econometric model where the error term (ε_t) is added to account for the effect of all other omitted variables in the model as well as the influence of any measurement error that might affect the dependent variable. The error term is assumed to be normally, independently and identically distributed with zero mean and constant variance $[i.e.\ \varepsilon_t \sim NIID(0,1)\ ]$

In order to arrive at a reliable result, the variables are transformed into natural logarithm. Thus, the empirical equation is formulated as followings:

$RGDP_t = \alpha_0 + \alpha_1 InGCF_t + \alpha_2 InGEE_t + \alpha_3 InLBF_t + \alpha_4 InIT_t + \alpha_5 InTSE_t + \alpha_6 InSSE_t +$
ε_t……(3.4)

Where

$RGDP_t = Real\ Gross\ domestic\ product$
$InGCF_t = Gross\ Capital\ Formation$
$InGEE_t = Government\ Expenditure\ on\ Education$
$InLBF_t = Labour\ Force$
$InIT_t = Information\ Technology$
$InTSE = Tertiary\ School\ Enrolment$
$InSSE = Secondary\ School\ Enrolment$
$\varepsilon_t = is\ the\ error\ term$

α_0, α_1, α_2, α_3, α_4,α_5, and α_6 are the parameters to be estimated whereas, the a priori expectations are <> 0.

3.2 ARDL Model and Error Correction Mechanism

The appropriate test for such a model is ARDL when variables are shown to be stationary at different orders of co-integration. To guarantee a long-term link between the variables and that the data-generation process complies with the model, it is necessary to test for both co-integration and stability. If the variables are co-integrated then there is the need to test for ECM which shows how much of the disequilibrium is being corrected over a period; what is called 'adjustment effect' (Asteriou and Hall, 2007). ECM

possesses advantages of resolving the problem of spurious regression because it eliminates trend in the variables involved; and that the disequilibrium error term is stationary variable, which is prevented from exploding over time (Asteriou and Hall, 2007). The general autoregressive distributed lag (ARDL) ECM is presented in equation

$\Delta y_t = \mu + \sum_{i=1}^{n-1} a_i \Delta y_{t-i} + \sum_{i=0}^{m-1} \Upsilon_i \Delta x_{t-i} - \pi \hat{e}_{t-1} + \varepsilon_t$.....(3.5)

Where Δ is the difference operator, y_t is a vector of dependent variable, $x_{t-1}$is the matrix of lag values of explanatory variables and π is the adjustment effect or error correction coefficient which is expected to be negative for the error to be corrected. Specifically, the ECM model to be tested is specified in equation

$\Delta RGDP_t = \mu + \sum_{i=1}^{n-1} a_i \Delta RGDP_{t-1} + \sum_{i=0}^{m-1} \beta_i \Delta\, GCF_{t-i} + \sum_{i=0}^{m-1} \Upsilon_i \Delta\, GEE_{t-i} + \sum_{i=0}^{m-1} u_i \Delta\, IT_{t-i} + \sum_{i=0}^{m-1} v_i \Delta\, TSE_{t-i} + \sum_{i=0}^{m-1} \Upsilon_i \Delta\, SSE_{t-i} - \pi \hat{e}_{t-1} + \varepsilon_t$.....(3.6)

If π = 1 then 100% of the adjustment takes place within single period (instantaneous/full adjustment). If $\pi = 0$ then there is no adjustment. Thus, any other value is interpreted accordingly; a value of π closer to *1* implies quick adjustment, and value closer to0implies slow adjustment. To select the most fitted model lag length are chosen automatically by Akaike Information Criterion (AIC).

The null and alternative hypothesis for bound test concerning the test for cointegration is:

Ho: a_i=β_i=ϒ1=$u_i = v_i = \omega_i$= 0 (No long run relationship).

H1:$a_i \neq \beta_i \neq$ϒ1$\neq u_i \neq v_i \neq \omega_i \neq 0$ (there is long run relationship).

4 RESULT AND DISCUSSION

4.1 Descriptive statistics

Table 4.1 Descriptive statistics

Statistics	LRGDP	LGCF	LIT	LLB	LTSE	LSSE
Mean	3.276491	0.791406	2.061701	1.458379	0.193962	1.478659
Median	3.247944	0.834560	2.004794	1.480697	0.150384	1.488311
Maximum	3.427729	1.610062	4.149815	1.506681	0.100097	1.728453
Minimum	3.155156	-0.283884	-0.036212	1.371788	0.489254	1.328882
Std. Dev.	0.103581	0.402142	1.644043	0.048466	0.114060	0.142515
Skewness	0.185631	-0.622051	0.005017	-0.890184	-0.599324	0.279903
Kurtosis	1.345915	4.210905	1.263727	2.013568	4.313414	1.473918
Jarque-Bera	2.514604	2.637323	2.637901	3.624916	10.46186	2.312021
Probability	0.284420	0.267493	0.267416	0.163252	0.005349	0.314739
Sum	68.80632	16.61952	43.29573	30.62596	-4.073211	31.05185
Sum Sq. Dev.	0.214581	3.234356	54.05752	0.046980	0.260194	0.406212
Observations	33	33	33	33	33	33

Source: Researchers' computation using E-views 10, (2023).

Table 4.1 shows the result of descriptive statistics of the study, it indicates that the standard deviations of the variables employed are far away from their means. The Skewness of the distribution shows positive values of real gross domestic product, information technology, and secondary school enrolment while negative values of growth capital formation, labor force, and tertiary school enrolment this means that all the variables employed are normally distributed. Kurtosis in the table shows that all the variables employed are normally distributed because their values are less than 3 except growth capital formation, labor force, and tertiary school enrolment. The Jarque-Bera test for normality is also estimated. It indicates that all the variables employed are normally distributed as their p-values are greater than 5% except tertiary school enrolment.

4.2 Unit root test

The study estimated the unit root test of both Augment Dickey-Fuller and Phillips Perron to identify the order of integration of the variables under study.

Table 4.2 Unit root test Augment Dickey-Fuller and Phillips Perron

	Test at level		Test at first difference		Order of Integration
Variables	**ADF test**	**PP test**	**ADF test**	**PP test**	
LRGDP	-2.327482	-1.417637	-3.581136**	-3.710813**	I(1)
LGCF	-10.07331	-7.791702	-	-	I(0)
LIT	-1.020686	-1.700972	-4.954166	-19.60773	I(1)
LLB	-2.772428	-1.668479	-4.049879	-3.083836**	I(1)
LTSE	-3.001766	-3.721270**	-3.614389**	-	I(0), (1)
LSSE	-2.235372	-2.251121	-5.856152	-5.854082	I(1)

Source: Researchers' computation using E-views 10, (2023).

*Asterics ** indicates a stationary 5% level of significance.*

Table 4.2 presents the result of the Augment Dickey-Fuller and Phillips Perron unit root test, the tests show that real gross domestic product, information technology and secondary school enrolment are stationery at first difference in both ADF and PP while growth capital formation is stationary at level in both ADF and PP, tertiary school enrolment is stationery at first difference in ADF while is stationary at level in PP test. Therefore, there is mixture of order of integration among the variables employed.

4.3 Bound Test for Long Run

The test is conducted to ensure that the variables employed are related in the long run.

Table 4.3 Result of cointegration Bound test

Statistics	**Value**		**Critical bound**			
F-statistics	4.926074**		1%	2.5%	5%	10%
		I (0) Bound	3.06	2.7	2.39	2.08
		I (1) Bound	4.15	3.73	3.38	3.

Source: Researchers' computation using E-views 10, (2023).

From table 4.3, the result of the cointegration bound test indicates a higher value of F-statistics than any of the critical values of all bounds. Therefore, there is strong evidence of cointegration in the model. This provides evidence of adopting Autoregressive Distributive Lag model (ARDL) in the study.

4.4 Results of the Autoregressive Distributed Lag (ARDL) Model

After conducting the unit root tests, it suggests the use of the ARDL model, this section presents the results of the model as demonstrated in chapter three. The appropriate model (number of lags) is selected automatically using the Akaike Information Criterion (AIC) which is seen as more parsimonious. Below, both short-run and long-run parameters of the model are presented. The results of the diagnostics checks are also presented.

4.4.1 Short Run Relationship

Table 4.5 presents the short-run parameters of the ARDL tests conducted. AIC suggests a 2, 0, 0, 2, 1, 0, model after testing for up to 54 different models (see appendix for the results of the top 20 models).

Table 4.5 Short run parameters of the ARDL Model

Variables	**Coefficient**	**Std error**	**t- statistics**	**Prob.**
D(LRGDP (-1))	0.184444	0.093430	1.974149	0.0523
D(LIT)	0.002616	0.006139	0.426196	0.0245
D(LIT (-1))	0.028373	0.006132	4.627416	0.0002
D(LTSE)	0.069960	0.018280	3.827113	0.0011
R-squared	C			
Adjusted R-squared	0.992594			
S.E. of regression	0.008874			
Sum squared resid	0.001575			

Log-likelihood	109.2701			
F-statistic	403.0520			
Prob(F-statistic)	0.000000			

Source: Researchers' computation using E-views 10, (2023).

The result from Table 4.5 indicates a positive autoregressive and statistically significant impact-dependent variable (real gross domestic product), this means that real gross domestic product largely depends on itself in the short run. Information technology shows a positive but statistically significant effect on gross domestic product in Nigeria, at lag 1 also indicates a positive and statistically significant effect on gross domestic product in Nigeria. Tertiary school enrolment indicates a positive and statistically significant effect on gross domestic product in Nigeria. The R-squared and its adjusted value are very high The R-squared and its adjusted value are very high 0.989313, this implies that 98% change in gross domestic product is explained by growth capital formation, information technology, labour force, tertiary school enrolment and secondary school enrolment in Nigeria. The p-value of f-statistics indicates (0.000000), this means that growth capital formation, information technology, labour force, tertiary school enrolment and secondary school enrolment have 100% significance influence on the real gross domestic product in Nigeria.

4.4.2 Long Run and Error Correction Result

Evidence from the bound test result in Table 4.4, indicates a long-run relationship among the variables in the ARDL model; hence, the next task is to compute the cointegrating and long-run form of the model. This is done to enable the researcher to observe whether there exists a long-run among trade openness, industrial output and economic growth in Nigeria. Thus, the result is presented in table 4.6.

Table 4.6 ARDL Cointegrating and Long Run Form Results

Variables	Coefficient	Std error	t- statistics	Prob.
GCF	0.060658	0.000763	0.862245	0.0088
LLB	0.738444	0.629764	1.172571	0.0347
LIT	0.018622	0.030773	0.605147	0.0419
LTSE	0.166910	0.236733	0.705056	0.0289
LSSE	0.782895	0.474948	1.648379	0.0149
ECM	-0.197396	0.033025	-5.977230	0.0000

Source: Researchers' computation using E-views 10, (2023).

The result from Table 4.6 indicates that growth capital formation has a positive but statistically significant effect on the real gross domestic product in Nigeria in the long run, by implication one-unit increase in growth capital formation will result 6% increase in gross domestic product in Nigeria. The labor force shows a positive but statistically significant effect on the real gross domestic product in Nigeria in the long run, this means that if the Labor force increases by a single digit the real gross domestic product in Nigeria will increase by 73%. Information technology shows positive but statistically significant effect on the real gross domestic product in Nigeria in the long run, this implies that single digit increase in information technology will bring about 1% increase in the real gross domestic product in Nigeria. Tertiary school enrolment indicates positive but statistically significant effect on the real gross domestic product in Nigeria in the long run, by implication one unit increase in tertiary school enrolment will result 16% increase in gross domestic product in Nigeria. Secondary school enrolment shows a positive but statistically insignificant effect on the real gross domestic product in Nigeria in the long run, this means that a unit increase in school enrolment will result 78% increase in gross domestic product in Nigeria. The error correction term (ECT) meets all the theoretical and statistical requirements both in the sign and size. The ECT coefficient is -0.197396 and the significance at 5%. This indicates that 19.73% of the disequilibrium due to the shock in the previous years is adjusted back to the long-run equilibrium in the current year.

4.4.3 Post-estimation tests

Table 4.7 post-estimation tests

Tests	P-value
Serial correlation	0.2373
Heteroscedastic	0.9652
Normality	0.138053
Ramsey test	0.8108

Source: Researchers' computation using E-views 10, (2023).

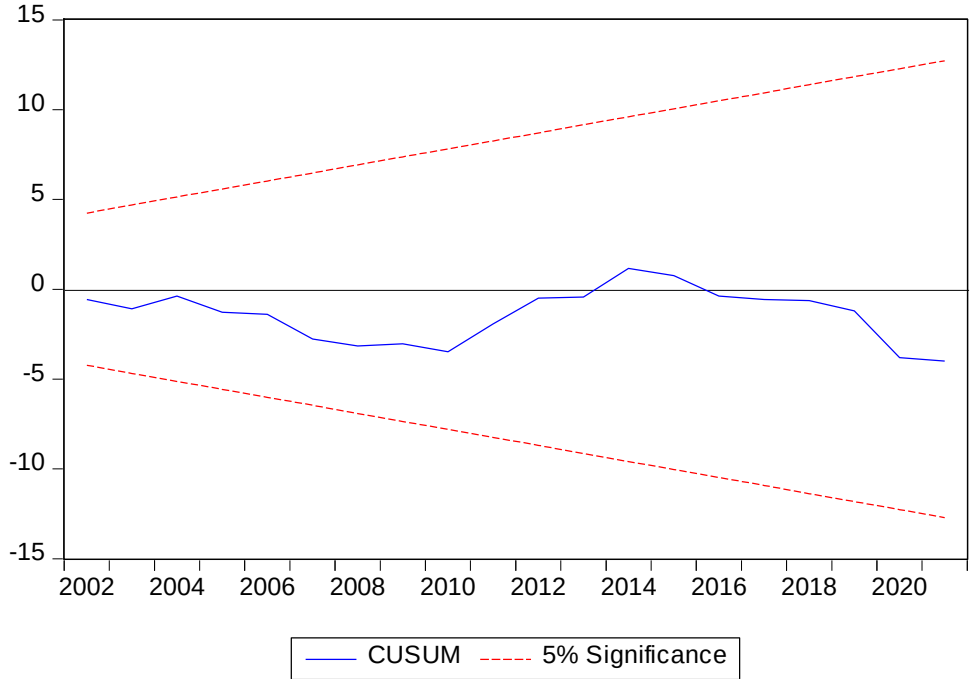
The model passed all post-estimation tests such as serial correlation, Heteroscedasticity, Normality and Ramsey reset test, as their probability values are greater than 5%. We can conclude that the model is robust.,

4.4.4 Stability

A stability test of the model is employed to ensure the data-generating process is compatible with the estimated coefficient of the model.

Figure 4.1 CUSUM Plot Recursive Residuals of ARDL model.

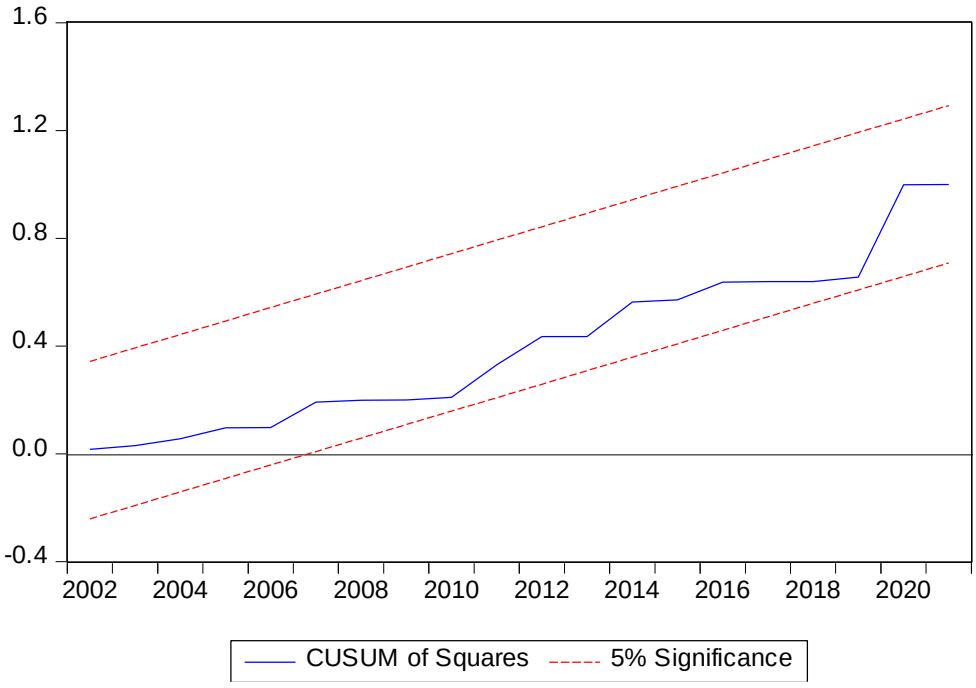
Figure 4.2 CUSUM SQUARE Plot Recursive Residuals of ARDL model.



Source: *Researcher computation using E-views 10, (2023).*

From Figure 4.1, the CUSUM plot is within 5% level of significant, this means that the model is stable. This shows that there is no chance of having spurious regression.

Figure 4.2 CUSUM SQUARE Plot Recursive Residuals of ARDL model.



Source: *Researchers' computation using E-views 10, (2023).*

From Figure 4.2, the Cumulative sum square plot is within 5% level of significant, this means that the model is stable. This shows that there is no chance of having spurious regression.

5 CONCLUSIONS AND RECOMMENDATIONS

The study examines the impact of Human Capital Development on Information Technology and Economic Growth in Nigeria. Variables employed in the study include real gross domestic product, growth capital formation, information technology, labour force, tertiary school enrolment and secondary school enrolment. The Augmented Dickey Fuller and Phillips Perron indicate that real gross domestic product, information technology and secondary school enrolment are stationery at first difference while growth capital formation is stationary at level, tertiary school enrolment is stationery at first difference in ADF while is stationary at level in PP test. Akaike information criteria (AIC) based on lag (2, 0, 0, 2, 1, 0) was used, the model is free from heteroscedasticity and serial correlation. Bound test for long run shows that f- statistics is 4.92 which are more than upper and lower bound critical values at 1%, 2.5%, 5%, and 10%. This indicated that there is a long run relationship among the variables employed. In the short run, relationship among the variables employed shows that Information technology has a positive but statistically significant effect on gross domestic product in Nigeria, at lag 1 also indicates positive and statistically significant effect on gross domestic product in Nigeria. Tertiary school enrolment has a positive and statistically significant effect on gross domestic product in Nigeria. In the long run relationship indicates that growth capital formation has a positive but statistically significant effect on the real gross domestic product in Nigeria. Labour force has a positive but statistically insignificant effect on the real gross domestic product in Nigeria. Information technology has a positive but statistically significant effect on the real gross domestic product in Nigeria. Tertiary school enrolment has a positive but statistically significant effect on the real gross domestic product in Nigeria. Secondary school enrolment has a positive but statistically significant effect on the real gross domestic product in Nigeria. The study recommended For Nigeria to enhance its economic growth, there is need to developed and implement specific policies that facilitate investment in ICT in the country by empowering youth on the different aspect of the information technology so as to become self-reliant and achieve higher economic growth. Policy makers should set ICT objectives that fall in line with the economic goals to realize the benefits. Efficient ICT sector does not work in isolation but could blend with the various economic sectors to achieve productivity in Nigeria. Development policies and strategies should consider investments in ICT as very important.

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