On the Relationship between Education Reforms and Sustainable Development: Evidence from Nigeria

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ABSTRACT

Nigeria between 1980 and 2018 shows a mixed relationship between education reforms and sustainable development. In 2016, over 45 percent of Nigerian graduates are unemployed and about a 39.4 percent increase in education enrolment rate had resulted in stagnated economic sustainable development in Nigeria. Following the endogenous growth theory and the environmental Kuznets hypothesis underpinnings, this study investigated the cause and effect of education reforms and sustainable development in Nigeria between 1980 and 2018. The descriptive statistics employed describe the data distribution of the included variables while the vector error correction model (VECM) econometric technique was used to determine the short-run and long-run impact of education reforms on economic, social, and environmentally sustainable development in Nigeria. The results found that qualitative education reform has a positive impact on economic and environmentally sustainable development while quantitative education has a negative impact on socially sustainable development in the long run. Further, the short-run, VECM results revealed that qualitative education reforms will speedily affect economic, social, and environmentally sustainable development than the quantitative education reforms within the period of study. The study recommends that quantity and quality education reforms should be seen as complementary and not a substitute in achieving sustainable development by the year 2030 in Nigeria.

Keywords: Education reforms, Economic sustainable, Social sustainable, Environmental sustainable, VECM

INTRODUCTION

Education is widely accepted by development theorists as a fundamental and veritable tool to accelerate economic growth for all nations (Saint, Hartnett & Strassner, 2003; World Bank, 1999).

The early economic growth theories led by Smith in 1776 and other classical growth scholars emphasized on the quantity education, that is, labour size is a determinant of accelerated economic growth of a nation. However, these classical growth theories failed to account for nations without abundant natural resources as well as the role of government in education. Subsequently, the neoclassical growth theories led by Solow (1956) also recognizes the role of education to accelerate economic growth through the term human capital accumulation. According to exogenous growth theories, education is the combination of labour size, human and physical capital. Further, this theory identified education not only from labour size but also in terms of students' enrolment rate, adult literacy, per capita income, nominal wages and individual education expenditure (Mulligan & Sala-i-Martin, 1995 cited in Akinleye & Ogunyomi, 2016).

Unfortunately, the neoclassical growth theories that spanned for three decades but failed to provide a long run economic growth due to unexpected technological progress in the model as well as the non-governmental role in the economy. This implies that the popular exogenous growth theory does not recognize the role of government in education and the presence of other development goals towards achieving long run economic growth in a nation. Recently, the new growth theory scholars such as Lucas (1988), Rebelo (1991) and Robert (1986) specifically identified the role of education in terms of quantity and quality due to the assumptions of the presence of technological progress as an endogenous variable in the model. This theory concludes that education is not only quantity of labour size or human capital accumulation but a dynamic variable that requires continuous changes or reforms largely from the government and private sector to achieve a long run economic growth for all nations.

Given the theoretical underpinning of the importance role of education to the attainment of economic growth and development for all nations, it becomes imperative for the United Nations (UN) member states to include education as one of the development goals in the Millennium Development Goals (MDGs) in year 2000 and the recent Sustainable Development Goals (SDGs) to be achievable between 2015-2030 by all nations, both developed and developing countries. As a result of the development goals set by the United Nation (UN) member states, several countries had continually tried to improve their education reforms in recent years.

Specifically in Nigeria, education reform had undergone two (2) education reforms since pre-independence in 1954 till date. The salient question posed is "to what extent has the Nigerian education reforms affects sustainable development from economic, social and environmental perspective? Unlike many related studies (Moja, 2000; Saint, Hartnett, & Strassner, 2003; Vladimirova & Le Blanc, 2015) that considered the historical analysis while a few studies (Bashir, Herath & Gebremedhin, 2012; Babatunde & Adefabi, 2005; Akinleye and Ogunyomi, 2016; Babasanya, Ogunleye and Ogunyomi, 2017) examined the empirical analysis of the study. However, all the studies focused on the relationship between education and either economic or social or environmental sustainable development and not education reforms and sustainable development including all the three core developments – economic, social and environment simultaneously in Nigeria. Therefore, the study intends to fill the existing gap in the relationship between education reforms and sustainable development in Nigeria within the period 1980-2018 using descriptive statistics and econometric techniques.

The paper is composed of five sections. Section 2 provides the trend of Education reforms in Nigeria. Section 3 presents the literature review. Section 4 discusses the methodology and data sources. Section 5 outlines the empirical results and discussion of findings, while section 6 presents the conclusion and recommendations.

TREND OF EDUCATION REFORMS AND SUSTAINABLE DEVELOPMENT IN NIGERIA

Prior to independence in 1960, the Nigerian education system witnessed the first structural education reform. In 1954, the educational system changed from the British education system of 8 – 6 – 2 – 3 that is 8 years primary, 6 years secondary, 2 years higher school certificate and 3 years university to a self-rule education system of 6 – 5 – 2 – 3, that is, 6 years primary, 5 years secondary, 2 years higher school certificate and 3 years university. The changes resulted in the reduction of the number of years at the primary and secondary school levels (Moja, 2000).

Further, the post-independence educational reforms also commenced with a structural education reform but unlike pre-independence, the objective of this education system changed from 6 – 5 – 2 – 3 to 6 – 3 – 3 – 4 for the development of sciences and technology in the Nigerian education system. This new structural education system was recommended by national curriculum conference of the September 1969 held in Lagos. Also, they referenced this new structural education system from American and Japan with their successes in sciences and technological development.

Notably, the structural education reform inherited from the British education system to self-rule education system that was motivated for science and technology development were considered inadequate in meeting the Nigerian educational needs and development with poor access to education and shortages of middle education level for science and technology.

Following this educational gap identified in the structural education reform, it becomes imperative for the Government to change to another educational system. In 1976, the government launched the free Universal Primary Education (UPE) which earmarked the beginning of expansion education system from the structural educational system in Nigeria. Surprisingly, between 1976 and 1980, there was a remarkable increase in pupil enrolments from 8.7 million in 1976/77 to 12.5 million in 1979/80, which accounted for 43.7 percent increase of enrolment rate in Nigeria. Also, there was a double increase in the number of universities in Nigeria from six (6) in 1970 to thirteen (13) in 1979.

More importantly, table 1 shows the trend of quantity expansion and quality education reforms and sustainable development from 1970 to 2018. Unfortunately, between 1970 and 1979, there was no availability of data for analysis. But the fourth development plan which spans from 1980 to 1986 shows the total enrolments rate and total government expenditure on education at 914.67 and N7.45 million respectively. In same period, the aggregate economic and environmental sustainable development shows a positive value of 5.23 and -0.08 percent respectively. While a negative value of 1.58 percent was recorded for social sustainable development between 1980 and 1986 in Nigeria.

Further, the periods between 1987 and 1998 earmarked the military era or post-structural Adjustment Program (SAP) phase. The table reveals that within these periods, a 55 percent increase in total tiers of education enrolment rate from 914.67 in 1980 –1986 to 1417.48 in 1987 –1998 were recorded. Surprisingly, a positive economic and environmental

sustainable development witnessed by 11.1 and 22.5 percent as well as a negative social sustainable development of – 0.05 percent due to the massive enrollments rate between 1987 and 1998 in Nigeria. In the same years, the total budget on education rose from ₦4.45 million in 1980-1986 to ₦69.89 million in 1987-1998, which accounted for about 14.71 percent which led to insignificant positive economic and environmental sustainable development but a remarkable decrease in social sustainable development witnessed between the 1987 and 1998 in Nigeria.

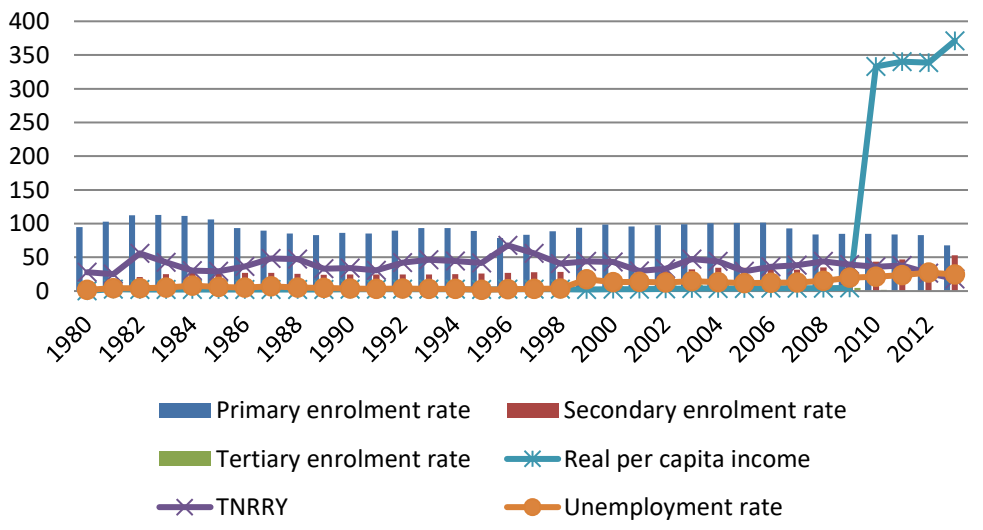
Table 1: Trend in Quantity Expansion and Quality Education Reform and Sustainable Development in Nigeria

Year (Development Plans)	Enrolments (Quantity Expansion Education Reform)				Total Government Expenditure Quality Education Reform			Sustainable Development		
	PER	SER	TER	TLER	TCEDU	TREDU	TEDU	Economic (RGDPCPG)	Social (UNRG)	Environment (TNRRYG)
1970-1974	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1975-1979	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1980-1986	733.6	161.5	19.57	914.67	2.997	4.45	7.447	5.229	1.576	–0.079
1987-1998	1045.33	309.75	62.30	1417.48	28.732	69.89	98.622	0.111	–0.05	0.225
1999-2013	1369.35	520.51	86.64	1976.51	317.82	2263.69	2581.51	73.81	4.498	–0.434

Source: Authors' Compilation, 2017.

Also, between the 1999 and 2013 that is earmarked as the democratic phases witnessed an extensive expansionary education reforms with much emphasis on quality education approach, unlike previous development phases discussed. This was confirmed with a 39.4 percent increase in education enrolments rate from 1987–1998 to 1999 –2018. While for the quality education approach, a 25.18 percent increase was witnessed from 1987–1989 to 1999–2018.

Fig. 1: Enrollment rates and Ecconomic, Social and Environment Sustainable Development in Nigeria (1980-2013)



Source: Authors, 2017

Remarkably, the extensive use of qualitative education over quantitative education resulted in a significant increase in economic sustainable development from 0.11 percent between 1987 and 1998 to 73.81 percent between 1999 and 2013 in Nigeria. However, the social and environmental sustainable development were in opposite direction with the Nigerian education reforms of about 4.50 and – 0.43 percent respectively within this same periods as economic sustainable development in Nigeria.

In addition, figure 1 and 2 exhibit the annual time series of the relationship between the expansionary education reform (quantity & quality approaches) and sustainable development in Nigeria between 1980 and 2013.

First, figure 1 indicates that the three educational enrolments rate were not consistent in their increasing trends within the period 1980 and 2013. In addition, the deviations among the three bars, representing high rate of drop-out among primary, secondary and tertiary enrolment rates in Nigeria between 1980 and 2013. In addition, the figure 1 reveals that a stagnated relationship exists between the quantitative expansion education reform and sustainable development except social sustainable development that is cyclical between 1980 and 1988 in Nigeria.

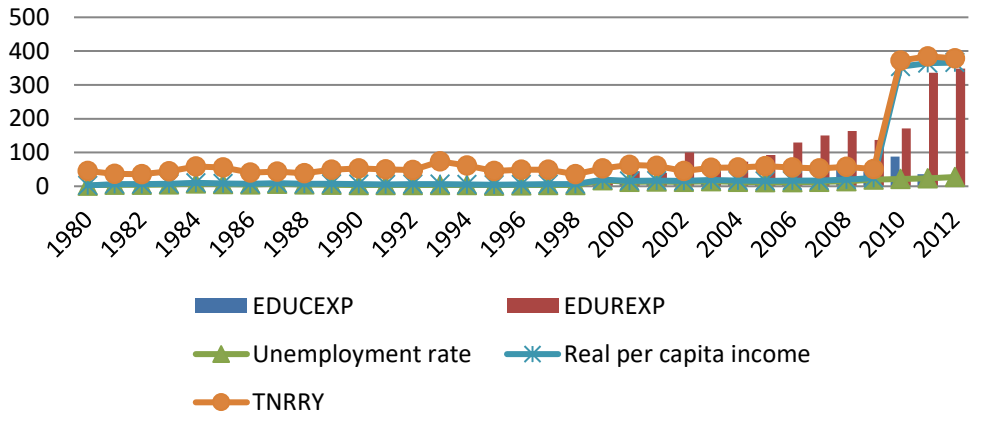
Unfortunately, between 1999 and 2013, the figure 1 found that as education enrolment rates increases, environment sustainable development proxies as total natural resources rent to GDP decreases inconsistently in Nigeria, implying that education reforms had not positively contributed to environmental sustainability as well as economic diversification to natural resources as major source of income to the economy of Nigeria. In addition, between 1999 and 2009 the increasing enrollment rates had also resulted in stagnated economic sustainable development proxies as real per capita income and worsen by a rise in unemployment rate which represents social sustainable development within the period in Nigeria

Surprisingly, between 2010 and 2013, the figure 1 shows a positive significant relationship between quantity expansion education reform and economic sustainable development while both social and environmental sustainable developments remain worse abated in Nigeria. In sum, the figure 1 reveals that between 1980 and 2008, the quantity expansion education reform contributes more to environmental sustainable development, followed by economic and least contributed is the social sustainable development in Nigeria. However, since 2009 till 2013, the quantity expansion reform shows a reduction in drop-out gap between primary and secondary enrolments education, resulting to an increased secondary enrolments which led to a positive significant contribution in economic sustainability, but continually raise the unemployment rate and natural resources rent to gdp reduction, that is, it worsen both social sustainability and environment sustainability in Nigeria.

Second, figure 2 shows the relationship between the quality expansion education reforms and sustainable development within the period 1980–2012. The quality expansion education is proxied by the recurrent expenditure on education (EDUREXP) and capital expenditure on education (EDUCEXP). The figure 2 shows that recurrent expenditure on education has a longer bar than the capital expenditure on education in all the period provided. Surprisingly, the year 2010 with the highest capital expenditure on education remains above other years bars , hence, it is indicated as the highest economic and environment sustainable development. This implies that a greater portion of capital

expenditure on education to total expenditure has a positive impact on economic and environment sustainable in Nigeria. Importantly, between 1980 and 1998, the recurrent and capital expenditure on education were indifferent and resulted in constant economic and social sustainable development, except environment sustainable development that was cyclical. By 1999, economic sustainable development witnessed a sharp rise due to improvement in public expenditure on education and thereafter remains constant between year 2000 and 2009 as high deviations were witnessed between recurrent and capital expenditure on education in Nigeria.

Fig. 2: Government Expenditure on Education and Sustainable Development in Nigeria (1980-2013)



Source: Authors, 2017

In same vein, between 1980 and 1998, the social sustainable development remains relatively insignificant due to negative and constant recurrent and capital expenditures within these periods. By 1999, the social sustainable development measured as unemployment rate witnessed a sharp rise due to poor government spending and also remains constant between 2000 and 2009, and thereafter exhibits a rising trend from 2010 to 2012, due to persistent wide deviations between recurrent and capital expenditure on education in Nigeria. This implies that as long as recurrent expenditure is greater than capital expenditure, then, unemployment rate will be abated in the country, Nigeria.

In summary, the table 1 and figures 1 and 2 trends indicated a relationship between education reforms and sustainable development in Nigeria but mixed and inconclusive for inference. Nonetheless, this study shall employ robust scientific techniques such as descriptive statistics and econometric techniques to draw a reliable inference for the policy makers.

LITERATURE REVIEWS

Conceptual Review

The concept sustainable development can be traced to the Meadows 1972 "The limits to Growth" and the Stockholm conference on the human environment in 1972. The former considered how the World rising population from 3 billion in 1960 to 7 billion in 2011 (see

www.worldmeters.info/) do not limit material wealth and thus ensure a state of global equilibrium (Robert et al., 2005). While the latter emphasized on humans and the environment relationship and the needs to address environmental challenges which leads to global poverty and hunger. Therefore, the conference suggested the solution to environmental challenges in form redistribution of wealth. Unfortunately, the Stockholm conference conclusion was difficult to frame and enforce (Stern, 2001).

The foregoing failures of the Meadows 1972 and the Stockholm 1972 conferences, the United Nations (UN) established a World commission on the environment and development (WCED) in 1984. The WCED commonly known as the Brundtland Commission, named after the chairperson Gro Harlem Brundtland. According to Brundtland (1987), "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Robert et al., 2005; Johnston & OECD, 2007).

Further, the 1992 Earth summit held in Rio De Janerio and the third UN conference on environment and Development in Johannesburg, perceived sustainable development as an integrated approach. Therefore, Strange and Bailey (2008) unpack Brundtland definition and make it explicit as:

> "Developing in a way that benefits the widest possible range of sectors, across broaders and even between generations. In other words, our decisions should take into consideration potential impact on society, the environment and the economy, while keeping in mind that: our actions will have impact elsewhere and on the future"

In summary, sustainable development is being redefined as balancing the economic, social and environmental pillars of sustainability, ruling out the prioritization of environmental issues (Berger & Steurer, 2009). Further, considering only one of these at a time leads to errors in judgement and "unsustainable" outcomes. That is, realization of economic growth alone is not enough but the interconnected balances of the economic, social and environment guarantees a sustainable development not only for the present but also for the future generations (Stranger & Bailey, 2008). Table 2 indicates sustainability pillars and indicators accordingly to the National Sustainability Council established by the Australian Government in October 2012 as:

Table 2: Sustainability Development Indicators

Sustainability pillars	Sustainability Development Indicator
Social	Education, health, community engagement, employment & security
Environmental	Climate, Atmosphere, Biodiversity & ecosystems, Water, Natural resources
Economic	Wealth & Income, housing, transport & communications, Productivity and Innovation, additional economic information

Source: Authors compilation from Robert, Thomas and Anthony, 2005.

Recently, the UN member States have adopted the Brundtland publication "Our Common Future" in the year 2014 with the establishment of seventeen (17) development goals, common known as Sustainable Development Goals (SDGs) for all countries and not only

developing countries which Millennium Development goals was anchored in the year 2000.

Theoretical Review

The neoclassical growth theory that dominated the economic philosophy for three decades (1955-1985) failed on the premise of constant returns and unexplained residual technological factors as sources of long-run growth among countries. By late 1980s, the dissatisfaction with neoclassical growth theory to explain long-run growth among nations coupled with the publication of the Brundtland report in 1987 to define sustainable development gave birth to the new theory of growth, commonly called the endogenous growth model.

The endogenous growth theory developed by Romer in 1990 as an extension of the neo-classical growth theory recognizes technological progress rate as endogenous factors, unlike exogenous in the Solow-Swan production function.

The endogenous growth theory is expressed in the production function below as:

$Y_t = F(K_t, N_t, A_t)$ _____(1)

Equation (1) above shows that the level of aggregate output depends on the quantities of capital (K_t), and labour (N_t) used in the production as well as in technology (A_t) which is treated as endogenous factor, appear as an input in the production function above.

Further, Romer in 1990 characterized the endogenous growth model as increasing returns while the technological progress represents investment as a source of long-run growth in the economy. Also, these external increasing returns are due to the technological improvements which result from (i) the rate of investment, (ii) size of the capital stock, and (iii) the stock of human capital.

Having recognized the importance of investment in human capital as assumed to be the source of technological progress under the endogenous growth model, each theory measures human capital investment differently. First, Arrow introduced the concept of learning by doing. According to this theory, the greater the level of labour input, the greater is the scope of learning and acquiring of new skills. Second, Lucas in his work in 1988 lays emphasis on the accumulation of human capital in the endogenous growth model. According to this model, acquisition of new skills and knowledge will not only make a worker more productive but also increase the productivity of capital and other workers in the economy. In a nutshell, each new knowledge or skill makes the next idea possible and so the knowledge can grow indefinitely, implying sustainability not only for the present but for future generations.

The Lucas Cobb-Douglas production function is expressed as:

$Y = Ak^{a} (HeL)^{1-a}$ _____(2)

Where the technology coefficient, A represents the external effect of human capital productivity (H) and Labour productivity (eL). In addition, the quantity of K represents the stock of physical capital in the economy, while the human capital (H) is a function of labour input in the function 2 above.

In the literature, sustainable development is composed of three broad objectives: the economic objectives, social objectives, and the environmental objectives. Importantly, none

of these objectives shall be neglected towards achieving a long-run growth for sustainable development.

Of these objectives, environmental sustainable development is concerned with the interaction of economic growth, economic policies and the natural environment. Recent studies especially among the natural resource-rich countries examined the growth-environment relationship to achieve sustain growth in the long-run, without compromising the present needs. The findings are however inconclusive in the literature (see Gylfason, 2001, Auty, 2007).

In this study, the environmental Kuznets curve (EKC) in 1955 pioneers the inverted U-shaped relationship between economic growth and environmental quality (Panayotou, 2000a cited in Tim et al., 2010). This curve exhibits an increasing environmental degradation and economic growth at initial and lower income rates. However, after the turning point, increases in GDP per capita lead to reduction in environmental damage. This is depicted in the figure below as:

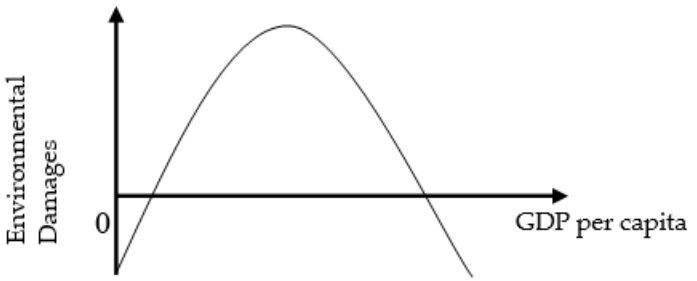


Figure 1: The Environmental Kuznets curve

Following the theoretical interactions between the endogenous growth theory and the environmental Kuznets hypothesis, it is important to empirically analyse the long run relationship between education reforms and sustainable development in Nigeria, unlike several previous studies (Ogunade, 2011; Omojimite, 2011; Ajibade, 2013; Kola-Olusanya, 2013) that assessed the theoretical relationship between human capital development and sustainable development while only a few studies like (Valeria and Salvatore, 2006 and Alam, na) empirically examined the long run relationship between human capital development and sustainable environmental development.

Empirical Review

Barro (2001) studied education as a measure of human capital. His results showed that economic growth is positively related to starting level of average years of school enrolment of adult males at the secondary and higher level. The results further revealed that the quantity of school education and its impact on economic growth is different among rich and poor countries.

Dowrick (2002) examined the relationship between economic growth and R & D (Research & Development). His study showed that education and R & D are substantial sources to promote economic growth. Participation rate in education and public expenditures on education increased during 19th & 20th centuries, leading to 40 percent increase in Enrolment rate in public education system from 1870 to 2001 and also public expenditure

on education increased from 0.86 percent to 4.85 percent of GDP during the same time period.

Bashiru, Herath & Gebremedhin (2012) examined the empirical analysis of higher education on economic growth in West Virginia. They found that income growth and education growth are positively related while education growth reduces population growth in West Virginia.

Akinleye & Ogunyomi (2016) examined the empirical investigation of whether human capital accumulation affect unemployment rate in Nigeria? They found that human capital accumulation does not reduce unemployment rate but fiscal policy does affect unemployment rate reduction in the long-run within the period 1980 – 2013 in Nigeria.

Babasanya, Ogunleye & Ogunyomi (2017) investigated the long-run relationship between human capital development and environment and sustainable development in Nigeria using VECM techniques. They found a weak positive relationship between HCD and sustainable development. Further, the results revealed that Human capital development is a strong catalyst to speedily shock other cointegrating variables within a shorter period that converges to a long-run equilibrium within the period 1977 and 2013 in Nigeria.

Sahlberg (2006) examined the role of education reform in raising economic competitiveness within and between countries and the world's regions. He found no competition between education systems, schools and students but suggests that education systems should be flexible to encourage creativity in schools and thus leads to open-sharing of ideas at all levels of education to achieve a raising economic competitiveness.

METHODOLOGY SOURCES OF DATA AND VARIABLE MEASUREMENT

Model Specification

This study adapted the empirical works of Barro (2001) and Babasanya, Ogunleye & Ogunyomi (2016). First, Barro (2001) measured education by considering only the quantitative education measures of the average years of school. In our model, the education was measured using both quantitative and qualitative measures as suggested by (Mullian & Sala- i -Martin, 1995). The quantitative education measures used all the three tiers of enrolment rates while the qualitative education measures employed the public expenditure on education, comprising of both capital expenditure and recurrent expenditure on education.

Second, the works of Babasanya, Ogunleye & Ogunyomi (2016) that focused on environment sustainable development was extended in our study and considered all the three pillars of sustainable development — Economic, Social and environment sustainable development as identified and measured in table 2 of this study.

Based on the foregoing theoretical and empirical studies and the main objective of this study, our adapted model is specified into three independent equations:

$$RPCI_g = f(L_t, K_t, A) \quad \text{——— (3)}$$

$$UNR_g = f(L_t, K_t, A) \quad \text{——— (4)}$$

$$Tnrry_g = f(L_t, K_t, A) \quad \text{——— (5)}$$

Where $RPCI_g$, UNR_g and $Tnrry_g$ represent economic, social and environmental sustainable development as the dependent variable for each equation respectively. Further, the $RPCI_g$ is real per capita income growth; the UNR_g is the unemployment rate growth, and the $Tnrry_g$ is the total natural resources rent to income respectively. The independent variables L_t, K_t and A are labour, capital and total factor productivity. Further, the labour is proxied by education, comprising, the quantitative and qualitative education. The qualitative education is represented by the three education tiers enrolment rates, which ranges from primary enrolment rate, secondary enrolment rate and tertiary enrolment rate while the quantitative education is proxied by public expenditure on education, comprising of capital expenditure on education and recurrent expenditure on education. Also, the capital represents the economic infrastructure, measured as ratio sum of public housing and road construction expenditure to public expenditure. Finally, the total factor productivity is a vector of relevant control variables such as growth rate of GDP (*GDPg*), political stability (*POS*) and ratio of information and communication technology to total public expenditure (*ICTR*) respectively. The control variables except *POS* are justified in the work of Babasanya, Ogunleye and Ogunyomi (2016).

Therefore, our econometric estimated equations are specified in equations 6, 7 and 8:

$$RPCIG_t = \alpha_0 + \alpha_1 PER_t + \alpha_2 SER_t + \alpha_3 TER_t + \alpha_4 log(EDUCEXP_t) + \alpha_5 log(EDUREXP_t) + \alpha_6 K_t + \alpha_7 GDPG_t + \alpha_8 POS_t + \alpha_9 ICTR_t + \varepsilon_t \quad (6)$$

$$UNRG_t = \alpha_0 + \alpha_1 PER_t + \alpha_2 SER_t + \alpha_3 TER_t + \alpha_4 log(EDUCEXP_t) + \alpha_5 log(EDUREXP_t) + \alpha_6 K_t + \alpha_7 GDPG_t + \alpha_8 POS_t + \alpha_9 ICTR_t + \varepsilon_t \quad (7)$$

$$TNRRYG_t = \alpha_0 + \alpha_1 PER_t + \alpha_2 SER_t + \alpha_3 TER_t + \alpha_4 log(EDUCEXP_t) + \alpha_5 log(EDUREXP_t) + \alpha_6 K_t + \alpha_7 GDPG_t + \alpha_8 POS_t + \alpha_9 ICTR_t + \varepsilon_t \quad (8)$$

Where α_1 to α_9 are the elasticities, while α_0 is constant and ε_t is the white-noise error. All the expected sign of the elasticities are positive in eq (6) and (8). While eq (7) all have an expected negative sign. In addition, *POS* is a dummy variable. The "0" proxies political instability while "1" proxies political stability.

Types and Sources of Data

The dataset used in this study was secondary data in the form of annual time series, ranging from 1980 to 2018. All the data except *Tnrry*, *PER*, *SER* and *TER* are sourced from the Central Bank of Nigeria (CBN) statistical bulletins (2019) and National Bureau of Statistics (NBS). While the mentioned variables are sourced from the World Development Indicators (WDI) database (2019).

Estimation Techniques

In this study, the least square (OLS) techniques was employed to achieve the broad objective of the study. Specifically, the vector error correction multivariate cointegration (VECM) model was used to estimate the long-run and short-run relationships of education reforms and sustainable development in Nigeria within the period of study. Further, the time series dataset are tested using the Augmented Dickey Fuller (ADF) unit root test and the Johansen multivariate cointegration test to ascertain individual stationary level and the long-run comovement of the non-stationary included variables respectively and importantly, to avoid spurious regression results. These estimation techniques are performed using Eviews 7.0 econometric software in this study.

RESULTS AND DISCUSSION

Descriptive Results

Descriptive Statistics

Table 3 shows the summary of the descriptive statistics of education reform and sustainable development, comprising of economic, social and environmental sustainable development for this study. First, the second column shows that *PER* is the highest mean value of 93.95 while the *POS* is the lowest mean value of 0.40 in the table 3. Second, the fifth column shows the degree of variability for each included variables in this study. In this study, the highest variability is the economic sustainability development ($RPCI_g$) (13.35), followed by primary enrolment rate (*PER)* (9.26) and the least variability is the environmental sustainability development ($Tnrry_g$) (0.32).

Table 3: Descriptive Statistics for Education Reforms and Sustainable Development in Nigeria

Variable	Mean	Max.	Min.	Standard Deviation	Jarque-Bera	Observations
RPCIg	2.63*	73.11*	–0.08*	13.35*	897.99* (0.00)	38
Unrg	0.19*	4.00*	– 0.41*	0.78*	468.74* (0.00)	38
Tnrryg	0.05*	1.21*	– 0.34*	0.32*	35.61* (0.00)	38
PER	93.95***	112.8	78.5	9.26	1.67*** (0.43)	38
SER	28.24	43.8	17.00	5.50	4.22 (0.12)	38
TER	5.56	10.4	1.94	2.33	1.53 (0.46)	38
LEDUCEXP	0.95	4.48	–1.97	2.03	2.60 (0.27)	38
LEDUREXP	2.18	5.14	–0.67	2.14	2.99 (0.22)	38
K	2.29	7.78	0.28	1.85	17.62 (0.00)	38
GDPG	0.26*	6.96*	–0.07	1.26	913.88 (0.00)	38
POS	0.40	1.00	0.00	0.50	5.03 (0.08)	38
ICTR	3.73	14.5	0.69	3.39	29.20 (0.00)	38

Source: Authors' compilation from Eviews results (2017)

(b) P values are in parenthesis

(c) * and *** represents individual types of sustainable development -economic, social & environment and some for all types of sustainable development.

Further, the higher variability among the included variables suggest for Jarque-bera test. The sixth column shows the Jarque-bera test for the normality distribution of each included variables and found that all except economic sustainable development, social

sustainable development (unr_g), environment sustainable development ($Tnrry_g$), economic infrastructure (k), initial economic growth ($GDPG$) and $ICTR$ were normally distributed, if the p-value is greater than 0.10 percent and thus, accept the null hypothesis. Finally, the included variables are large sample size and parametric data but political stability (POS) is a nominal data, that is, non-parametric data in this study.

Matrix Correlation

Table 4: Matrix Correlations result of Education reforms and Sustainable Development in Nigeria.

Variables	RPCIg	UNRg	Tnnryg	PER	SER	TER	LNEDUCEXP	LNEDUREXP	k	GDPG	POS	ICTR
RPCIg	1.000	NA	NA									
UNRg	NA	1.000	NA									
Tnnry	NA	NA	1.000									
PER	–0.17*	0.05**	0.09***	1.00								
SER	0.50*	–0.20**	–0.18***	–0.17	1.00							
TER	–0.31*	–0.06**	–0.09***	–0.02	0.30	1.00						
LNEDUCEXP	0.32*	0.11**	–0.10***	–0.21	0.67	0.58	1.00					
LNEDUREXP	0.24*	0.02**	–0.13***	–0.22	0.71	0.69	0.96	1.00				
K	0.55*	–0.08**	–0.15***	–0.10	0.26	–0.34	–0.01	–0.05	1.00			
GDPG	–0.03*	0.07**	–0.20***	0.36	0.03	–0.20	–0.26	–0.21	0.30	1.00		
POS	0.22*	0.18**	–0.10***	0.05	0.64	0.60	0.84	–0.87	–0.03	–0.14	1.00	
ICTR	–0.01*	0.13**	0.24***	0.38	–0.31	–0.42	–0.17	–0.30	–0.13	–0.05	–0.18	1.00

Source: Authors' compilation from Eviews results (2017)

Table 4 shows the degree of association between the dependent variables —economic, social and environment sustainable development and the included explanatory variables in this study. First, the second column shows the bivariate matrix correlations between economic sustainable development and the included explanatory variables. All the included variables shows positive correlations except primary enrollment rate (PER), tertiary enrollment rate (TER), initial economic growth ($GDGP$) and information and communication technology expenditure to total expenditure ($ICTR$) in this study. Further, the economic infrastructure (k) shows the highest positive association with the dependent variable, economic sustainable development, followed by secondary enrollment rate (SER) and POS is the least positive association in the study. Also, TER is the highest negative correlation with economic sustainable development in Nigeria.

Second, the third column also showed the degree of association between the social sustainable development and the included explanatory variables. Here, the political stability (POS) is the highest positive association (0.18) and followed by $ICTR$ (0.13) while capital expenditure on education ($LnEDUCEXP$) is the lowest positive association (0.02) in this study. Also, SER is the highest negative association with social sustainable development within this period of study.

Third, the fourth column showed the matrix bivariate relationship between environment sustainable development ($Tnrry_g$) and the included explanatory variables in this study. All but PER and ICTR exhibited negative associations with environment sustainable development ($Tnrry_g$) within period of study. The ICTR is the highest positive correlation (0.24) while the GDPG is the highest negative association with the environment sustainable development ($Tnrry_g$) within the study period in Nigeria.

Time Series Econometric Results

Unit Root Test

Since macroeconomic time series dataset are usually non-stationary and leads to spurious regression results, it becomes imperative to conduct pre-estimation tests, including unit root test and cointegration test. A unit root test is used to determine the stationarity of each series or variables as well as confirm that the mean and autocovariances of this series or each variable do not depend on time. In this study, Augumented Dickey-Fuller test is employed because the series observations are of large sample as well as accounts for serial correlation problems in the residual over other unit root tests in the Eviews 7.0 Packages (Eviews 7 users manual II ,2010). Further, the constant with trends unit root equation is employed in this study because all series exhibited trends and constant within the period of study. Therefore, the constant with trend ADF unit root equation is expressed in eq (9):

$$\Delta Y_t = \alpha + \beta_i Y_{t-i} + \phi T + \sum_{i=1}^{k} \lambda_i \ \Delta Y_{t-i} + \mu_t \quad \text{_____ (9)}$$

Where Y is the variable under consideration, Δ is the first difference operator, t captures anytime period, μ_t is a random error, and k is the maximum lag length. The α, β, ϕ and λ are the estimated parameters. If the $\beta = 0$, then the series is said to be non-stationary and accept the null hypothesis, that is, presence of a unit root in the series or the variable.

Table 5: Augumented Dickey Fuller (ADF) Unit root tests results

Variables	H_0 : $\beta = 0$ (Non-stationarity) H_1 : $\beta < 0$ (Stationarity) Constant linear trend	Integrate order
RPCIg	– 5.84*** (0.0002)	I(1)
UNRg	– 6.903*** (0.000)	I(1)
Tnrry	– 6.863*** (0.000)	I(1)
PER	– 4.666*** (0.0045)	I(2)
SER	– 4.48*** (0.0067)	I(1)
TER	– 7.043*** (0.000)	I(2)
LNEDUCEXP	– 6.198*** (0.0001)	I(1)
K	– 7.326*** (0.000)	I(1)
GDPG	– 4.603*** (0.006)	I(1)
ICTR	– 4.394*** (0.009)	I(1)

Source: Authors' compilation from Eviews results.

Note: (a) *** significant at the 1% level; ** at 5% level and * at the 10% level.

(b) P values are parenthesis.

Table 5 reveals that all the included variables were non-stationary until first differenced, I(1) and second differenced, I(2) order at 1% significant level. Further, the non-stationary variables at 2nd differenced, according to Peseran et al (2001) disregards I(2) and consider I(1) if it gives the lowest AIC when compared with I(2). Therefore, in this study, *PER* and *TER* at I(2) are replaced with I(1) because the I(1) has the lowest AIC when compared with I(2) in table 5. Therefore, all the included variables have same order of differenced, that is, I(1).

Multivariate Cointegration test

The conintegration test is the second pre-estimation test to justify the existence of long run relationship among the included non-stationary variables in the study. The multivariate cointegration test, common known as Johansen cointegration test was employed in this study because all the individual series in table 5 have same order of integration I(1). In addition, the objective of long run relationship between education reforms and sustainable development within the study period in Nigeria also necessitated the used of Johansen cointegration test in this study.

The Multivariate cointegration test is expressed in eq (10):

$X_t = k_0 + k_1\Delta X_{t-1} + k_2\Delta X_{t-2} + \ldots.. + k_{p-1}\Delta X_{t-p} + \Pi X_{t-p} + \mu_t$ _____(10)

Where X_t = (*RPCIg*, *UNRG*, *TnrryG*, *PER*, *SER*, *TER*, *LNEDUCEXP*, *k*, *GDPG*, *ICTR*)

X_t = a 8 × 1 vector of variables that are integrated of order one (i.e. I(1))

K = a 8 × 8 matrix of coefficient

Π = 8 × 8 matrix of parameters and

μ = a vector of normally and independently distributed error term.

More importantly, the *RPCIg*, *UNRG* and *Tnrry* are the endogenous variables, while the other eight (8) are exogenous variables in this model. Also, the presence of r cointegrating vectors between the elements of *X* implies that Π is rank *r* ($0 < r < N$). The *N* is the number of elements of *X*, which is 8. Then Π is a rank *r* ($0 < r < 8$).

Further, Johansen developed two likelihood ratio tests to determine the number of cointegrating vectors: Trace test (λ_{trace}) and Maximum Eigen-value test (λ_{max}). The two tests are expressed in equation (11) and (12):

$$\lambda_{trace} = -T\sum_{i=r+1}^{n}\ln(1-\lambda_i^2) \_\_\_\_\_ (11)$$

$$\lambda_{max.(r,\,r+1)} = -T\ln(1-\lambda_{r+1}) \_\_\_\_\_ (12)$$

Where λ_i is the estimated values of the ordered Eigen-values obtained from the estimated matrix and *T* is the number of observation after the lag adjustment. More importantly, if there is a divergence in results between these two tests, the λ_{max} test is superior over the λ_{trace} test for its reliability in small sample (Mukhtar and Rasheed, 2010).

Table 6 established the cointegration relationship among the included explanatory variables and the dependent variables, economic, social and environment sustainable development using the Johansen maximum likelihood method. The two statistics trace (λ_{trace}) and Maximum Eigen-values (λ_{max}) statistics indicate that there are six and six cointegrating vectors respectively in this study.

This implies that Π is a rank *r* and therefore the results reject the null hypothesis of no cointegrating vector in favour the alternative hypothesis. This concludes that a long run relationship exists between education reforms and sustainable development within the study period in Nigeria.

Table 6: Johansen Cointegration test for Education reform and Economic Sustainable Development

Null hypothesis	Trace (λ) Statistics	Critical value	Prob.	Null hypothesis	Maxi-Eigen Statistics	Critical value	Prob.
$H_0 : r = 0^{*(**)(***)}$	360.70 (367.64) (489.93)	187.47	0.00	$H_0 : r < 0^{*(**)(***)}$	110.47 (95.96) (166.79)	56.71	0.00
$H_0 : r = 1^{*(**)(***)}$	250.23 (271.68) (323.14)	150.56	0.00	$H_0 : r \leq 1^{*(**)(***)}$	75.07 (81.09) (85.43)	50.60	0.00
$H_0 : r = 2^{*(**)(***)}$	175.16 (190.58) (237.71)	117.71	0.00	$H_0 : r \leq 2^{*(**)(***)}$	51.42 (67.69) (70.49)	44.50	0.00
$H_0 : r = 3^{*(**)(***)}$	123.74 (122.90) (167.22)	88.80	0.00	$H_0 : r \leq 3^{*(**)(***)}$	50.89 (55.07) (56.48)	38.33	0.00
$H_0 : r = 4^{*(**)(***)}$	72.84 (67.83) (110.74)	63.88	0.00	$H_0 : r \leq 4^{*(**)(***)}$	39.53 (35.51) (46.34)	32.12	0.00
$H_0 : r = 5^*$	64.41 (32.32) (31.33)	42.92	0.00 0.37	$H_0 : r \leq 5^*$	38.60 (18.50) (17.77)	25.82	0.00 0.34 (0.26)
$H_0 : r = 6$	13.54 (13.82) (25.81)	25.87	0.67 0.05	$H_0 : r \leq 6$	4.50 (9.68) (18.28)	19.39	(0.67) 0.07 (0.65)
$H_0 : r = 7$	4.04 (4.14) (7.53)	12.52	0.29 (0.72)	$H_0 : r \leq 7$	4.04 (4.13) (7.53)	12.52	(0.74) 0.29 (0.72)

Source: Author's compilation from Eviews result

Note (a) * (**) and (***) denotes rejection of the null hypothesis at 0.05 significant level and represents economic, social and environment sustainable development.

(b) Trace test indicates 6, 5 and 5 cointegrating equation(s) at the 0.05 level.

(c) Maxi-Eigen value test indicates 6, 5 and 5 cointegrating equation(s) at the 0.05 level.

(d) Also * (**) and (***) represents results of economic, social and environmental sustainable development respectively.

VECM Estimates and Discussion

The table 7A–7C show the long-run and short-run vector error correction model (VECM) estimates of education reforms and sustainable development within the study periods in Nigeria. Further, each table specifically presents the long-run and short-run VECM estimates of education reforms and economic, social and environmental sustainable development in Nigeria.

Table 7A: Summary of Long-run and Short-run VECM estimates (1980-2018)

Regressor	**Long-run estimates**
RPCIG (–1)	1.0000
PER (–1)	–0.014(–19.667)***
SER (–1)	0.021(10.123)***
TER (–1)	–0.054(–11.327)***
LnEDUCEXP (–1)	0.098(19.631)***
K (–1)	0.045(9.999)***
GDPG (–1)	0.296(36.608)***
ICTR (–1)	–0.107(–36.516)***
C	1.119

Short-run estimates								
	D (RPCIG)	**D (PER)**	**D (SER)**	**D (TER)**	**D (LnEDUCEXP)**	**D (K)**	**D (GDPG)**	**D (ICTR)**
Constant	3.02 (0.953)	–0.45 (–0.393)	0.677 (1.387)	0.010 (0.055)	0.283 (2.579)	0.469 (0.951)	0.187 (1.700)	–0.281 (–0.619)
ECT (–1)	9.957 (1.157)	–0.106 (–0.035)	–0.951 (–0.717)	–0.300 (–0.635)	0.701 (2.352)**	–0.903 (–0.674)	–4.393 (–14.693)***	5.009 (4.059)***
R^2	0.344	0.343	0.414	0.519	0.503	0.410	0.958	0.566
Adjusted R^2	0.02	0.02	0.121	0.277	0.255	0.115	0.937	0.349
SE of Regression	13.07	4.90	2.11	0.75	0.47	2.13	0.48	1.96
F-Stat	1.05	1.05	1.41	2.15	2.03	1.39	45.31	2.61

Source: Author's compilation from Eviews result

In table 7A, the long-run estimates reveal that all included explanatory variables except a one year lagged primary enrolment rate (*PER*), tertiary enrolment rate (*TER*) and the ratio of information and communication technology expenditure to total expenditure (*ICTR*) have a positive significant impact on the economic sustainable development within the period of study in Nigeria. Further, the result found that initial economic growth (*GDPG*) has the highest positive significant impact on the economic sustainable development within the period 1980-2018 in Nigeria. This implies that a one percent increase in initial economic growth will leads to 29.6 percent increase in the economic sustainable development in the long-run of study in Nigeria. While for the two education reform variables, the results revealed that a one year lagged capital expenditure on education has a low positive significant impact on economic sustainable development by 9.8 percent than the a one-year lagged secondary enrolment rate (*SER*) positive significant by 2.1 percent in the long-run. This suggests that quality education reform, measured by public expenditure on education has more positive impact than the quantity expansion education reform, measured by enrolment rates within the period 1980-2018 in Nigeria. Also, the economic infrastructure coefficients of 0.045 at 1% significant level, indicates that a one percent increase in economic infrastructure will also leads to a 4.5 percent increase in the economic sustainable development in the long-run. Finally, the intercept coefficient 1.119 indicates that without included explanatory variables, economic sustainable development is achievable in the long-run of the period of study in Nigeria.

On the other hand, the short-run VECM estimates in this study found that of all the endogenous variables that can speedily adjust to the long-run equilibrium path and initial economic growth has the highest convergence speed rate to the long-run equilibrium within the short-run at 1 percent significant level, followed by *PER*, *SER*, *K* and *TER* but not statistically significant at either 1% or 5% or 10%. In addition, the high convergence rate of –4.393 implies that initial economic growth will converge quickly to the long run equilibrium, that is, economic sustainable development within the shortest period in

Nigeria. Further, the study found that only the quantity expansion education reform in terms of *PER*, *SER* and *TER* do converge to long-run equilibrium path but not statistically significant within the short-run in Nigeria. This implies that the changes in the quantity expansion education reform could achieve economic sustainable development but not reliable within the short-run in Nigeria.

Table 7B also showed the long-run and short-run VECM estimates of education reform and social sustainable development within the period 1980-2018 in Nigeria. Specifically, the long run estimates found that all but a one-year lagged primary enrolment rate (*PER*) and capital expenditure on education have negative impact on social sustainable development in Nigeria. However, only Tertiary enrolment rate (*TER*), economic infrastructure (*K*), initial economic growth and information and communication technology expenditure (*ICTR*) were negative and statistically significant at 1% level. Further, the results revealed that economic infrastructure (*K*) has the highest negative significant impact on social sustainable development by 55.9 percent, followed by *TER* (24.4 percent) and the least was initial economic growth by 8.7 percent. Finally, the intercept value of 3.115 implies that without the included explanatory variables, social sustainable development is achievable in the long-run in Nigeria.

Table 7B: Summary of Long-run and Short-run VECM estimate for Education reform and Social Sustainable Development in Nigeria (1980-2018)

Regressor				**Long-run estimates**				
UNRG (–1)				1.0000				
PER (–1)				0.0048(0.772)				
SER (–1)				–0.020(1.149)				
TER (–1)				–0.244(–5.885)***				
LnEDUCEXP (–1)				0.1152(2.701)***				
K (–1)				–0.559(–14.485)***				
GDPG (–1)				–0.087(–14.485)***				
ICTR (–1)				–0.186(–7.340)***				
C				3.115				
Short-run estimates								
	D (UNRG)	**D (PER)**	**D (SER)**	**D (TER)**	**D (LnEDUCEXP)**	**D (K)**	**D (GDPG)**	**D (ICTR)**
Constant								
ECT (–1)	–0.437 (–2.03)**	0.92 (0.748)	0.786 (1.36)	0.131 (0.647)	–0.153 (–0.999)	1.73 (3.80)	0.248 (0.532)	0.282 (0.443)
R-squared	0.698	0.448	0.417	0.533	0.309	0.643	0.460	0.394
Adjusted R^2	0.546	0.172	0.126	0.300	–0.036	0.464	0.189	0.091
SE of Regression	0.783	4.49	2.11	0.74	0.56	1.66	1.70	2.32
F-Stat	4.61	1.62	1.43	2.29	0.90	3.59	1.70	1.30

Source: Author's compilation from Eviews result

The t-statistics are in parenthesis and the t-tabulated values for 1%, 5% and 10% are represented by ***, ** and *.

More importantly, the results established that quantity expansion education reform comprising of *SER* and *TER* have negative significant impact on social sustainable development than the capital expenditure on education (EDUCEXP) in the long-run period of study in Nigeria.

While the VECM short-run estimates in table 7B revealed that only a change in capital expenditure on education has the expected negative sign, which implies that a change in

capital expenditure on education can converge to the long-run equilibrium path within a short period but not statistically significant at 10% level. Therefore, a first difference change in capital expenditure on education is not reliable to affects other endogenous variables in the system within the short-run. Further, the expected negative sign of a first differenced change in unemployment growth rate of –0.437 is high and significant at 5 percent level. This implies that the change in unemployment growth rate can speedily affects other endogenous variables in the system within the shorter period to converge to the long-run equilibrium path in Nigeria. In sum, the quality education reform, proxies by capital expenditure on education is superior over the quantity expansion education reform to achieve social sustainable development within short period in Nigeria.

Table 7C: Summary of Long-run and Short-run VECM estimate for Education reform and Environment Sustainable Development in Nigeria

Regressor	**Long-run estimates**
Tnrryg (–1)	1.0000
PER (–1)	0.0087(3.184)***
SER (–1)	–0.085(–10.606)***
TER (–1)	–0.02(–1.160)
LnEDUCEXP (–1)	0.0998(5.205)***
K (–1)	–0.0741(–4.268)***
GDPG (–1)	–0.132(–4.381)***
ICTR (–1)	–0.076(–7.312)***
C	2.0006

Short-run estimates

	D (Tnrryg)	**D (PER)**	**D (SER)**	**D (TER)**	**D (LnEDUCEXP)**	**D (K)**	**D (GDPG)**	**D (ICTR)**
C	0.04 (0.59)	–0.46 (–0.40)	0.53 (1.16)	–0.05 (–0.33)	0.29 (2.18)	0.43 (0.85)	0.04 (0.15)	–0.32 (–0.52)
ECT (–1)	–0.767 (–4.124)***	0.367 (0.129)	2.517 (2.190)	0.825 (2.08)	–0.304 (–0.922)	–0.045 (–0.036)	2.196 (3.292)	0.613 (0.406)
R-squared	0.646	0.345	0.489	0.605	0.293	0.390	0.755	0.242
Adjusted R-squared	0.469	0.017	0.233	0.408	–0.059	0.084	0.632	–0.137
SE of Regression	0.319	4.89	1.97	0.68	0.57	2.17	1.15	2.59
F-Stat	3.65	1.05	1.91	3.07	0.83	1.28	6.16	0.64

Source: Author's compilation from Eviews result

The t-statistics are in parenthesis and the t-tabulated values for 1%, 5% and 10% are represented by ***, ** and *.

Finally, table 7C also revealed the long-run and short-run VECM estimates of education reform and environmental sustainable development in Nigeria. First, the long-run VECM estimates found that only one-year lagged capital expenditure on education and *PER* have positive significant impact on environmental sustainable development in the long-run in Nigeria. Unfortunately, other included explanatory variables have a negative significant impact on environmental sustainable development in the long-run in Nigeria. This results empirically established that quality education reform, measured by capital expenditure on education has more significant impact on environmental sustainable development by 9.9 percent than the quantity education reform, measured by primary enrolment rate of 0.8 percent within the period of study in Nigeria at the long-run. More importantly, the results found that initial economic growth has the highest negative impact on environmental sustainable development at the long-run in the Nigeria by 13.2 percent. That is, a one percent increase in initial economic growth will leads to a 13.2 percent decrease in environmental sustainable development in

Nigeria. This finding is supported by Kuznets environment (1995) that initial economic growth adversely affects environmental sustainable development. Finally, the intercept value of 2.0006 indicates that other explanatory variables not included in this study positively affect environmental sustainable development in the long-run.

On the other hand, the short-run VECM estimates found that environmental sustainable development (*Tnrryg*), capital expenditure on education (*Lneducexp*) and economic infrastructure (*k*) have the expected negative sign but only environmental sustainable development (*Tnrryg*) is statistically significant at 1 percent level. Further, the environmental sustainable development (*Tnrryg*) coefficient value of –0.767 is high which implies a faster convergence rate to affect other endogenous variables within the system at a shorter period towards a long-run equilibrium path in Nigeria. Also, the study found that a change in capital expenditure on education and economic infrastructure (*k*) will speedily affects other endogenous variables within the system towards a long-run equilibrium path within a short-run in Nigeria. In summary, quality education reform, proxies as capital expenditure on education is most relevant than the quantity expansion education reform in achieving environmental sustainable development within a short period in Nigeria.

CONCLUSION AND POLICY IMPLICATIONS

The main objective of this study was to empirically examine the relationship between education reforms and the sustainable development, consisting of economic, social and environmental in Nigeria within the period 1980-2018 using vector error correction model (VECM) techniques. First, the long-run VECM estimates concludes that quality education reform proxied by capital expenditure on education has positive significant impact on economic and environmental sustainable development within the study periods in Nigeria. Also, the quantity expansion education reform, specifically, secondary enrolment rate (*SER*) and tertiary enrolment rate (*TER*) have negative impact on social sustainable development in the long-run in Nigeria. Second, the short-run VECM estimates concludes that changes in quality education reform, measured by capital expenditure on education do speedily affect social and environmental sustainable development within the short period while the changes in quantity expansion education reform also converge to economic sustainable development within the short-run in Nigeria. Following the empirical results, the policy implication of this study is in two folds. First, the government should see the two education reforms – quantity and quality expansion education reforms as complimentary and not substitutes in achieving sustainable development – economic, social and environmental in Nigeria by the year 2030. Second, the government should intensify efforts to increase economic growth and economic infrastructure in achieving a successful education reforms which will guarantee sustainable development in Nigeria by the year 2030.

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