Impact of Innovation for 21st Century Educational Sector in Nigerian Economic Growth

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Authors' contributions

This work was carried out in collaboration between these authors. Author ALE designed the study, wrote the introductory part of the paper and the literature review. Author KAH designed the theoretical framework of this paper upon we designed the model for the paper and author IMS designed the variables that formed the model for the study, tested the formulated model by using the RGDP as the dependent variable and TGEXPE, TGEXP, INFL, POL, CPI as the independent variables. To run the econometric analysis, Eview 7.2 statistical windows was employed, which enabled us to draw the summary and recommendations from the result findings. All authors read and approved the final manuscript.

Article Information

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ABSTRACT

The paper examined the impact of innovation for 21st century educational sector in Nigeria. The paper employed the secondary data and sourced from the National Bureau of Statistics (NBS), Statistical Bulletin of Central Bank of Nigeria. With the aid of statistical package (E-views, version 7.2); the model was estimated using annual time series data from 1960 to 2012. The paper

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employed the characteristics of each time series by testing their stationarity using Augmented Dickey Fuller (ADF) tests, including co-integration tests and Error Correction model through over-parameterization and parsimonious of the variables to enable the researcher to ascertain both short run and long run equilibria. The result of the findings had a strong implication on government expenditure in Nigeria. The paper recommended that there is the need for government to increase budgetary allocation to the educational sector, as to the recommendation of the United Nations that 26% budgetary allocation to education, ensure that information communication technology (ICT) is introduced at least for the teachers and students to have fundamental knowledge about computers and internet. This will facilitate the new approach to teaching and learning, ensure that zero corruption tolerance exist in educational sector since it has a direct relationship with economic growth.

Keywords: Education; teaching; learning; innovation; growth.

1. INTRODUCTION

Education is said to be the bedrock of any nation that has growth and/or development as one of her objectives. Hence, a conducive social and/or working environment for innovations and/or transformations is desirable in the educational sector [1]. The desire of educational sector to meet up with the pace of growth and/or development requires the government and/or educational operators (.i.e. public and private) to look inwards and/or make innovations a priority in the school system. For any economy to achieve her growth and/or development (i.e. full potentials or utilizations of her full capacity) depends on swiftness in education. In other words, significant proportion of her population should be educated, that is having new skills, ability, dexterity, intellects and knowledge to face the competition among nations across the globe [1].

According to new endogenous growth theory, development of human capital (in addition to physical capital stocks and technological advancements) is *sine qua non*. This sector is quintessential to a nation that needs to attain development and/or proper handling of her technologies. Globalization has brought about technological development or enhancement, which every nation needs to be acquitting with. Therefore, it is sufficient to speak that education has direct relationship with economic growth and beside, contributes a significant percentage to Gross Domestic Product (GDP) [2]. No nation could attain development without swiftness in developing the educational sector [3].

Innovation in education could be achieved, if and only if, the culture of innovation is embedded in the educational system of 21st century. Innovation may seem as a transformation to many, but not accurately. Over the centuries, the educational system in Africa most especially Nigeria was crude (i.e. moving from standard one to six, before college and/or teaching and learning was subjectively and symmetrically crude—where chalks, local boards, etc were used). In the 21st century, the educational system has worn a new face; in other words, absolute innovation has taken place. In the words of [1] innovation means to be operating in new methodologies or new inventions or attitudinal changes. This is most especially true now that economies of the World are liberalized (or globalized). Innovation started manifesting in Nigerian secondary schools when they started operating 6-3-3-4 systems and more examination bodies beside WAEC, GCE and JAMB were introduced—such as: (i) NECO and (ii) NABTEB. These examinations are parameters to measure who is qualified to be admitted into the Universities or Polytechnics or Monotechnics or colleges of Education in Nigeria and some West African Countries [1,4].

The 21st century educational (e-education) system incorporates new devices for e-teaching and e-learning—such as: (I) Computer systems; (ii) Internet services; (iii) Laptops; (iv) Mini and Macro Computers and Projector Transmissions, Conference Teaching and Learning. Computer departments have been introduced to various tertiary institutions in Nigeria. While in both primary and secondary schools, computer teachers are being employed to teach this subject, in order for the pupils to have fundamental or peripheral knowledge of computers. Many Information and Computer Technology (ICT) or Information and Communication Technology (ICT) laboratories have been built and/or stocked with computer facilities for students in Nigerian schools, in order for them to be abreast with the new technologies

or methods for online reading, learning and doing assignments. Perhaps, this is possible through Google windows, CM Browser, Browser, Firefox, Opera Mini, CU Browser, Maxton Browser, YouTube, Chrome and others. Most tertiary institutions in Nigeria now conduct data base tests for new entrance into various departments of the institutions. Soon it will cascade to secondary and primary schools [5].

Having discussed the 21st century structure of the educational system, government has a significant role to play in terms of financing (i.e. providing finances to acquiring the facilities for schools). International donors—such as the World Bank, UN, IMF, UNESCO, USAID and IFC have equally played a meaningful role in developing the ICT in Nigerian schools. It was recommended by the UN that 26% of aggregate budgets should be allocated to the educational sector. Therefore, the government's capital and recurrent expenditure on the educational sector should be increased—since the population attending these schools are skying up day in day out. The population of Nigeria is over 160 million and/or 90% of the total population is attending various categories of school. Government has to increase its budgetary allocation to this sector [1,6-10].

The recommendation from the UN has not been met by the Nigerian government, in other words, this sector has been marginalized in terms of budgetary allocations. It may be sufficed to speak however that other irrelevant sectors have been clinching the highest percentage of budgetary allocations at the expense of educational and/or health sectors. The meager percentage allocated to this sector has been embezzled by a few persons, which has resulted in a fall in the standard of education in Nigeria. For 21st century educational (e-education) system to be achieved, there is a need for overhauling the educational sector in Nigeria and/or being able to compete with international schools and making the certificates from the Nigerian schools recognized internationally [9,11].

In the 21st century as regards teaching patterns, more exposed teachers are employed and/or engaged in the handling of the new technologies and are also teaching the students with the acquired knowledge, skills and abilities. Today, online or conference teaching and learning is possible, perhaps resulting from the liberalization of economies of the world as advocated by Smith

(1776) and Ricardo (1819) as cited in [12,13]. Though positive results have not been achieved, the standard of education in Nigeria is gradually falling into decadence, resulting from the fact that corruption is too high in the educational sector. The best brains are not employed to handle the teachings. Moreso, modern technologies are not found in these schools, hence, influx into the foreign countries were these technologies are found [14].

2. LITERATURE REVIEW

Multiple research works on the impact of the 21st century innovations on Nigerian educational system both theoretical and empirical are abound in every academic's nooks and crannies or communities. Some researchers conducted their research through development of Information and Communication Technology (ICT) or Information and Computer Technology (ICT). Others either examined it through development in human capital, or investment in education or government expenditure on education or human capital and economic growth.

Examining the impact of 21st century innovation in education, [15] examined the government expenditure and economic growth in Nigeria, 1970-2008, the results revealed that government total capital expenditure (TCAP), total recurrent expenditures (TREC) and government expenditure on education (EDU) have negative effect on economic growth. On the contrary, rising government expenditure on transport and communication (TRACO) and health (HEA) results to an increase in economic growth.

Corroborating the work of Abu & Abdullahi, [16] averred the impact of Information and Communication Technology (ICT) on the Growth of the Nigerian Economy using annual time series data from 1970 to 2010. The basic variables of concern derived from the literature review are: real gross domestic product proxied as economic growth, ICT proxied as telecommunications (TELCOM), enrolments into Tertiary (TSE), Secondary (SSSE) and Primary (PSE) on educational institutions were used as proxied for human development. With the aid of statistical package (E-views, version 3.1); the model was estimated using annual time series data from 1970 to 2010. The paper employed stochastic characteristics of each time series by testing their stationarity using Augmented Dickey Fuller (ADF) and Phillip Perron (PP) tests, including cointegration tests and Vector

Autoregressive Measure. Empirical results revealed that there is, indeed a long-run relationship among government expenditure on education, human capital development proxied as tertiary school enrolments, Secondary school enrolments and Primary school enrolments and economic growth in Nigeria. All the variables have short and long run relationship with each other as revealed by Johansen cointegration. From the Findings, it was revealed that there is a feedback mechanism between ICT and economic growth in Nigeria.

Akpokerere et al. [17] affirmed the effect of government expenditure on economic growth in Nigeria using a disaggregated approach. He observed that rise in government expenditure has not translated to meaningful development as Nigeria is still being ranked among the world poorest countries. Several researches on the actual relationship between government expenditure and economic growth are mixed and inconclusive and most of the researchers used aggregate approach. Data for the period (1977-2009) was used. Our estimation reviews that Government total capital expenditure (TCAP), total recurrent expenditures (TREC), Government expenditure on education (EDU) and power (POW) have negative effect on economic growth and are significant in explaining this relationship. On the contrary, rise in Government expenditure on transport and communication (TRACO) and health (HEA) results to an increase in economic growth.

Ohwofasa et al. [18] asserted the Impact of Government Expenditure in Education on Economic Growth in Nigeria, 1986-2011, the study employed Johansen co-integration technique and error correction method. The co-integration result showed that long run relationship exists between the variables. The econometric results further indicated that a one year lag of gross domestic product, current level of recurrent expenditure on education, two year lags of recurrent expenditure on education, current as well as two year lags of gross capital formation exhibit positive impact on economic growth in Nigeria. On the other hand, previous year capital expenditure on education and human capital development has negative and significant impact on economic growth within the period, 1986-2011.

Lawal et al. [19] ascertained the education and economic growth: Nigerian Experience, time series data were collected between 1980 and 2008 and ordinary least squares technique was used to estimate the model. It was discovered that education investments have direct and significant impact on economic growth in Nigeria.

Aluyor et al. [6] examined the impact of investment in education on the growth of the Nigerian economy. The paper employed ordinary least square (OLS) techniques, using annual time series data from 2001 to 2010 to explore the link between education, human capital and economic growth. The results revealed that investment in human capital has direct relationship with economic growth. The results revealed that the endogeneity (i.e. Physical capital accumulation, human capital development and technological development) growth model theory in Nigeria is unrealistic. The findings have a strong implication on educational policy in Nigeria.

Okogbo [20] examined the impact of government expenditure on economic development in Nigeria. The study employed E-view 7.0 statistical output as a window in exploring the possible links between government expenditure and/or economic development. The results revealed that government expenditure has a direct relationship with infrastructural development as well as economic growth which statistically significant at 5% level.

Government has a significant role to play in terms of financing (i.e. providing finances to acquiring the facilities for e-education). International donors—such as World Bank; UNESCO; USAID; IFC and IMF have equally played a meaningful role in developing the ICT in Nigerian schools. It was recommended by the UN that 26% of aggregate budgets should be allocated to educational sector. Therefore, the government capital and recurrent expenditure on educational sector should be increased—since population attending these schools are skying up day in day out. The population of Nigeria is over 160 million and 80% of the total population is attending various categories of school then government has to increase its budgetary allocation to this sector [1,6-10].

3. ANALYTICAL FRAMEWORK AND THE MODEL

An endogenous model of economic growth appears to be the most suitable for the study.

The model suggests that endogenous factors such as physical capital stock, human capital, and technological advancement can significantly

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affect e-teaching and/or e-learning in tertiary institutions of Nigeria.

The framework for this study is adapted from [1]. It assumes a standard neoclassical production function which begins from a premise that changes in quantities of factors of production (i.e. Labour and capital) account for growth. The neo-classical model is based on the Cobb-Douglas production function and is given as thus:

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

Where Y, K, L are aggregate real output, capital and labour respectively and T denotes technical progress or total factor productivity.

When we differentiate equation (1) with respect to time, divide by Y and rearrange the terms, it gives equation (2) as thus:

$$\left\{\frac{\Delta Y}{Y}\right\} = \left\{\frac{\Delta T}{A}\right\} + \left\{F_K \frac{\Delta K}{Y}\right\}\left\{\frac{K}{K}\right\} + \left\{F_L \frac{\Delta L}{Y}\right\}\left\{\frac{L}{L}\right\} \tag{2}$$

Where: Y/K = Rate of growth of output; K/K= Rate of growth of capital; L/L = Rate of growth of labour force. FK and FL = Social marginal product of capital and labour respectively; ΔT/T= Hicks neutral rate of change of technological progress.

Modern economic growth depends on the accumulation of physical capital and an increase in labour force with improved technological embodiment without which labour cannot be effective [4]. Consequently, for high labour productivity, an integral part of technological progress is investment in human capital and thus is termed endogenous factor because accumulation of physical capital is enhanced by the knowledge, skills, attitudes and health status of the people who partake in such exercise. Thus, there is a direct relationship between investment in human capital, technology and output growth level of Nigerian economy.

Generally, the impact of innovations for 21st century educational sector in Nigerian economic growth is incorporated into the endogenous model framework and given as below:

$$Y(t) = K(t) \alpha H(t) \beta (T(t) L(t))1 - \alpha - \beta - \tag{3}$$

Where: Y is output; K = Physical capital and H = the Human Capital Stock; L = Labour force; T is level of technology and $\alpha, \beta < 1$, implying decreasing returns to capital. By implication,

there is a positive relationship between innovations and productivity.

Based on the theoretical framework, the following model is specified to evaluate the impact of innovation for 21st century educational sector on economic growth of Nigeria.

$$RGDP = (TGEXPE, TGEXP, INFL, POL, CPI) \tag{4}$$

Where: RGDP = Real gross domestic product proxied for economic growth; TGEXPE = Total government expenditure on education is proxied for 21st century innovations (i.e. talents, skill and knowledge); TGEXP = Total government expenditure as a proxy for infrastructural development or maintenance of equipments of the schools; INFL = Inflation (increase of cost of acquiring the facilities); POL = Population proxied for the number of the recipients of the talents, skills and knowledge; Corruption Perception Index (CPI) as a proxy of embezzlement and inappropriate waste of school funds; μ = White noise error.

The data was transformed into double-log. Therefore, we re-specify equation (4) in a logarithm functional form: Thus gives:

$$LOGRGDP = \alpha 0 + \alpha 1 LOGEXPE \pm \alpha 2 LOGEXP \pm \\ \alpha 3 LOGINFL \pm \alpha 4 LOGPOL \pm \alpha 5 LOGCPI + \mu \tag{5}$$

The a priori expectations are as follows:

$$\alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_5, \alpha_6, > 0$$

The equation was estimated using a variety of analytical tools, including unit root tests, over parameterization, parsimonious variables and co-integration tests. The results are discussed below.

The data used for the study cover the period of 1960 and 2012. The study employed secondary data which are derived from various issues of [21,22].

4. MODEL SUMMARY

Table 1 shows the summary of the unit root test using ADF test with Schwarz Info Criterion (SIC) maxlags 10 and 3 of the variables used for the empirical study. The test shows that corruption perception index (CPI); Total government expenditure (TGEXP) and Total Government Expenditure on Education (TGEXPE) were stationary at the first differenced 1(1) at 10, 5 and 1 percent levels of significance respectively.

Population and inflation were stationary at the level 1(0) at 5, 1 and 10 percent levels of significance respectively. The next step after finding out the order of integration is to run the regression for the variables at first differenced 1(1) to enable us to achieve ECM to use for over-parameterization and parsimonious models for the study and establish co-integration test. The variable Population (POL) and Inflation (INFL) that were stationary at level 1(0) has already co-integrated themselves. To establish this, Johansen Cointegration test was used. In line with the Engel and Granger step, after the OLS of the first differenced (1) has been run, then forecasting of the dependent variable follows as witnessed in diagram 1. The variables of interest are—Theil Inequality coefficient (0.002); Bias Proportion (0.000); Variance Proportion (0.010) and Covariance Proportion (0.990). See diagram 1.

4.1 Empirical Results of the Dynamic Error Correction Model (ECM)

Error Correction Models (ECMs) are based on the behavioural assumption that two or more time series exhibit an equilibrium relationship that determines both short and long-run behaviour, equilibrium relationships in turn have implications for short-run, one or two series move to restore equilibrium [23,24]. The researcher uses the error correction models with time series that are not integrated. The researcher might want to model both long and short-term forces simultaneously in a simple statistical model just as error correction models allow. The coefficients of the explanatory variables in the error correction model measure the short-run relationship. Perhaps, conducting error correction technique, an over-parameterized and parsimonious model is usually done in dealing with the problem of spuriousness in the model. The results of the over-parameterized model are presented in Table 2. While, the result of the parsimonious model is given in Table 3. From Table 3, it was revealed that Total government

expenditure (TGEXP) has an inverse and an insignificant relationship with economic growth. The reason behind this inverse relationship and/or no significance impact of government spending on educational innovation is not far-fetched. This indicates that corruption in Nigeria is high. To address this menace, policy measures must be put in place to ensure total government expenditure should be used judiciously to acquire modern equipments to facilitate e-teaching and e-learning in schools in Nigeria. It is obvious from the coefficients of multiple determination (R^2) 0.814268 that the model is satisfactory as the independent variables were found to jointly explain 81 percent of the movement in the dependent variables. The error correction variable ECM which is minus -0.237337, was highly significant validating the error correction model specification and statistically significant at five percent level. This shows that a feedback of -0.237337 (-24%) from the previous year's disequilibrium from the long-run elasticity of the identified variables can determine economic growth. The strong significance of the ECM connotes the existence of a long-run equilibrium relationship between real gross domestic product and the factors affecting it. The ECM reveals a long-run relationship between explanatory and explained variables in the model. If these kinds of long-run relationships describe behavior, ECMs present a nice fit with theory. The DW was 2.264256 (2.26) which means there was an absence of serial correlation or autocorrelation.

4.2 Cointegration Test Results

Co-integration test is carried out to determine the long-run relationship between the dependent and independent variables when one or all of the variables is/are non-stationary at level which means they have stochastic trend or spuriousness. Co-integration tests are conducted by using the reduced procedure developed by [25,26]. This method should produce

Table 1. Results of units roots tests using Augmented Dickey Fuller (ADF): 1990-2012

Variables	Max lag	ADF test statistics	95% ADF critical level	90% ADF critical level	99% ADF critical level	Order of integration	Remark
Log_rgdp_	10	-6.632969	-2.919952	-2.597905	-3.565430	1(1)	Stationary
Log_cpi_	3	5.096848	3.098896	-2.690439	-4.004425	1(1)	Stationary
Log_infl_	10	-5.340130	-2.925169	-2.600658	-3.577723	1(0)	Stationary
Log_pol_	10	7.469847	-2.922449	-2.599224	-3.571310	1(0)	Stationary
Log_tgexp_	10	-7.875737	-2.919952	-2.597905	-3.565430	1(1)	Stationary
Log_tgexpe_	10	-7.890436	-2.921175	-2.598551	-3.568308	1(1)	Stationary

*Notice: Variables are as defined in equation 5, *significant at 5, 1& 10 percent level,*
Source: Author's computation

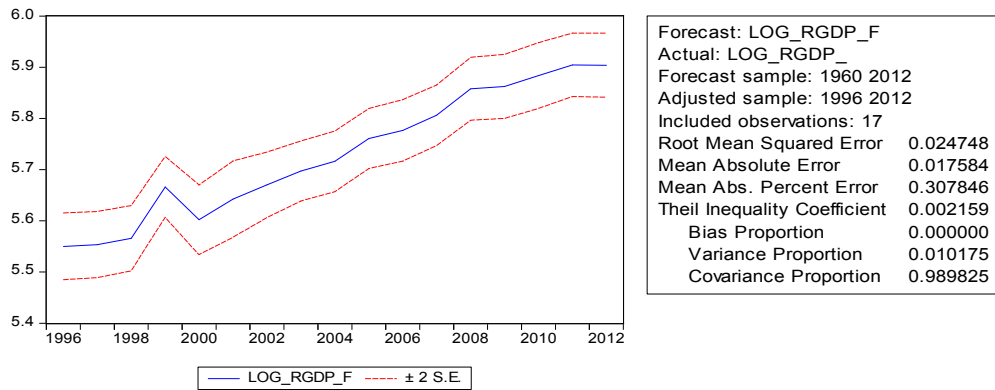|	
Forecast: LOG_RGDP_F	
Actual: LOG_RGDP_	
Forecast sample: 1960 2012	
Adjusted sample: 1996 2012	
Included observations: 17	
Root Mean Squared Error	0.024748
Mean Absolute Error	0.017584
Mean Abs. Percent Error	0.307846
Theil Inequality Coefficient	0.002159
Bias Proportion	0.000000
Variance Proportion	0.010175
Covariance Proportion	0.989825

Diagram 1. Forecast

Table 2. Modeling the impact of innovation for 21st century educational sector in Nigerian economic growth (a dynamic error correction model) – Over-parameterized model

Dependent Variable: D(LOG_RGDP_)
Method: Least Squares
Date: 07/01/14 Time: 10:11
Sample (adjusted): 1999 2012
Included observations: 14 after adjustments

Variable	Coefficient	Std. error	t-statistic	Prob.
C	-1.165678	0.109094	-10.68511	0.0594
D(LOG_CPI_)	0.143769	0.022253	6.460591	0.0978
D(LOG_CPI_(-1))	0.103603	0.009371	11.05591	0.0574
D(LOG_CPI_(-1),2)	-0.105532	0.015827	-6.667889	0.0948
D(LOG_TGEXP_)	-0.024330	0.009982	-2.437325	0.2479
D(LOG_TGEXP_(-1))	-0.200871	0.017091	-11.75326	0.0540
D(LOG_TGEXPE_)	0.051718	0.005356	9.656118	0.0657
D(LOG_TGEXPE_(-1))	0.075057	0.015009	5.000666	0.1256
LOG_POL_	-0.536536	0.100583	-5.334256	0.1180
LOG_POL_(-1)	0.672556	0.108100	6.221637	0.1015
LOG_INFL_	0.028665	0.004169	6.876275	0.0919
LOG_INFL_(-1)	0.054560	0.010802	5.050824	0.1244
ECM(-1)	-0.865913	0.103692	-8.350842	0.0759
R-squared	0.998865	Mean dependent var		0.025678
Adjusted R-squared	0.985248	S.D. dependent var		0.007961
S.E. of regression	0.000967	Akaike info criterion		-11.82690
Sum squared resid	9.35E-07	Schwarz criterion		-11.23349
Log likelihood	95.78830	Hannan-Quinn criter.		-11.88183
F-statistic	73.35449	Durbin-Watson stat		3.370680
Prob(F-statistic)	0.091017			

asymptotically optimal estimates since it incorporates a parametric correction for serial correlation. The nature of the estimator means that the estimates are robust to simultaneity bias, and it is robust to departure from normality [25]. [25] method detects a number of cointegrating vectors in non-stationary time series. It allows for hypothesis testing regarding the elements of cointegrating vectors and loading matrix.

The result is presented in Table 4. It revealed that there is cointegration among the variables. This is because the Trace Statistic value of 91.22646 is greater than the critical value of 47.85613 at 5 percent level of significance, which means the probability of obtaining that value 91.22646 is zero. We reject the null hypothesis of none* of the hypothesized number of cointegrating equations. Also the Trace Statistics value of 48.38012 is greater than critical value of 29.79707 at 5 percent level of significance, which means the probability of obtaining that value of 48.38012 is zero. We reject the null hypothesis of At most 1* of the hypothesized number of Cointegration equations.

Table 3. Modeling the Impact of Innovation for 21st century educational sector in Nigerian economic growth (a dynamic error correction model) – parsimonious model

Dependent Variable: D(LOG_RGDP_)				
Method: Least Squares				
Date: 07/01/14 Time: 10:15				
Sample (adjusted): 1998 2012				
Included observations: 15 after adjustments				
Variable	**Coefficient**	**Std. error**	**t-statistic**	**Prob.**
C	0.008826	0.004511	1.956396	0.0821
D(LOG_RGDP_(-1))	0.715501	0.153190	4.670689	0.0012
D(LOG_CPI_(-1))	0.034084	0.020620	1.653012	0.1327
D(LOG_TGEXP_(-1))	-0.044535	0.020010	-2.225683	0.0531
D(LOG_TGEXPE_(-1))	0.002645	0.010425	0.253719	0.8054
ECM (-1)	-0.237337	0.085933	-2.761874	0.0220
R-squared	0.814268	Mean dependent var		0.024770
Adjusted R-squared	0.711083	S.D. dependent var		0.008439
S.E. of regression	0.004536	Akaike info criterion		-7.664386
Sum squared resid	0.000185	Schwarz criterion		-7.381166
Log likelihood	63.48290	Hannan-Quinn criter.		-7.667403
F-statistic	7.891368	Durbin-Watson stat		2.264256
Prob (F-statistic)	0.004146			

Table 4. Results of Johansen cointegration

Date: 07/01/14 Time: 13:24				
Sample (adjusted): 1998 2012				
Included observations: 15 after adjustments				
Trend assumption: Linear deterministic trend				
Series: LOG_RGDP_ LOG_CPI_ LOG_TGEXP_ LOG_TGEXPE_				
Lags interval (in first differences): 1 to 1				
Unrestricted Cointegration Rank Test (Trace)				
Hypothesized		**Trace**	**0.05**	
No. of CE(s)	**Eigenvalue**	**Statistic**	**Critical value**	**Prob.****
None*	0.942526	91.22646	47.85613	0.0000
At most 1*	0.900689	48.38012	29.79707	0.0001
At most 2	0.591203	13.73767	15.49471	0.0904
At most 3	0.021082	0.319616	3.841466	0.5718

*Trace test indicates 2 cointegrating eqn(s) at the 0.05 level, * denotes rejection of the hypothesis at the 0.05 level, **mackinnon-haug-michelis (1999) p-values*

Accordingly, Trace Statistic test indicates none* cointegrating equations at 5 percent level of significance, which means we do reject the null hypothesis and accept the alternative hypothesis as its Trace Statistics is greater than critical value at 5 percent level of significance. For None* and At most 1*, we do fail to reject (or accept) the null hypothesis and/or accept the alternative hypothesis as its Trace Statistics is greater than critical value at 5 percent level of significance. For the remaining numbers of hypothesized cointegrating equation (At most 2, 3), we do not fail to reject (or accept) the null hypothesis and reject the alternative hypothesis as its Trace Statistic value is less than the critical values at 5 percent level of significance. The main conclusion is that there is the coexistence

of long-run relationships amongst the variables. Though, the variables may wander away from themselves in the short-run, but in the long-run, there is the coexistence of a relationship amongst them.

5. CONCLUSION

The result of the econometrics on the impact of innovation for 21st century educational sector in Nigerian economic growth for the period of 1960-2012, the paper revealed from its findings that government expenditure on education has a direct relationship with economic growth (i.e. innovation for 21st century educational sector). This means that even though government has

established more schools corroborated by private schools in Nigeria, this has not impacted positively and/or significantly on the Nigerian economic growth.

6. SUMMARY

The paper empirically examines the impact of innovation for 21st century educational sector in Nigerian economic growth, using annual time series data from 1960 to 2012. The endogenous growth model developed by [1] is used for the study. The paper employs stochastic characteristics of each time series data by testing their stationarity using Augmented Dickey Fuller (ADF) tests, including Co-integration tests and Error Correction Model (ECM). Empirical results reveal that there is, indeed a long-run relationship between total government expenditure and 21st century innovations in Education. All the variables have both short and long run relationship with each other as revealed by Co-integration tests. They have positive coefficients. It is evident that there is a feedback mechanism between total government expenditure on education and 21st century innovations in Nigerian education. Thus, the policy implication of the findings is that government should place a high priority on expenditure in education via the innovations of the educational sector for the 21st century. It can be concluded that government expenditure has a vital relationship with the 21st century innovation in the Nigerian educational sector as well as growth and development of any nation. It normally improves the learning, teaching and/or productivity of labour.

7. RECOMMENDATIONS

From the econometric study of the impact of innovation for 21st century educational sector in the Nigerian economic growth, the following recommendations are stated below:

- There is the need for government to increase budgetary allocations to the educational sector as the power house of the growth and development as measured through GDP.
- Government should as a matter of priority implement the minimum United Nations

recommendations of 26 percent budgetary allocation to education.

- Government should ensure that information and communication technology (ICT) is introduced at least for the teachers and students to have fundamental knowledge about computers and the internet; this will facilitate the new approach to pedagogy and/or learning.
- Government and management of schools should intermittently organize conferences, symposia and fora for the teachers to abreast them of the 21st century method of teaching and playing along with students in order to carry them along.
- Government should increase capital expenditure on schools since empirically total government expenditure has a negative sign and not statistically significant at any level.
- The donor agencies like the World Bank, UNDP and UNESCO should also be encouraged to inject funds into the educational sector, especially the tertiary institutions.
- Lecturers should be encouraged to carry out academic research relevant and non relevant to their field or area of specialist.
- Government should ensure that zero corruption tolerance exist in educational sector since it has a direct relationship with educational development and economic growth.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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