INTERNATIONAL JOURNAL OF ACADEMIC RESEARCH IN ECONOMICS & MANAGEMENT SCIENCES

OPEN ACCESS JOURNAL

Vol 15, Issue 1, (2026) E-ISSN: 2226-3624

Human Resource Development, Economic Growth and Poverty Reduction In Nigeria

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DOI Link: http://dx.doi.org/10.6007/IJAREMS/v15-i1/27925

Published Online: 26 March 2026

Abstract

Amid growing concerns about how developing economies can strengthen human resource capacity to drive long-term development, this study examined the effect of human resource development on economic growth and poverty reduction in Nigeria using annual data spanning 1996 to 2024. Human resource development was measured through government expenditure on education (LEXPE), government expenditure on health (LEXPH), secondary school enrolment (LESI), and tertiary school enrolment (LETI) on economic growth (LGRGDP) and poverty reduction measured at the international poverty line (LPOVL). The study adopted the Phillips and Perron (PP) unit root test to determine the order of integration of the variables, and employed the Autoregressive Distributed Lag (ARDL) framework and the bounds testing procedure to establish both long-run and short-run relationships for the growth and poverty models. The long-run results showed that LEXPE, LESI and LETI exerted significant positive effects on LGRGDP, confirming the productivity-enhancing role of education, while LEXPH had a significant negative long-run effect on growth, indicating inefficiencies in the health sector. For the poverty model, LETI was the only variable with a significant long-run effect on reducing LPOVL, although both LESI and LETI produced strong short-run reductions in poverty. The short-run estimates for the growth model indicated that changes in LESI and LETI continued to stimulate LGRGDP, while LEXPE and LEXPH showed no immediate influence. The error correction terms for both models were negative and highly significant, confirming rapid convergence to long-run equilibrium. Granger causality tests revealed bidirectional causality between LEXPE and LGRGDP, and strong bidirectional

causality between LPOVL and both LESI and LETI, suggesting that educational participation not only influences poverty outcomes but is also shaped by welfare conditions. Overall, the findings demonstrate that human resource development, particularly through secondary and tertiary education, plays a central role in shaping Nigeria's economic trajectory and poverty outcomes. Thus, the study recommends that policymakers prioritise sustained increases in LEXPE, improve the efficiency of LEXPH, expand access to LESI and LETI, and develop coordinated strategies that link human resource development to Nigeria's long-term growth and poverty reduction objectives.
Keywords: Human Resource Development, Economic Growth, Poverty Reduction, Nigeria, Workforce Skills, Education, Employment, Productivity, Sustainable Development

Introduction

Human resource development (HRD) has long been recognised as a key determinant of economic growth and national development. It encompasses the processes of improving people's knowledge, skills, competencies, and overall capabilities through education, training, healthcare, and other social investments that enhance labour productivity and economic performance. The World Bank has consistently emphasised that building human capital is essential for inclusive and sustainable economic growth, particularly in developing economies such as Nigeria, where abundant labour resources remain underutilised (World Bank, 2025). Studies have further shown that human capital investments especially in education and health significantly contribute to Nigeria's long-term economic growth (Oloke, Usman, & Adebayo, 2023; Eze, 2023). Anigboro (2024) noted that achieving higher and more equitable growth requires deliberate investments in human capital development, which serves as a catalyst for reducing poverty and improving productivity in Nigeria.

In the classical and modern growth theories, the accumulation of human capital is a crucial factor influencing productivity and technological progress. The endogenous growth theory, for instance, posits that investments in human capital, research, and innovation contribute significantly to long-run economic growth (Eriksson, Lindén, & Papahristodoulou, 2023; Lei, Chen, Wang, & Zhou, 2025). In Nigeria, however, the potential benefits of HRD have not been fully realised due to persistent underinvestment in education, inadequate vocational training, weak healthcare systems, and poor institutional frameworks for human capital utilisation (Ayoade, Orisadare, Adediwura, & Ofino, 2023; Damba, 2024).

Over the years, Nigeria has implemented several national policies aimed at improving human resource capacity, including the National Policy on Education, the National Employment Policy, and the Economic Recovery and Growth Plan (ERGP). Yet, the impact of these policies on productivity, economic growth and poverty reduction has remained minimal due to gaps in implementation, governance inefficiencies, and inadequate resource allocation (Bello & Neba, 2022). The United Nations Development Programme (2024) reports that Nigeria ranks low on the Human Development Index (HDI), reflecting the inadequacy of investments in human capital formation relative to its population growth.

Furthermore, despite Nigeria's abundant human and natural resources, the country's economic growth has remained largely non-inclusive and weakly human welfare. Between 2015 and 2023, Nigeria's annual real GDP growth averaged 1.7 to 2.0 %, marked by major fluctuations including contraction in 2016 and a modest recovery to about 3.6 % in 2021

(World Bank, 2025; World Bank, 2024). However, this growth has not been matched by commensurate progress in human development indicators such as education, employment, health outcomes, and income equality. UNDP (2025) noted that Nigeria ranked 164th out of 193 countries on the Human Development Index in 2023, reflecting persistent under-investment in human capital despite economic potential.

Human resource development in Nigeria faces numerous challenges, including inadequate funding for education and training institutions, skill mismatches between graduates and labour-market demand, poor access to quality healthcare, and limited technological innovation. According to the National Bureau of Statistics' (NBS) Nigeria Labour Force Survey Annual Report (2023), the unemployment rate in Nigeria stood at 5.4 percent, while informal employment accounted for about 92.2 percent of all employed persons. This suggests that although headline unemployment appears relatively low under the revised labour-force methodology, a large proportion of Nigeria's working-age population, particularly the youth, remains engaged in low-quality and vulnerable informal jobs. The predominance of informal work and limited access to stable, productive employment underscore the persistent challenges of underemployment and labour market insecurity in the country (NBS, 2023). Furthermore, the World Bank (2025) reported that poverty remains widespread in Nigeria, with about 46 percent of the population living below the national poverty line, reflecting deep and persistent income deprivation. In addition, the country accounts for over 11 million out-of-school children, representing the highest number globally, a situation that underscores the severity of educational deprivation and its implications for human capital development (World Bank, 2024).

Empirical evidence indicates a positive correlation between human resource development and economic performance and poverty reduction. Studies by Balogun, Ajiboye, and Olorunmade (2023) and Egbon-Charles, Tanko, Gambo, Ehiaguina, and Yakubu (2024) demonstrate that improved access to education, skill acquisition, and healthcare services significantly enhance workforce productivity, poverty reduction, innovation, and competitiveness. However, in Nigeria, unemployment, underemployment, and skill mismatches persist, limiting the economy's capacity to absorb its growing labour force productively.

These conditions suggest that the relationship between human resource development and economic growth and poverty reduction in Nigeria has been weak and insufficiently explored from an empirical standpoint. Economic growth has not effectively translated into improved living standards or human development outcomes. The inability of economic expansion to reduce poverty and inequality raises fundamental questions about the effectiveness of HRD strategies and the structural composition of Nigeria's growth. Additionally, successive government policies aimed at improving education, health, and workforce productivity have often suffered from poor implementation, inadequate monitoring, and corruption, thereby reducing their intended impact (Omoju, Ikhide, Olanrele, Abeng, Petreski, Adebayo, Odigie, & Muhammed, 2023). This policy–practice gap has perpetuated a situation in which Nigeria's economic performance appears detached from its human development progress. The implication is that Nigeria may continue to experience economic growth without development and poverty reduction, a condition where increases in Gross Domestic Product (GDP) fail to reflect in the welfare and productivity of the people.

While numerous studies such as (Balogun et al., 2023; Onwuka & Udeze, 2024) have examined the relationship between human resource development (HRD) and economic growth in developing economies, the empirical findings remain inconclusive and context-dependent. Some scholars, including Asombo et al. (2023) and Ibrahim (2025), found that investments in education, skill acquisition, and health have a significant and positive impact on productivity and long-term economic growth. In contrast, studies such as Ofori, Kuuwill, and Quaye (2024) reported weak or statistically insignificant relationships, arguing that the benefits of HRD are undermined by poor institutional quality, inadequate implementation of human capital policies, and weak governance structures. Moreover, a large proportion of existing research has focused on cross-country analyses, with limited attention to the specific dynamics of HRD in country-specific like Nigeria's resource-dependent and demographically youthful economy. This lack of consensus and the paucity of country-specific empirical evidence highlight the need for a more nuanced investigation of how HRD influences economic growth and reduce poverty within the Nigerian context.

It is therefore imperative to investigate the extent to which human resource development influences the growth of the Nigerian economy and its impact on poverty alleviation. Understanding this relationship will help to identify the mechanisms through which investments in education, skill acquisition, and health can stimulate productivity and accelerate sustainable development and poverty reduction. This study thus seeks to fill the existing research gap by empirically analysing how human resource development indicators contributes to Nigeria's economic growth, poverty reduction and the causal relationships between human resource development indicators and key macroeconomic outcomes, particularly economic growth and poverty levels, in Nigeria. The rest of the paper is organized as follows: Section 2 presents the literature review; Section 3 discusses the research methodology; Section 4 provides the empirical analysis and results; and Section 5 concludes with key findings and policy recommendations.

Literature Review

Conceptual Literature

Human resource development (HRD) is seen as a strategic process of improving the knowledge, skills, competencies, and health of the population to enhance productivity and foster economic growth. It encompasses education, training, healthcare, and capacity-building initiatives aimed at strengthening the nation's human capital base. According to the National Bureau of Statistics (NBS, 2023), the quality of human resources in Nigeria directly influences labour productivity and national output, making HRD a critical driver of economic transformation. The concept emphasizes that the most valuable asset of any nation is its people, and sustainable growth can only be achieved when citizens are healthy, educated, and empowered to contribute productively to the economy.

Despite its importance, human resource development in Nigeria faces numerous challenges, including poor educational outcomes, underfunded health systems, high unemployment, and skill mismatches in the labour market. The Nigerian economy has long been dominated by the oil sector, resulting in limited attention to knowledge-based industries and technical education. As noted by UNESCO (2025), Nigeria's public expenditure on education has consistently fallen below the UNESCO-recommended threshold of 15–20% of total government spending. Recent estimates show that Nigeria allocated only about 4.4% of its public expenditure to education in 2023, far below this benchmark. This chronic under-investment has contributed to deteriorating infrastructure, low-quality instruction, and persistent brain drain among skilled professionals (TheGlobalEconomy.com, 2023). Similarly, the Central Bank of Nigeria (CBN, 2024) notes that recurrent expenditure continues to dominate the federal budget, accounting for over 70% of total public spending in recent reports, while capital expenditure remains below 20%. This persistent imbalance severely constrains capital investment in critical sectors such as education, thereby limiting progress in improving school infrastructure, enhancing teacher quality, and strengthening research capacity. Furthermore, the healthcare sector faces critical challenges such as poor access to quality services, inadequate medical personnel, and low life expectancy, all of which negatively affect labourproductivity and human development (Okunade, Olayiwola, Joseph, and Olawunmi, 2025). These limitations highlight the need for policy reforms that strengthen vocational training, improve educational quality, and expand access to affordable healthcare.

Economic growth is refers to the sustained increase in the nation's real gross domestic product (RGDP) resulting from the efficient utilization of human, natural, and capital resources. It reflects improvements in productivity, output, and overall living standards (Doki & Udaah, 2024). Over the past two decades, Nigeria has experienced fluctuating economic growth patterns influenced by oil price volatility, policy inconsistencies, insecurity, and global economic shocks. According to the World Bank, Nigeria's real GDP growth averaged about 7 % between 2000 and 2014, after which growth slowed sharply (to 2.7 % in 2015 and -1.6 % in 2016) as the economy was hit by falling oil prices and declining production (World Bank Group, 2018). The Nigerian economy remains highly exposed to oil price and production shocks, underscoring structural vulnerabilities including over-reliance on oil revenues and underdevelopment of non-oil sectors and human-capital intensity.

A strong and sustainable economic growth path requires diversification, innovation, and investment in human capital. As Wirajing, Nchofoung and Etape (2023) note, economies that channel resources toward improving education, health, and skills development experience higher productivity and resilience against global shocks. In Nigeria, however, inadequate human capital has limited industrial output, technological progress, and productivity growth. This has often led to persistent gap between economic expansion and social development outcomes that reveals a form of "jobless growth," where GDP rises without a corresponding reduction in unemployment and poverty (International Labour Organization, 2024).

Several factors have contributed to the unstable growth trajectory in Nigeria. Weak infrastructure, policy inconsistency, corruption, and poor governance have stifled private investment and innovation (Osuma, Ayinde, Ntokozo, and Ehikioya, 2024). Moreover, regional insecurity and limited access to finance have hindered the performance of key non-oil sectors such as agriculture and manufacturing. According to Elegbede and Akinbile (2024), the Nigerian economy remains constrained by low productivity levels and a shortage of skilled labour, both of which are closely tied to inadequate human resource development. This interconnection suggests that economic growth in Nigeria cannot be sustained without deliberate investment in human capital to improve workforce efficiency and technological capacity.

Poverty in Nigeria represents a multidimensional condition in which individuals and households lack adequate income, access to essential services, and opportunities required to maintain a decent standard of living. It is not limited to low monetary income but extends to deprivation in education, health, nutrition, housing, and productive capabilities (United Nations Development Programme, 2023). Although Nigeria is endowed with large natural and human resources, persistent poverty has remained one of the country's most pressing developmental challenges. According to the National Bureau of Statistics (2022), more than 63 percent of Nigerians are multidimensionally poor, meaning they experience overlapping deprivations that restrict their ability to live productive and secure lives.

Over the past two decades, Nigeria's poverty trend has been shaped by several structural and macroeconomic factors, including weak economic diversification, high unemployment, income inequality, and limited access to quality education and healthcare. The collapse in global oil prices between 2014 and 2016, inflationary pressures, and slow economic recovery further aggravated welfare conditions (World Bank Group, 2020). These shocks reduced household purchasing power, limited access to basic services, and pushed vulnerable populations deeper into poverty. Scholars such as Ogunleye and Aye (2021) argue that the persistence of poverty in Nigeria reflects underlying constraints related to low human capital accumulation, inadequate social protection, and weak institutional capacity to deliver inclusive development outcomes.

Theoretical Literature Review

This study is grounded in growth theories that emphasize human capital accumulation and knowledge creation as key drivers of economic growth. Central to this framework are the Human Capital Theory, Endogenous Growth Theory, and the Augmented Solow-Swan Growth Model. Human Capital Theory posits that investment in education and health enhances individuals' productivity and contributes to economic growth by increasing the stock of human capital (Schultz, 1961; Becker, 1964). Education improves skills, efficiency, and adaptability, while health enhances labour productivity and reduces absenteeism (Grossman, 1972). Empirical evidence shows high returns to education across economies (Psacharopoulos & Patrinos, 2018), with cognitive skills strongly linked to growth performance (Hanushek & Woessmann, 2012). Despite criticisms regarding its linear assumptions and neglect of institutional constraints (Auerbach & Green, 2024), the theory remains fundamental in growth analysis.

Endogenous Growth Theory extends this perspective by internalizing technological progress and attributing sustained growth to deliberate investments in human capital, innovation, and knowledge accumulation (Romer, 1986, 1990; Lucas, 1988). Human capital enhances individual productivity and generates positive spillovers that support long-term growth. The theory also highlights the role of public policy in promoting education and innovation, though it has been criticized for underestimating external shocks and institutional weaknesses (Aghion & Howitt, 2009). The Augmented Solow-Swan Growth Model incorporates human capital into the neoclassical growth framework, explaining growth and income differences through variations in physical and human capital accumulation (Solow, 1956; Swan, 1956; Mankiw et al., 1992). While criticized for assuming homogeneous human capital and weak institutional effects (Temple, 2001), it provides a practical foundation for empirical growth studies. Overall, these theories collectively underscore the importance of human capital development in driving economic growth.

Empirical Review

Bloom, et al. (2020) examined the impact of human development indicators-education, general health, and reproductive health-on economic growth spanning from 1985 to 2020. Bloom, et al. employed a theoretical economic growth model with poverty traps, a comprehensive literature review, and empirical analyses estimating the relative contributions of various human development indicators to GDP growth across heterogeneous growth regimes. Their results revealed that a one-child decrease in the total fertility rate corresponds to a 2-percentage-point increase in annual per capita GDP growth in the short run and 0.5 percentage points in the long run. Similarly, a 10% rise in life expectancy at birth was linked to a 1-percentage-point increase in short-run GDP growth and 0.4 in the long run, while a one-year increase in average educational attainment led to a 0.7-percentage-point short-run and 0.3-percentage-point long-run increase in GDP growth..

Bakare (2020) examined the interrelationship among educational training (formal and non-formal), human resource development, and economic growth. Bakare employed a survey research design using data collected from 60 participants through a structured instrument titled “Impact of Human Resources Management on Economic Growth Indices” (HRMEGI). His results revealed a reverse causal relationship between the quality of human resources and economic growth, while enrollments across the three tiers of education showed varying degrees of contribution to economic growth. Further findings indicated a positive and significant relationship between educational training and the quality of human resources, as well as between human resource management strategies and economic growth.

Ageli (2022) examined the short- and long-run relationships between health expenditure per capita, environmental sustainability-measured by CO_2 emissions per capita (CO_2)-GDP per capita (GDPPC), and green energy-measured by electric power consumption per capita (GEPC)-in Saudi Arabia using annual time-series data from 1995 to 2021. Ageli employed the Bootstrap Autoregressive Distributed Lag (BARDL) cointegration model as its methodological technique. Ageli’s results revealed no long-term cointegration relationship among the variables, providing strong empirical support for the absence of long-run equilibrium between them. However, his findings showed a unidirectional relationship between GDP per capita and health expenditure, as well as between green energy and CO_2 emissions. Additionally, a bidirectional relationship was observed between health expenditure and CO_2 emissions, and between green energy and economic growth.

Carillo (2024) examined the impact of human capital composition on technological progress and its influence on the transition from economic stagnation to growth, as well as on persistent global income disparities. Carillo employed empirical analysis to test theoretical predictions regarding the trade-off between higher and lower education levels within an economy. Carillo’s results revealed that while highly educated individuals drive technological innovation, inadequate education among a significant portion of the workforce can hinder technology adoption, thereby delaying the transition from stagnation to growth. Furthermore, he found that technology adoption complements technological progress, particularly in the modern era where innovations are increasingly complex, ultimately enhancing economic growth.

Simmons (2024) examined the link between education spending in Mexico and Central American countries and illegal immigration to the United States. Simmons employed empirical analysis to explore the economic motivations and migration costs influencing migration patterns, with a focus on the role of education expenditure in fostering economic growth. His revealed that inadequate investment in education contributes to limited economic opportunities, thereby intensifying the push factors driving illegal migration. Conversely, increased education spending was found to enhance economic growth and reduce the incentive for irregular migration.

Kausar, et al. (2024) examined the relationship between education and Pakistan's economic growth in both the short and long run using thirty years of data spanning from 1987 to 2016. Kausar, et al. employed the Pesaran bounds test approach and the Autoregressive Distributed Lag (ARDL) model to determine co-integration between variables. Their results revealed that increasing the education level of the labourforce positively and significantly impacts real GDP, confirming a long-term relationship between education and economic growth. Specifically, a 1% increase in labour force education was associated with a 0.62% rise in real GDP in the long run. Conversely, they found a significant negative long-run relationship between government education expenditures and economic growth, likely due to incomplete data on total educational spending and declining trends in public education investment.

Nica, et al. (2023) examined the interrelationships among energy consumption, health expenditure, pollution, institutional quality, financial development, and human health in Eastern European countries between 1990 and 2021. They employed the Cross-Sectional Autoregressive Distributed Lag (CS-ARDL) model alongside Quantile Regression (QR) for robustness testing, after confirming cross-sectional dependence (CSD) and slope heterogeneity (SH) among the panel data. Their results revealed that increased health expenditure, renewable energy consumption, and a higher institutional quality index (IQI) significantly improve health outcomes and longevity in Eastern European nations. Additionally, while financial development showed a positive but statistically insignificant effect on life expectancy, CO_2 emissions and fossil fuel consumption were found to reduce life expectancy. The findings were consistent across both the CS-ARDL and QR estimations.

Demir, et al. (2022) examined the asymmetric effect of environmental quality on health expenditures in Türkiye over the period 1975–2019. Demir, et al. employed the Non-Linear Autoregressive Distributed Lag (NARDL) model to analyze the long- and short-run dynamics among environmental quality, natural resources, economic growth, trade openness, and health expenditure. Their results revealed an asymmetric cointegration relationship among the variables. Specifically, positive environmental pollution shocks were found to increase health expenditures in the long run, while negative pollution shocks had no statistically significant impact. Both positive and negative shocks to natural resources reduced health expenditures in the long run. Furthermore, positive economic growth shocks had an insignificant positive effect on health expenditures, whereas negative economic growth shocks showed a significant positive effect. The study also found that positive trade openness shocks reduced health expenditures, while negative shocks increased them.

Uddin and Khan (2024) examined the role of higher education in promoting economic growth across South Asian countries-Bangladesh, Bhutan, India, Nepal, Pakistan, and Sri Lanka-over the period 1990 to 2019. Their study employed the Panel Autoregressive Distributed Lag (Panel ARDL) model to analyze both short- and long-run relationships among tertiary education enrolment, higher education expenditure, exports, imports, and gross capital formation in relation to GDP per capita. Their results revealed that all these variables positively and significantly affect economic growth in the long run. The authors' findings underscore that higher education plays a vital role in fostering a skilled, innovative, and adaptable workforce that supports sustained economic development.

Diakodimitriou, et al. (2025) examined the relationship between education expenditures and economic growth in selected European countries-Germany, France, Greece, Italy, Spain, and Portugal-covering the period 1996 to 2019. Their study employed advanced econometric techniques, specifically the adaptive LASSO and Three-Stage Least Squares (3SLS) models, to assess how education spending influences GDP per capita. Their results revealed that education expenditure significantly enhances economic growth, with research and development (R&D) expenditure identified as the primary channel through which education impacts GDP per capita. Their findings remained consistent across all sampled countries.

Kuzior, et al. (2025) examined the relationship between healthcare financing and economic growth in 34 European countries over the period 2000 to 2023. Their study employed cluster analysis with the Calinski-Harabasz pseudo-F stopping rule, the pooled mean group estimator, and the Hausman test to test three hypotheses concerning the short- and long-run effects of healthcare spending on economic growth and the variation of these effects by income level. Their results partially confirmed the hypotheses, revealing that increases in healthcare spending positively influence economic growth in the long run, although the magnitude and direction of this relationship vary among countries with different income levels. The short-run effects, however, were found to be less consistent across the sample.

Doan (2025) examined the impact of public education expenditure on economic growth in nine Southeast Asian countries-Brunei, Cambodia, Indonesia, Laos, Malaysia, the Philippines, Singapore, Thailand, and Vietnam-covering the period 1998 to 2022. Doan employed multiple econometric techniques, including Ordinary Least Squares (OLS), Fixed Effects Model, Random Effects Model, and the Generalized Method of Moments (GMM), to ensure robustness and consistency in the estimations using secondary data from the World Development Indicators. His results revealed that public education spending did not exhibit a clearly positive effect on economic growth across the models. In several estimations, the coefficient of education expenditure on GDP growth was statistically insignificant or even negative, with the GMM model showing a -0.031 coefficient ($p > 0.1$). However, institutional quality was found to have a positive and statistically significant effect, indicating that governance quality and fiscal management play critical roles in determining the effectiveness of public spending.

Research Methods

Theoretical Framework

The theoretical framework for this study is grounded in the assumptions of the Solow growth model. In earlier neoclassical formulations, human capital was not explicitly recognized as a key input in the production process and was therefore omitted from most growth analyses. Solow's (1956) contribution marked an important shift, as his model incorporated capital accumulation, labour force growth, and a residual component representing technological progress as the main drivers of economic growth.

The Solow model employs an aggregate production function that is continuous and homogeneous of degree one. It is generally expressed as:

$$Y = f(L, K, T) \tag{1}$$

where Y represents aggregate real output, K denotes the capital stock, L represents labour, and T captures technological progress. Holding technology constant, equation (1) can be differentiated with respect to time to obtain:

$$\frac{\partial Y}{\partial K} \cdot \frac{K}{Y} + \frac{\partial Y}{\partial L} \cdot \frac{L}{Y} + \frac{\partial Y}{\partial T} \cdot \frac{T}{Y} \tag{2}$$

For estimation purposes, this can be expressed in growth rate form as:

$$\frac{\Delta Y}{Y} = \alpha^0 + \alpha^1 \left(\frac{\Delta K}{Y}\right) + \alpha^2 \left(\frac{\Delta L}{Y}\right) \tag{3}$$

where:

$\alpha_0 = \frac{\partial Y}{\partial T}\frac{T}{Y}$ represents the rate of technological progress

$\alpha_1 = \frac{\partial Y}{\partial K}\frac{K}{Y}$ represents the marginal productivity of capital

$\alpha_2 = \frac{\partial Y}{\partial L}\frac{L}{Y}$ represents the marginal productivity of labour

Since $\frac{\Delta K}{Y}$ approximates the investment–income ratio and $\frac{\Delta L}{Y}$ approximates labour force growth relative to output, the model can be re-specified in growth rate form as:

$$GRY = \alpha_0 + \alpha_1 GRK + \alpha_2 GRL + U \tag{4}$$

where:

GRY is the growth rate of real GDP

GRK is the growth rate of capital

GRL is the growth rate of labour

U is a disturbance term

The coefficients α_1 and α_2 are expected to be positive, consistent with the theoretical assumption that increases in capital and labour contribute positively to economic growth.

Model Specification

The model for this study is adapted from Adelakun (2011), who examined the relationship between human capital development and economic growth in Nigeria. His study modified the Solow growth model by incorporating human capital variables. The functional form of Adelakun's (2011) model is specified as:

$$GDP = f(TGVTEE, TGVTEH, TSE, SCSE, PRYSE) \tag{5}$$

Where:

GDP = Gross Domestic Product

TGVTEE = Total Government Expenditure on Education
TGVTEH = Total Government Expenditure on Health
TSE = Tertiary School Enrolment
SCSE = Secondary School Enrolment
PRYSE = Primary School Enrolment
For the purpose of this study, the dependent variable is modified to the growth rate of Real Gross Domestic Product (GRGDP). This modification is necessary because GDP measures the level of domestic output, but does not directly reflect growth performance, and its nominal value is significantly affected by inflation. Using the growth rate of real GDP helps to isolate inflationary effects and better capture economic performance over time. Furthermore, primary school enrolment is excluded from the modified model. In Nigeria, basic education is legally fulfilled upon completion of the Basic 9 curriculum, after which students take the Junior WAEC examination. Therefore, this study focuses on enrolment at the secondary and tertiary levels as more relevant indicators of human capital development.
Based on these modifications, the functional form of the model for this study becomes:

Model One

$$GRGDP = f(EXPE, EXPH, ESI, ETI) \quad (6)$$

The explicit econometric form is written as:

$$GRGDP = \alpha_0 + \alpha_1 EXPE + \alpha_2 EXPH + \alpha_3 ESI + \alpha_4 ETI + U \quad (7)$$

Model Two

To examine the effect of human capital development on poverty reduction, the second model is specified as:

$$POVL = f(EXPE, EXPH, ESI, ETI) \quad (8)$$

The explicit econometric form is:

$$POVL = b_0 + b_1 EXPE + b_2 EXPH + b_3 ESI + b_4 ETI + U \quad (9)$$

Where:
GRGDP = Growth Rate of Real Gross Domestic Product
POVL = Poverty Level
EXPE = Government Expenditure on Education
EXPH = Government Expenditure on Health
ESI = Enrolment into Secondary School
ETI = Enrolment into Tertiary Institution
α_0 & b_0== Intercept
$\alpha_1, \alpha_2, \alpha_3, \alpha_4, b_1, b_2, b_3, b_4$== Parameters
U= Stochastic disturbance term

Sources of Data

The study relies on annual time series data covering the period 1996 to 2024. The dataset comprises key macroeconomic and human resource development indicators which include Growth of Real Gross Domestic Product (GRGDP), Government Expenditure on

Education (EXPE), government Expenditure on Health (EXPH), Secondary School Enrolment (ESI), and Tertiary School Enrolment (ETI). These variables were selected because they represent the major channels through which human resource development affects macroeconomic outcomes such as growth and poverty reduction. The choice of a long study period ensures adequate observation of structural changes, policy reforms, economic cycles, and variations in human capital investment patterns within the Nigerian economy. All data used in the study were obtained from the world development indicators (WDI, 2024), published by the World Bank.

Method of Data Analysis

Descriptive Statistics

Descriptive statistics are computed to summarise the basic characteristics of the data series. Measures such as the mean and median help to describe the central tendency of each variable, while the standard deviation captures the degree of dispersion around the average value. The minimum and maximum values show the range of each series and highlight extreme observations that may need attention. Skewness is analysed to determine whether the distribution of each variable is symmetric or skewed, and kurtosis indicates whether the data are more peaked or flatter than the normal distribution. The Jarque Bera statistic is also reported to formally test for normality. These descriptive measures provide a preliminary understanding of the behaviour and distributional properties of each variable before conducting formal econometric modelling.

Correlation Analysis

A correlation matrix is estimated to evaluate the degree and direction of linear association among the variables. The correlation coefficients range between negative one and positive one, indicating the strength and direction of the relationship. The purpose of this analysis is to provide preliminary insights into how the variables move relative to one another. It also helps detect potential multicollinearity issues that may hinder estimation accuracy in regression analysis. Although correlation does not imply causation, it helps refine expectations regarding the interaction of macroeconomic variables and supports the model-building process (Gujarati and Porter, 2009).

Unit Root Testing (Phillips Perron Test)

Before model estimation, it is necessary to determine whether the variables are stationary (Phillips & Perron, 2001). The Phillips Perron (PP) unit root test is employed to detect the order of integration. The PP test is robust to serial correlation and heteroscedasticity in the error terms and is based on the following regression:

$$\Delta Y_t = \alpha + \beta t + \gamma Y_{t-1} + u_t \quad (10)$$

With the hypotheses:

$H_0: \gamma = 0$ non-stationary

$H_1: \gamma < 0$ stationary

Determining the order of integration ensures that no variable is integrated of order two, which would invalidate the estimation technique.

Lag Length Selection Criteria

Before estimating the ARDL model, it is necessary to determine the optimal lag lengths for each variable. Appropriate lag selection ensures accurate dynamic representation of the relationships among variables and prevents model misspecification. The study employs standard information criteria to guide lag selection, including: Akaike Information Criterion (AIC), Schwarz Bayesian Criterion (SBC or BIC) Hannan Quinn Criterion (HQC) and Final Prediction Error (FPE). The criterion that produces the lowest value is chosen as the optimal lag order. Correct lag selection is crucial because it influences both the short-run dynamics and the long-run cointegration results.

Bounds Test for Cointegration

The ARDL bounds testing technique is then used to determine whether a long-run relationship exists among the variables. The test is conducted using an unrestricted error correction form:

$$\Delta Y_t = \alpha_0 + \sum_{i=1}^{p} \lambda_i \Delta Y_{t-i} + \sum_{j=1}^{q} \theta_j \Delta X_{t-j} + \psi_1 Y_{t-1} + \psi_2 X_{t-1} + u_t \quad (11)$$

The hypotheses for cointegration are:
$H_0: \psi_1 = \psi_2 = 0$ no long-run relationship
$H_1: \psi_1 \neq 0, \psi_2 \neq 0$ long-run relationship exists
The bounds test relies on the F statistic, which is compared against the lower and upper critical bounds provided by Pesaran et al. If the statistic exceeds the upper bound, cointegration is confirmed.

Granger Causality Test

The Granger causality test is conducted to determine the direction of causality between the variables used in the study. The test evaluates whether past values of one variable contain information that helps predict another variable beyond the information already contained in its own past values. In essence, a variable $X_t$is said to Granger-cause another variable $Y_t$if the inclusion of lagged values of $X_t$significantly improves the prediction of Y_t(Granger, 1969).
The test is implemented by estimating a system of regressions of the form:

$$Y_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i Y_{t-i} + \sum_{j=1}^{q} \beta_j X_{t-j} + u_t \quad (12)$$

$$X_t = \delta_0 + \sum_{i=1}^{p} \delta_i X_{t-i} + \sum_{j=1}^{q} \gamma_j Y_{t-j} + v_t \quad (13)$$

The hypotheses for testing whether X_tGranger-causes $Y_t$are:
$H_0: \beta_1 = \beta_2 = \cdots = \beta_q = 0$ no Granger causality
$H_1: \beta_j \neq 0$ for at least one j Granger causality present
A rejection of the null hypothesis indicates that past values of X_t provide statistically significant predictive information about Y_t. Similarly, the second equation is used to test whether Y_tGranger-causes X_t.

The Granger causality test helps to determine whether relationships between variables are unidirectional, bidirectional, or non-existent. This is useful for understanding underlying transmission mechanisms between macroeconomic variables such as trade openness, economic growth, inflation and foreign investment. Asteriou and Hall (2016) note that causality analysis supports policy formulation because it identifies which variables drive changes in others and the direction of influence within the economic system.

ARDL Model Specification

Error Correction Model (ECM) Representation

When cointegration is confirmed from the Bound test, the ARDL model is reparametrized into the Error Correction Model (ECM) to capture both short-run dynamics and the speed of adjustment toward long-run equilibrium. The ECM for Model One is expressed as:

$$\begin{aligned}\Delta GRGDP_t &= \gamma_0 + \sum_{i=1}^{p-1} \psi_i \Delta GRGDP_{t-i} + \sum_{j=0}^{q_1-1} \theta_{1j} \Delta EXPE_{t-j} + \sum_{j=0}^{q_2-1} \theta_{2j} \Delta EXPH_{t-j} \\ &+ \sum_{j=0}^{q_3-1} \theta_{3j} \Delta ESI_{t-j} + \sum_{j=0}^{q_4-1} \theta_{4j} \Delta ETI_{t-j} + \pi ECM_{t-1} + u_t\end{aligned} \quad (14)$$

where:

$$ECM_{t-1} = (GRGDP_{t-1} - \lambda_0 - \lambda_1 EXPE_{t-1} - \lambda_2 EXPH_{t-1} - \lambda_3 ESI_{t-1} - \lambda_4 ETI_{t-1}) \quad (15)$$

The coefficient π is expected to be negative and statistically significant, indicating the speed at which the dependent variable adjusts toward long-run equilibrium.

ARDL and ECM for the Poverty Model

Following the same structure, the ARDL model for Model Two is specified as:

$$\begin{aligned}POVL_t &= \beta_0 + \sum_{i=1}^{p} \kappa_i POVL_{t-i} + \sum_{j=0}^{q_1} \delta_{1j} EXPE_{t-j} + \sum_{j=0}^{q_2} \delta_{2j} EXPH_{t-j} \\ &+ \sum_{j=0}^{q_3} \delta_{3j} ESI_{t-j} + \sum_{j=0}^{q_4} \delta_{4j} ETI_{t-j} + \nu_t\end{aligned} \quad (16)$$

After confirming cointegration, the ECM representation becomes:

$$\begin{aligned}\Delta POVL_t &= \eta_0 + \sum_{i=1}^{p-1} \omega_i \Delta POVL_{t-i} + \sum_{j=0}^{q_1-1} \phi_{1j} \Delta EXPE_{t-j} + \sum_{j=0}^{q_2-1} \phi_{2j} \Delta EXPH_{t-j} \\ &+ \sum_{j=0}^{q_3-1} \phi_{3j} \Delta ESI_{t-j} + \sum_{j=0}^{q_4-1} \phi_{4j} \Delta ETI_{t-j} + \rho ECM_{t-1} + \mu_t\end{aligned} \quad (17)$$

with:

$$ECM_{t-1} = (POVL_{t-1} - \beta_0 - \mu_1 EXPE_{t-1} - \mu_2 EXPH_{t-1} - \mu_3 ESI_{t-1} - \mu_4 ETI_{t-1}) \quad (18)$$

Data Analysis and Discussion of Results

This section presents and analyses the empirical results of the study following the procedures outlined in section Three.

Descriptive Statistics

This section presents the descriptive statistics for all the variables used in the study. The descriptive statistics of these variables are presented in Table 1.

Table 1
Descriptive Statistics

	GRGDP	POVL	EXPE	EXPH	ETI	ESI
Mean	4.653036	58.38491	0.431439	0.612878	10.17420	36.74659
Median	4.230147	57.30000	0.424844	0.541028	9.919895	39.30681
Maximum	15.32933	69.90000	0.549233	1.202034	14.41097	52.79673
Minimum	-1.794322	50.05734	0.293754	0.400696	5.287481	22.83241
Std. Dev.	3.445570	5.611228	0.068461	0.205662	2.704017	8.789737
Skewness	0.660305	0.497038	0.021545	1.608937	-0.298451	-0.242179
Kurtosis	4.656422	2.295212	2.146641	4.688907	2.171582	1.890165
Jarque-Bera	5.422690	1.794270	0.882177	15.95859	1.259770	1.771823
Probability	0.066447	0.407736	0.643336	0.000342	0.532653	0.412338
Sum	134.9380	1693.162	12.51174	17.77346	295.0518	1065.651
Sum Sq. Dev.	332.4146	881.6047	0.131233	1.184307	204.7279	2163.265
Observations	29	29	29	29	29	29

Source: Author’s Computation Using E-views 12

Table 1 summarises the statistical characteristics of the variables used in the study. The mean values show the average behaviour of each indicator over the 29-year period. Real GDP growth rate (GRGDP) averages 4.65 percent, indicating moderate economic performance, while the poverty rate at the 4.20-dollar line (POVL) averages 58.38 percent, which reflects a relatively high level of income deprivation. Government education expenditure (EXPE) and health expenditure (EXPH) show relatively low average values of 0.43 percent and 0.61 percent of GDP respectively. Secondary school enrolment (ESI) averages 36.75 percent, and tertiary enrolment (ETI) averages 10.17 percent, pointing to limited but gradually expanding educational access. The median values for all variables are close to their respective means, suggesting that the distributions are not heavily distorted by extreme observations. The maximum and minimum values show the range of each series. GRGDP fluctuates widely between -1.79 percent and 15.33 percent, indicating periods of both economic contraction and strong expansion. POVL ranges from 50.06 to 69.90 percent, while EXPE and EXPH move within narrow bands, consistent with the slow-moving nature of government budget allocations. ESI ranges between 22.83 and 52.80 percent, and ETI varies between 5.28 and 14.41 percent.

The standard deviations reveal the extent of variability in each variable. GRGDP and ESI exhibit relatively larger dispersion, while EXPE shows the smallest variation, indicating that education spending remains fairly stable from year to year. The skewness statistics show that GRGDP, POVL and EXPH are positively skewed, meaning their distributions are slightly tilted toward higher values. In contrast, ETI and ESI have mild negative skewness. Kurtosis results indicate that GRGDP and EXPH are leptokurtic, implying more peaked distributions, while the remaining variables have flatter distributions. The Jarque-Bera statistics and their associated probabilities show that EXPH does not satisfy the normality assumption at the 5 percent level, while the other variables do not significantly deviate from normality.

Pairwise Correlation Matrix

This section presents the pairwise correlation coefficients among the variables used in the study. The results are displayed in Table 2a and Table 2b for Model I and Model II respectively. The correlation matrix provides an initial indication of how the variables are linearly related and helps identify potential multicollinearity issues before proceeding to the regression analysis.

Table 2a
Pairwise Correlation for (Model I)

	LGRGDP	LEXPE	LEXPH	LESI	LETI
LGRGDP	1.000000				
LEXPE	0.467737	1.000000			
LEXPH	0.159917	0.612925	1.000000		
LESI	0.949500	0.416121	0.084615	1.000000	
LETI	0.961108	0.555734	0.384779	0.685898	1.000000

Source: Author's Computation Using E-views 12

Table 2b
Pairwise Correlation for (Model II)

	LPOVL	LEXPE	LEXPH	LESI	LETI
LPOVL	1.000000				
LEXPE	-0.471566	1.000000			
LEXPH	-0.310501	0.670659	1.000000		
LESI	-0.932359	0.342508	0.115647	1.000000	
LETI	-0.944569	0.529832	0.411214	0.691154	1.000000

Source: Author's Computation Using E-views 12

Tables 2a and 2b present the correlation coefficients for the variables used in Model I and Model II respectively. In Model I, where LGRGDP is the dependent variable, the results show very strong positive correlations between LGRGDP and the human capital indicators. LESI (0.9495) and LETI (0.9611) exhibit the highest associations with economic growth, indicating that increases in secondary and tertiary enrolment correspond with stronger growth performance. High correlations between the dependent variable and explanatory variables are not problematic because they simply reflect how strongly the variables move together. Gujarati and Porter (2009) emphasise that multicollinearity concerns arise mainly from strong correlations among the explanatory variables, not from their individual correlations with the dependent variable. Government expenditure on education (LEXPE) and health (LEXPH) on the otherhand display weaker positive associations with LGRGDP, at 0.4677 and 0.1599 respectively, suggesting modest relationships. Correlations among the independent variables remain moderate, such as between LEXPE and LEXPH (0.6129) and between LETI and LESI (0.6859). These fall within acceptable bounds and do not indicate multicollinearity problems.

For Model II, with LPOVL as the dependent variable, the relationships show strong negative correlations between poverty and the human capital variables. LESI (-0.9324) and LETI (-0.9446) exhibit the strongest inverse associations, indicating that improvements in secondary and tertiary school enrolment are linked with reductions in poverty at the 4.20-dollar poverty line. Government education and health expenditure show weaker negative correlations, at -0.4716 and -0.3105 respectively. Similar to Model I, the correlations among the explanatory variables remain moderate, such as the association between LEXPE and LEXPH (0.6707) and between LETI and LESI (0.6912). These values do not meet the threshold for multicollinearity and are therefore not expected to distort the regression outcomes. Overall, the correlation results suggest meaningful relationships among the variables while confirming that the explanatory variables remain sufficiently independent for reliable econometric estimation.

Phillip-Peron Unit Root Test

Table 3 presents the results of the Phillips–Perron unit root test conducted on all the variables. The results show that LEXPH and LPOVL are stationary at level, as their test statistics are significant at the 1 percent level, which leads to rejection of the null hypothesis of a unit root. These variables are therefore integrated of order zero, I(0). Conversely, LGRGDP, LEXPE, LETI and LESI are not stationary at level, as their probability values are above the critical significance threshold. However, they become stationary after first differencing, indicating that they are integrated of order one, I(1). The mixture of I(0) and I(1) variables confirms that none of the series is integrated of order two. This validates the use of the ARDL bounds testing procedure in the subsequent analysis, as recommended by Pesaran et al. (2001).

Table 3
Phillip-Peron Unit Root Test

Variables	**PP at Level**	**Remarks**
LGRGDP	-3.8437 (0.0056) no	I(1)
LEXPH	-4.1865 (0.0043) ***	I(0)
LEXPE	-3.8038 (0.0062) no	I(1)
LETI	-4.0795 (0.0144) no	I(1)
LESI	-5.7084 (0.0000) no	I(1)
LPOVL	-4.8888 (0.0020) ***	I(0)

Source: Author’s Computation Using E-views 12

Lag-Length Criteria Test

Tables 4a and 4b present the lag length selection results for Model I and Model II respectively, using the Log Likelihood (LogL), Likelihood Ratio (LR), Final Prediction Error (FPE), Akaike Information Criterion (AIC), Schwarz Criterion (SC) and Hannan–Quinn Criterion (HQ). In Model I, almost all the information criteria identify lag 2 as the optimal lag length. Lag 2 produces the smallest FPE value (8.11e−12) and the lowest AIC, SC and HQ values, which indicates a better model fit compared to lag 0 and lag 1. The LR statistic also supports lag 2, confirming that adding the second lag significantly improves the model. Therefore, lag 2 is chosen as the optimal lag structure for Model I.

Model II, the results show a similar pattern. The FPE and AIC criteria favour lag 2 because it produces the smallest error value (8.87e−15) and the lowest AIC. The HQ criterion also selects lag 2 as the optimal choice. Although the Schwarz Criterion identifies lag 1, the majority of the criteria, including the LR test which strongly favours lag 1 but supports improved fit at lag 2, suggest that lag 2 provides a more appropriate dynamic structure for the model. Since model selection usually follows the majority rule and places priority on AIC, FPE and HQ, lag 2 is selected as the optimal lag length for Model II. Overall, the results from both models indicate that a lag length of two is most suitable for capturing the dynamic behaviour of the variables and ensuring reliable ARDL estimation.

Table 4a
Lag-Length Criteria Output (Model I)

Lag	LogL	LR	FPE	AIC	SC	HQ
0	65.43065	NA	7.03e-08	-5.119221	-4.922879	-5.067131
1	179.1671	180.0827	2.09e-11	-13.26392	-12.28221	-13.00347
2	208.0775	36.13801*	8.11e-12*	-14.33979*	-12.57271*	-13.87098*

Source: Author's Computation Using E-views 12

Table 4b
Lag-Length Criteria Output (Model II)

Lag	LogL	LR	FPE	AIC	SC	HQ
0	102.9089	NA	1.97e-10	-8.159078	-7.913650	-8.093966
1	244.3582	212.1740*	1.27e-14	-17.86319	-16.39062*	-17.47251
2	277.4272	35.82475	8.87e-15*	-18.53560*	-15.83590	-17.81937*

Source: Author's Computation Using E-views 12

ARDL Bound Test

Table 5a presents the bounds test results for Model I, where LGRGDP is the dependent variable. The computed F-statistic of 18.40067 is far above the upper critical bounds at all conventional significance levels. For example, at the 5 percent level, the upper bound is 3.49, and at the 1 percent level, it is 4.37. Since the calculated F-statistic exceeds these critical values, the null hypothesis of no long-run relationship is rejected. This provides strong evidence of cointegration among LGRGDP, LEXPE, LEXPH, LESI and LETI. In practical terms, this means that economic growth and the explanatory variables share a stable long-run equilibrium relationship.

Similarly, Table 5b shows the bounds test results for Model II, with LPOVL as the dependent variable. The F-statistic of 40.49638 is significantly greater than the upper bounds across all significance levels. This implies that the null hypothesis of no cointegration is also rejected for Model II. Therefore, LPOVL and its associated regressors exhibit a long-run relationship. This result confirms that poverty and the determinants included in the model move together over time and do not drift apart in the long run. Overall, the bounds test results for both models demonstrate the presence of long-run equilibrium relationships. This justifies the estimation of both the long-run ARDL model and the corresponding Error Correction Model for further analysis.

Table 5a
ARDL Bound Test (Model I)

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	18.40067	10%	2.2	3.09
k	4	5%	2.56	3.49
		2.5%	2.88	3.87
		1%	3.29	4.37

Source: Author’s Computation Using E-views 12

Table 5b
ARDL Bound Test (Model II)

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	40.49638	10%	2.2	3.09
k	4	5%	2.56	3.49
		2.5%	2.88	3.87
		1%	3.29	4.37

Source: Author’s Computation Using E-views 12

ARDL Long and Short-run

The long-run estimates for Model I as revealed in Table 6, column 1, indicate several meaningful relationships between economic growth and the explanatory variables. The lagged value of LGRGDP is negative and significant, confirming the presence of mean reversion and supporting the ARDL framework. Government education expenditure (LEXPE) has a positive and statistically significant effect on economic growth, suggesting that higher spending on education contributes to long-term economic expansion. In contrast, government health expenditure (LEXPH) exerts a significant negative effect, implying that health spending has not translated into growth-enhancing outcomes during the period. Secondary school enrolment (LESI) and tertiary school enrolment (LETI) both have positive and highly significant long-run effects. This indicates that improvements in human capital, particularly through higher enrolment rates, are strongly associated with sustained economic growth. However, In the short run as represented in column 2 of Table 6, the results show mixed responses. Changes in education spending (DLEXPE) are not statistically significant in either the current or previous period. Health expenditure shows an immediate negative short-run impact (DLEXPH) but a positive adjustment in the following period, suggesting temporary distortions followed by correction. Changes in secondary enrolment (DLESI) have a positive and significant effect, while their lagged values are negative, indicating short-term fluctuations before stabilising. Tertiary enrolment (DLETI) also shows a positive short-run effect, but its lagged change is significantly negative, reflecting adjustment pressures. The error correction term (CointEq(-1)) is negative and highly significant, with a value of -0.543, showing that about 54 percent of deviations from the long-run equilibrium are corrected each year. This confirms a stable long-run relationship.

The long-run estimates for Model II as revealed in column 3, Table 6, reveal that poverty dynamics differ substantially from the growth model. The coefficient on LPOVL(-1) is negative and highly significant, showing strong convergence toward long-run equilibrium. Tertiary school enrolment (LETI) is the only variable with a significant long-run association, and its coefficient is negative, indicating that increases in tertiary education are linked to reductions in poverty over time. Education expenditure (LEXPE), health expenditure (LEXPH), and secondary enrolment (LESI) all display statistically insignificant long-run coefficients, suggesting that these variables do not exert measurable long-term effects on poverty after controlling for others. While in the short run, several variables show immediate effects on poverty. Changes in secondary enrolment (DLESI) are negative and highly significant, indicating that short-term increases in secondary school participation help reduce poverty. Changes in tertiary enrolment (DLETI) also reduce poverty significantly, while its lagged value (DLETI(-1)) produces a positive adjustment effect, reflecting short-lived transitions. The short-run effects of education and health expenditure are not significant. The error correction term (CointEq(-1)) is correctly signed and highly significant, with a coefficient of -0.842. This indicates a fast adjustment process, with approximately 84 percent of deviations from the long-run poverty equilibrium corrected within a year. This strong adjustment reinforces the existence of a stable long-run relationship for the poverty model.

Table 6
ARDL Long and Short-run Output

VARIABLES	(1) Model I Long Run (LGRGDP)	(2) Model I Short Run (LGRGDP)	(3) Model II Long Run (LPOVL)	(4) Model II Short Run (LPOVL)
LGRGDP(-1)	-0.543*** (-5.78)	—	—	—
LPOVL(-1)	—	—	-0.842*** (-13.65)	—
LEXPE(-1)	0.160*** (4.36)	—	—	—
LEXPH(-1)	-0.189*** (-4.06)	—	—	—
LEXPE**	—	—	-0.0144 (-0.78)	—
LEXPH**	—	—	0.0128 (1.12)	—
LESI(-1)	0.189*** (-3.11)	—	-0.0453 (-1.30)	—
LETI(-1)	0.557*** (-5.08)	—	-0.220*** (-8.03)	—
Short-Run Dynamics				
D(LEXPE)	—	0.0573 (1.32)	—	—

D(LEXPE(-1))	—	0.074 (1.64)	—	—
D(LEXPH)	—	-0.104*** (-8.60)	—	—
D(LEXPH(-1))	—	0.0457*** (3.03)	—	—
D(LESI)	—	0.114*** (3.24)	—	-0.128*** (-3.43)
D(LESI(-1))	—	-0.0973** (-2.50)	—	—
D(LETI)	—	0.128* (1.89)	—	-0.160*** (-3.14)
D(LETI(-1))	—	-0.345*** (-3.28)	—	0.191*** (3.28)
CointEq(-1)	—	-0.543*** (-12.13)	—	-0.842*** (-17.86)

Note: *** = significant at 1 percent, ** = significant at 5 percent**,** *= significant at 10 percent, parathesis is t-statistics
Source: Author's Computation Using E-views 12.

Granger Causality Test

The Granger causality results for Model I as revealed in Table 7a show several important directional relationships. First, there is evidence of bidirectional causality between LEXPE and LGRGDP. LEXPE Granger-causes LGRGDP at the 10 percent level, while LGRGDP Granger-causes LEXPE at the 1 percent level. This implies a feedback relationship where government education spending influences economic growth, and economic growth in turn affects education spending decisions. No causal link is found between LEXPH and LGRGDP in either direction, as both probability values are insignificant. This suggests that changes in health expenditure do not predict economic growth, nor does economic growth predict changes in health expenditure in the short run.

For school enrolment, the pattern is mixed. LESI does not Granger-cause LGRGDP, but LGRGDP Granger-causes LESI at the 1 percent level. This indicates a unidirectional causality from economic growth to secondary school enrolment. Higher economic performance appears to precede improvements in secondary enrolment, rather than the reverse. For tertiary enrolment, LETI Granger-causes LGRGDP at the 10 percent level, while the reverse relationship is insignificant. This provides evidence of unidirectional causality from LETI to LGRGDP, suggesting that changes in tertiary enrolment help predict future economic growth.
However, Granger causality results for Model II reveal stronger and more extensive interactions between poverty and the explanatory variables. Government education spending (LEXPE) exhibits bidirectional causality with poverty at the 5 percent and 1 percent levels respectively. This means that changes in education spending predict changes in poverty, and poverty levels also influence government decisions about education spending.

Health expenditure (LEXPH) shows unidirectional causality running from LEXPH to LPOVL at the 10 percent level, indicating that health spending helps explain variations in poverty. However, poverty does not Granger-cause health expenditure, suggesting no feedback effect. For secondary school enrolment (LESI), the results show a strong bidirectional relationship. LESI Granger-causes LPOVL at the 1 percent level, and LPOVL Granger-causes LESI at the same significance level. This suggests a close two-way interaction, where changes in poverty influence school participation, and changes in participation influence poverty outcomes. A similar bidirectional pattern is observed for tertiary enrolment (LETI). LETI Granger-causes LPOVL at the 1 percent level, and LPOVL Granger-causes LETI at the 5 percent level. This indicates that tertiary education plays an important role in shaping poverty outcomes, while poverty conditions also affect the capacity of households to pursue higher education.

Table 7a
Granger Causality Test Output (Model I)

Relationship	**Chi-sq**	**Df**	**Prob.**
LEXPE → LGRGDP	2.6633	1	0.0851*
LGRGDP → LEXPE	5.39639	1	**0.0096*** **
LEXPH → LGRGDP	2.25115	1	0.1217
LGRGDP → LEXPH	1.42729	1	0.2548
LESI → LGRGDP	1.29252	1	0.2885
LGRGDP → LESI	5.75488	1	**0.0073*** **
LETI → LGRGDP	2.8869	1	0.0704*
LGRGDP → LETI	0.12888	1	0.8795

Note: *** = significant at 1 percent, ** = significant at 5 percent, *= significant at 10 percent.
Source: Author's Computation Using E-views 12.

Table 7b
Granger Causality Test Output (Model II)

Relationship	**Chi-sq**	**df**	**Prob.**
LEXPE → LPOVL	3.65169	1	**0.0395** **
LPOVL → LEXPE	10.0742	1	**0.0005*** **
LEXPH → LPOVL	2.88193	1	0.0734*
LPOVL → LEXPH	0.55262	1	0.5818
LESI → LPOVL	14.0982	1	**0.00006*** **
LPOVL → LESI	6.79517	1	**0.0041*** **
LETI → LPOVL	13.8499	1	**0.00007*** **
LPOVL → LETI	4.44368	1	**0.0215** **

Note: *** = significant at 1 percent, ** = significant at 5 percent, *= significant at 10 percent.
Source: Author's Computation Using E-views 12.

Diagnostic Test

Diagnostic checks reported in Table 8 give confidence that both Model I and Model II are statistically reliable. Starting with serial correlation, the Breusch–Godfrey F-statistics are insignificant in both cases (Model I: F = 1.7653, p = 0.2098; Model II: F = 0.8649, p = 0.4424). This means the residuals do not show evidence of being correlated across time. Although the ObsR² statistic for Model I is only marginally above the 10 percent level (ObsR² = 6.1938, p = 0.0552), the insignificant F-statistic provides stronger reassurance that serial correlation is not a problem. Model II also passes this test comfortably. Heteroskedasticity results paint a similar picture. Using the Breusch–Pagan–Godfrey approach, all three statistics for Model I (F = 1.2603, p = 0.3308; ObsR² = 15.1394, p = 0.2987; Scaled SS = 3.2490, p = 0.9969) and for Model

II (F = 0.7435, p = 0.6541; ObsR² = 6.7751, p = 0.5611; Scaled SS = 1.4737, p = 0.9931) return p-values well above the 0.05 threshold. This simply means the spread of the residuals remains stable, and the models do not suffer from changing variance.

Model specification also appears sound. The Ramsey RESET test shows no sign of functional form problems in either model. For Model I, the t-statistic (0.3843, p = 0.7066), F-statistic (0.1477, p = 0.7066) and LR statistic (0.3042, p = 0.5812) are all comfortably insignificant. Model II shows a similar pattern, with p-values of 0.4026 for both the t-statistic and F-statistic, and 0.2719 for the LR statistic. In simple terms, the models do not seem to be leaving out important variables or using an incorrect functional form. Normality checks also look good. The Jarque–Bera statistics for both models (Model I: JB = 0.2886, p = 0.8656; Model II: JB = 0.9649, p = 0.6173) indicate that the residuals follow a roughly normal distribution, which supports the validity of the statistical inference.

Finally, the adjusted R-squared values show that both models explain a large proportion of variation in their dependent variables. Model I accounts for about 86 percent of the variation in economic growth, and Model II explains roughly 92 percent of the variation in poverty. These values suggest that the selected variables are meaningful and that the models are performing well.

Table 8
Diagnostic Test Output

Diagnostic Test	Model I	Model II
Serial Correlation (Breusch–Godfrey)	F = 1.7653, p = 0.2098; Obs*R² = 6.1938, p = 0.0552	F = 0.8649, p = 0.4424; Obs*R² = 2.7491, p = 0.2530
Heteroskedasticity (Breusch–Pagan–Godfrey)	F = 1.2603, p = 0.3308; Obs*R² = 15.1394, p = 0.2987; Scaled SS = 3.2490, p = 0.9969	F = 0.7435, p = 0.6541; Obs*R² = 6.7751, p = 0.5611; Scaled SS = 1.4737, p = 0.9931
Ramsey RESET Test	t = 0.3843, p = 0.7066; F = 0.1477, p = 0.7066; LR = 0.3042, p = 0.5812	t = 0.8614, p = 0.4026; F = 0.7420, p = 0.4026; LR = 1.2070, p = 0.2719
Normality (Jarque–Bera)	JB = 0.2886, p = 0.8656	JB = 0.9649, p = 0.6173
R^2 Adjusted	0.8646	0.9177

Source: Author's Computation Using E-views 12.

Stability Test

Figures 1 and 2 present the CUSUM and CUSUMSQ stability tests for Model I. In both cases, the plots remain within the upper and lower critical bounds throughout the sample period. This indicates that the coefficients in the economic growth model are stable and do not shift unexpectedly over time. In practical terms, the relationship between LGRGDP and its explanatory variables remains consistent, even in periods where the economy may have experienced shocks or structural adjustments. A similar pattern appears in Model II, as shown in Figures 4.9 and 4.10. Both the CUSUM and CUSUMSQ lines stay comfortably within the 5 percent significance bands, suggesting that the poverty model is also stable. This means the parameters linking poverty to education expenditure, health spending, and human capital variables did not undergo structural change during the study period. With both stability tests confirming parameter constancy, the long-run and short-run estimates from each ARDL model can be regarded as reliable and suitable for policy interpretation.

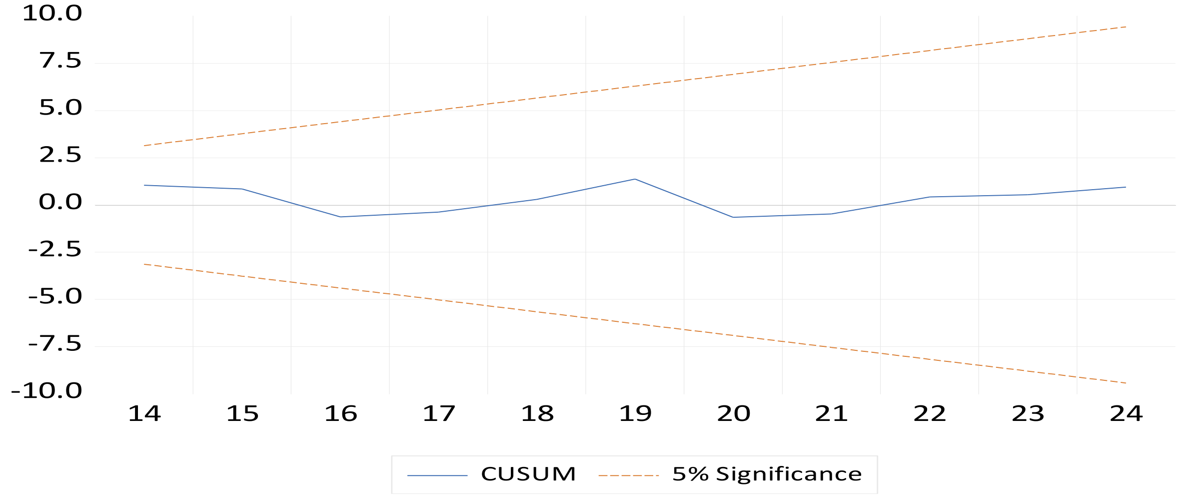

Fig 1 CUSUM Test for Model I

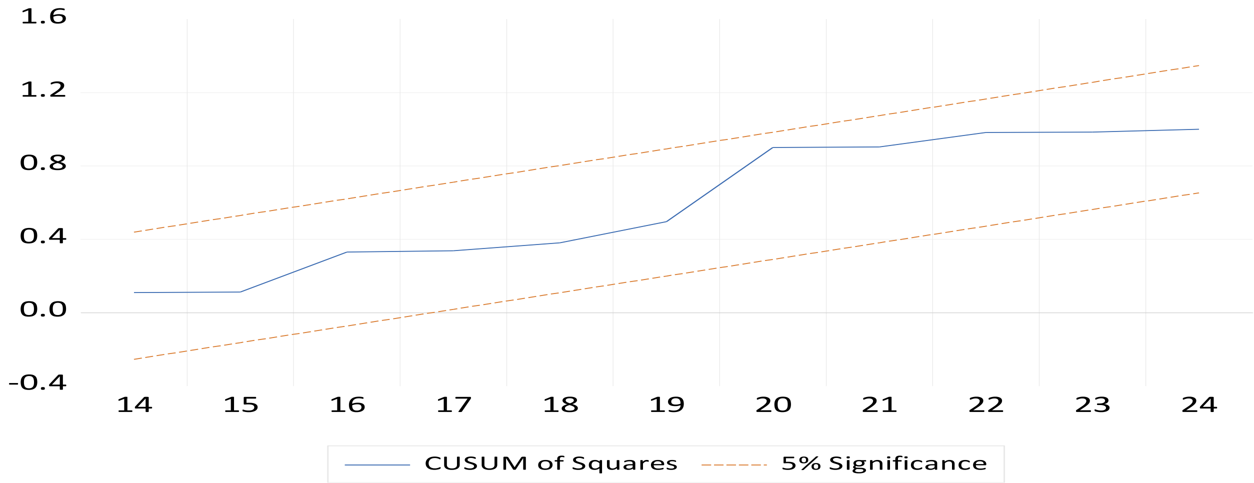

Fig 2 CUSUM of Squares Test for Model I

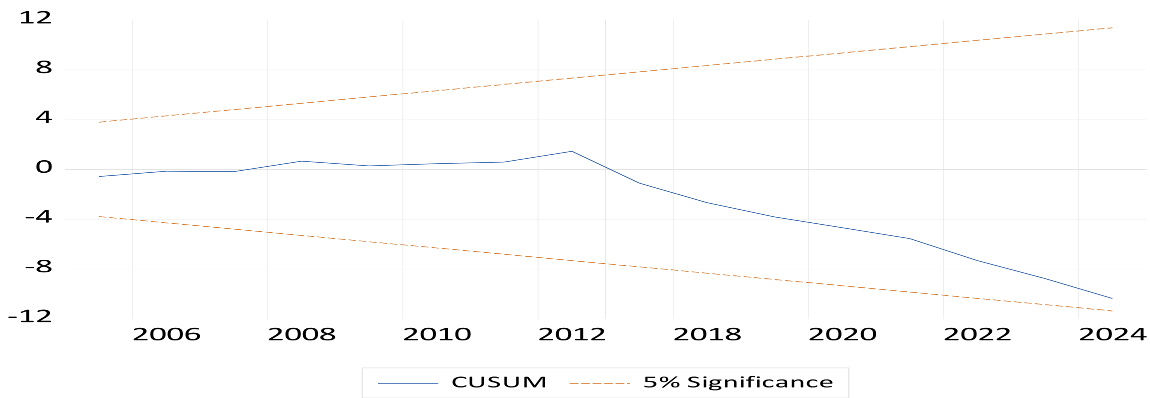

Fig 3 CUSUM Test for Model II

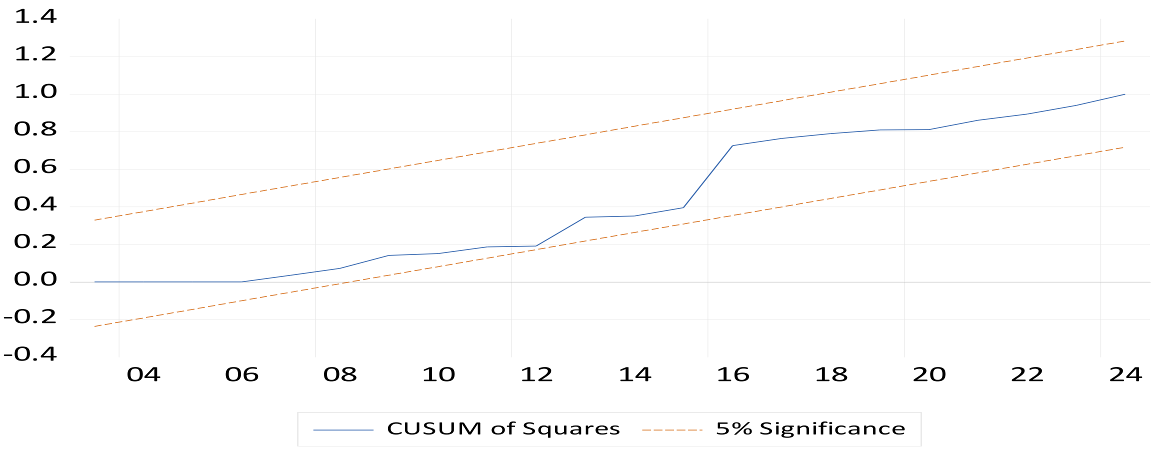

Fig 4 CUSUM of Squares Test for Model II

Conclusion and Policy Implications

This study examined the effect of human resource development on economic growth and poverty reduction in Nigeria, using government expenditure on education and health, as well as secondary and tertiary school enrolment, within an ARDL framework. The empirical evidence revealed stable long-run relationships between human resource development indicators and both economic growth and poverty outcomes, confirming the centrality of human capital in Nigeria's development process.

The findings demonstrated that secondary and tertiary school enrolment exert strong and positive effects on economic growth in both the short and long run, underscoring the productivity-enhancing role of education. Government expenditure on education contributed positively to long-run economic growth, though its impact remained constrained by persistently low funding levels and possible inefficiencies. In contrast, health expenditure exhibited a negative or insignificant long-run effect on growth, suggesting structural weaknesses and inefficiencies in the health sector that limit its contribution to productive capacity.

With respect to poverty reduction, tertiary school enrolment emerged as the only significant long-run determinant, highlighting the critical role of advanced education and higher-level skills in addressing structural poverty in Nigeria. In the short run, both secondary and tertiary enrolment significantly reduced poverty, indicating that improvements in educational participation generate immediate welfare gains. Government expenditure on education and health, however, did not exert significant short-run effects on poverty, reinforcing the conclusion that spending effectiveness depends more on efficiency, targeting, and outcomes than on expenditure volumes alone.

Granger causality results further revealed strong feedback mechanisms between education expenditure and economic growth, as well as between poverty and school enrolment. These interactions indicate that human resource development both drives and responds to macroeconomic and welfare conditions. Overall, the study concludes that human resource development particularly through expanded and sustained access to secondary and tertiary education is indispensable for achieving long-term economic growth and meaningful poverty reduction in Nigeria.

Policy Implications

The findings of this study carry several important policy implications for Nigeria's development strategy. First, education policy should prioritise sustained investment in secondary and tertiary education, as these levels demonstrated the strongest and most consistent effects on economic growth and poverty reduction. Increasing budgetary allocations, improving educational infrastructure, strengthening teacher training, and aligning curricula with labour market needs are essential for maximising the growth dividends of human capital development.

Second, given the dominant long-run role of tertiary education in reducing poverty, policies aimed at expanding access to higher education should be strengthened. Reducing financial barriers through scholarships, student loan schemes, and targeted subsidies, alongside expanding university, polytechnic, and technical education capacity, will enhance advanceed skill acquisition and promote inclusive development.

Third, the weak and negative effects of health expenditure on growth point to the need for comprehensive health sector reforms. Policy emphasis should shift from expenditure expansion alone to improving governance, efficiency, accountability, and service delivery. Prioritising preventive healthcare, strengthening primary healthcare systems, and reducing waste will enhance labour productivity and improve the developmental impact of health spending.

Fourth, the significant short-run poverty-reducing effects of secondary and tertiary enrolment suggest that policies aimed at keeping children and youths in school can yield immediate welfare benefits. Social protection programmes such as conditional cash transfers, school feeding schemes, and targeted support for vulnerable households should therefore be integrated into human resource development strategies.

Fifth, the existence of stable long-run relationships implies that human resource development policies require consistency and continuity. Long-term education and health development plans should be institutionalised to reduce policy reversals and ensure sustained human capital accumulation beyond political cycles.

Finally, the bidirectional relationship between economic growth and education expenditure suggests that government should adopt countercyclical fiscal strategies that protect education and health spending during economic downturns. Encouraging private sector participation through public private partnerships, tax incentives, and regulatory support will further expand capacity, reduce pressure on public institutions, and accelerate skill development. Conclusively, a coherent and efficiency driven human resource development strategy anchored on secondary and tertiary education expansion, improved education financing, and health sector reforms is critical for sustaining economic growth and achieving durable poverty reduction in Nigeria.

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