Impact of Innovations and Transformations in Teaching and Learning on Educational Systems 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 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. The authors read and approved the final manuscript.

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ABSTRACT

The paper examined the impact of innovations and transformations in teaching and learning on educational sector in Nigerian Economic Growth. The paper employed the secondary data and sourced from the Statistical Bulletin of Central Bank of Nigeria. With the aid of statistical package (E-views, version 7.2) windows, the model was estimated using annual time series data from 1960 to 2012. The paper 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 variable to enable the researcher to ascertain both short run and long run equiliria. The results of the findings revealed that total government expenditure on education proxied for teaching and learning has a direct relationship with economic growth. The paper recommended that there is a need for government as a matter of priority implements the United Nations (UN) recommendation of 26% budgetary allocation to educational sector, ensure that Information Communication Technology (ICT) is introduced at least for the teachers and students to have fundamental knowledge about computers, internets, etc, hence facilitate the new approach in teaching and learning, increase capital expenditure and infrastructural development on schools since empirically total government expenditure has a negative sign and it is not statistically significant at any level.

1. INTRODUCTION

One of the objectives of education (.i.e., Primary, Secondary, Tertiary Institutions, Adult & Nomad schools) in African Countries—such as—Nigeria is to prepare the future generations on the one hand on how to face future challenges or competitions among countries of the World and/or develop them to meet the nation's manpower requirements on the other. Education (.i.e., ePedagogy & eLearning) is one of the variables of economic growth model as emphasized by new endogenous growth theorists [1]. This has been the view of many economists, business analysts, etc. One of the most important assets of a nation or an organization is human factor. Hence, this sector needs to be adequately equipped or prepared for the future challenges or competitions in terms of technological growth [2].

The paradox of innovations and transformations of education in Nigeria are not quite different from what the Third World Countries are experiencing in terms of developing educational sector in order to contribute meaningfully to the economic growth measuring through Gross Domestic Product (GDP) and/or Gross National Product (GNP). The paradox of transformation and innovation in educational sector is an old phenomenon in the most advanced countries, unlike the emerging countries where innovation and transformation is a new phenomenon vice versa. According to Education Statistical Report, 80% of the population in Nigeria is starkly uneducated (or characterized as ignorant without knowledge and skills), about 10% is quite educated (or characterized as highly skilled and knowledgeable), and/or 10% accounted for indigenes who are highly skilled and knowledgeable but stayed in foreign countries. From the report available, the rural dwellers constitute about 80% of the total population (.i.e., interior villages that comprise of people with little or no access to the modern ICT facilities in schools or e-pedagogy and e-learning), 10% constitute of the urban dwellers (.i.e., modern cities that constitute people with absolute access to modern ICT facilities in schools and e-pedagogy and e-learning), and 10% of the population (are people who acquired higher skills, talents and knowledge, but) stayed back in foreign countries [3-5].

The effort of innovation and transformation in education had been made since twenty century and/or intensified in the twenty-one century in the emerging countries—such as Nigeria *per se*. Globalization (or liberalization of World economies) which had been advocated by the nineteen century economists—i.e., Smith 1776 and Ricardo 1817 as cited in [6] had advanced its pros, such as an access to IT facilities that are manufactured in the developed countries and/or consumed in the emerging countries, e.g., Nigeria. In the quest for e Education, International Agencies have contributed immensely to the e Education in African countries—such as Nigeria. UNESCO, USAID, World Bank, IFC, IMF, *inter alia* have contributed enormously to the e Schools in Nigeria. Today as we speak, methods of pedagogy and learning

in Nigeria have drastically changed. The paradigm shift is in the crude chalk's board used before now, which has been replaced with maker's board. However, computers are being installed in schools, internet services are enjoyed in some arena and/or computer department is virtually found in all tertiary institutions or higher educational institution in Nigeria [7,8].

Obviously, some of the capital projects going on in those schools are either World Bank, or UNESCO, or USAID, or TETF und, or ETF, etc. Hitherto, schools are being monitored in terms of carriage capacity; no school should have over fifty students in a class. The Primary and secondary schools are directly under the Ministry of Education either at the State or Federal level, the Universities are under the National Universities Commission (NUC), the Polytechnics were under the National Board for Vocational Colleges and Technical Education (NABTECH), but are under the National Board of Technical Colleges (NBTE); and the National Commission for Colleges of Education (NCCE) oversees the activities of the Colleges of Education [9-11].

In the 21st century, the pivot in the educational system in Nigeria has pronounced positively in the pedagogy (e Pedagogy) and/or learning (eLearning), this has manifested on the Information and Communication Technology (ICT) systems in the pedagogical methods of teaching and learning by both students and/or teachers [12].

Precisely, ICT in emerging countries has the potentials to augment e Education in Nigerian school environments, even though is lauded with plethora challenges—in terms of: (i) inadequate ICT infrastructures—such as: computer hardware and Software high, and bandwidth access; (ii) inadequate funding by the government and stakeholders; (iii) lack of train skilled manpower; (iv) unwillingness to adapt from the traditional pedagogical methods of teaching and learning to the conventional or new method of teaching and learning; (v) over-dependence of educational sectors on government; (vi) lack of coordination of ICT in schools by government agencies and (vii) lack of accessibility of few ICT facilities available to this sector [13].

In the 21st century, the importance of education succinctly has been the major discourse or debate of the world at large. Resulting from this,

all arms of government (Localities, States & Federal) in Nigeria corroborated by International Agency (ies) have keyed into this discourse or debate [8,14,15] Besides, the Millennium Summit was held in September, 2000 among the stakeholders (.i.e., 186 members countries of UN) on how to help the Sub-Sahara (or emerging) countries get developed in terms of education, health, poverty eradication, etc [16]. In the Millennium Summit of September, 2000, there was a consensus among 186 member countries of United Nations (UNs) to adopt eight Millennium Development Goals (MDGs), which education, etc is among. One of the objectives of the MDGs is to ensure that by 2015 every child between the ages of 6-11 should have acquired basic (fundamental) primary education in African Countries. Hence, education is social or economic indicators to an economic growth [17]. The paradox of transformation and innovation in education is not only to develop the students but also to develop the teachers who impart this knowledge on the students. Information and Communication Technology (ICT) or Information and Computer Technology (ICT) have impacted positively on the students and teachers *inter alia* [18].

Today, internet services *ceteris paribus* have facilitated e-learning and e-teaching in the 21st century. E-learning centers have been established for example at Auchi Polytechnic, Auchi and many other schools in Nigeria. New dimension *mutatis mutandi* however, is the use of computer systems, organizing conferences, symposia, fora, etc for teachers, in order to abreast them of the new methods or techniques of pedagogy and/or handling the students. Beside, computer training should be organized in the school arena for pedagogue and students to enable them get acclimatized in operating of the computer systems as *prima facie*, and better still; computer science should be introduced as a core (or prerequisite) course in tertiary institutions and/or both primary and secondary schools in Nigeria [1,9,11] With this development, several tertiary institutions in Nigeria—such as Auchi Polytechnic, Auchi; University of Benin, Benin City, etc. have adopted computer base test in the entrance examinations [19]. E-learning programmes have been organized at Auchi Polytechnic, Auchi and other tertiary Institutions in Nigeria. Sophisticated mobile phones, Laptops, Desk-Tops, etc are being fully utilized by pedagogues and students these days in schools [20].

This new trend or dimension in the Nigerian educational system (.i.e., eTeaching and eLearning) has made government at various levels to increase their budgetary allocations (or total governments expenditure) to the *per se* sector. Though in Nigeria positive results have not been achieved in Nigerian educational system, as most tertiary institutions in Nigeria could not be fully indulged in the use of computer system or internet services or the allocations (subventions) to this sector is not judiciously used because of the high rate of corruption among the administrators [21].

2. LITERATURE REVIEW

Theoretical and empirical research works on the impact of innovations and transformations in teaching and learning on educational systems in Nigerian economic growth are available in academic archives and online. Modern economic growth theory depends on the accumulation of physical capital stock and an increase in labour force (or human capital) with improved technological embodiment without which labour cannot be effective [22]. 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 through education and output growth level of Nigerian economy [23].

Discussing the relationship between the capital formation and economic growth, [23], averred the impact of capital formation on the growth of Nigeria using time series data from 1960 to 2010, the paper explored various econometrics and statistical analytical method to examine the relationship between capital formation and economic growth. The paper tested the stationarity and co integration of Nigeria's time series data and used an error correction mechanism to determine the long-run relationship among the variables examined. The paper reviewed the literature and discovered that Harrod-Domar model has scarcely been used to test the relationship between capital formation and economic growth. The empirical study found that the data were stationary and co integrated and showed that there is a significant relationship between capital formation and economic growth in Nigeria.

[17], evaluated 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. Even though the overall performance cannot be ascertained on the economic growth, but the components of the human capital have significant role in the growth of Nigerian economy. 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.

Measuring the parameter of economic growth, [24] affirmed empirically the impact of health sector on the growth of Nigerian economy 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 Granger Causality. Empirical results revealed that there is, indeed a long-run relationship between government expenditure on education, government expenditure on health, and human capital development as a proxy for tertiary school enrolments, Secondary school enrolments and Primary school enrolments and economic growth. All the variables have short and long run relationship with each other as revealed by Granger-causality test. From the Findings, it was revealed that there is a feedback mechanism between human capital development and economic growth.

[25] asserted using the human capital model of endogenous growth developed by Mankiw, Romer and Weil (1992), this paper examined empirically the role of human capital in Nigeria's economic development. The paper employed a variety of analytical tools, including unit root tests, cointegration tests and error correction mechanism (ECM). Empirical results indicated that there is, indeed a long-run relationship among labour force, physical capital investment proxied by real gross domestic capital formation, human capital formation, proxied by enrollment in educational institutions and economic growth in Nigeria. Findings show that there is a feedback

mechanism between human capital formation and economic growth in Nigeria.

Examining the role of ICT on 21st century pedagogical methods of teaching (or e Teaching) and learning (eLearning), in other words, e-education, [19] examined empirically the impact of Information and Communication technology on the Growth of the Nigerian Economy 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, government expenditure on health, 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.

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This study also found that there is a significant difference in university lecturers' utilization of technology and other relevant materials in their delivery of lectures. This finding is in line with Eze (2005) who researched upon the knowledge update of Nigerian academics: A case study of Enugu State University of Science and Technology, who observed that lecturers do not necessarily embark on academic researches as a means of updating their knowledge in areas of specialization. The use of these facilities of ICT (information and communication technology) to maintain awareness and remain current in their field of specialization was equally found to be low, making the reliance on lecturers as effective agents of transformation a mere dream [27].

The role of the educational system in training its citizens would also include the use of educational innovations to develop skills, gifts, abilities and capabilities of citizens, so they can function and ensure innovation and transformation of the world in which they live. Innovation, which is the generation, acceptance and implementation of new ideas, processes, methods and changes, most often leads to the introduction of transformation [28]. Innovation also leads to persistent changes in the patterns of behavior of members of an identified social system. It equally leads to such departure from the normal cultural practices that a sustained reform or transformation is noticed [29].

In respect of transformation, [30] asserted that it is the process of changing from one qualitative state to another. It defined quality, focuses on process, the enhancement and empowerment of the learner, especially when transformation is related to higher education [7,8]. Higher institutions otherwise referred to universities that have its major function, which is the obligation to empower students with specific skills, knowledge and attitudes that will enable them live and work in the knowledge society [31].

In terms of pros of globalization on education, [8] asserted that the pulls and pressures of globalization have affected educational policies. Education is universally acclaimed as the key to sustainable development and advancement of human welfare. To African nations, education is the key not only to socio- economic development and political stability, but also the instrument to translate the nations from league of low to those of high level technology nations. He further stressed however that the human capitalist theory postulates that the most efficient path to the national development of any society lies in the improvement of its population, that is, its human capital. Education was not to be viewed simply as a form of consumption but rather as a productive investment [7].

During the first military administration, the Federal Government created more States and assumed responsibility for the three Universities established by the three erstwhile regions. Subsequently, the Federal and State Governments alike established more secondary and tertiary educational institutions, and to regulate their activities, the central Government established the National Universities Commission (NUC) and the National Board for Technical Education (NBTE). The National Teachers' Institute (NTI) was set up to handle primary school teachers' examinations, while admission to Universities, and more recently, Polytechnics and Colleges of Education are managed by the Joint Admissions and Matriculation Board (JAMB). National youth service was introduced under the National Youth Service Corps (NYSC) scheme. In addition to performing their statutory functions, these bodies have tremendously facilitated the compilation of education statistics in the country [9-11].

The educational sector is guided by the National Policy on Education and several coordination mechanisms have been put in place to ensure that the highest standards are maintained in curriculum, infrastructure and manpower requirements. The Primary and secondary schools are directly under the ministry of education either at the state or federal level, the universities are under the National Universities commission (NUC), the polytechnics the National Board for vocational colleges and Technical education (NABTECH), and the National commission for colleges of education (NCCE) oversees the activities of the Colleges of Education [9-11].

The institutions under each of these coordinating mechanisms are enormous and diverse in many respects; however, for the purpose of classification, the following statistics would be necessary. There are 58 University Institutions, 48 Polytechnic Institutions and 67 Colleges of Education. Other institutions are 44,000 primary schools, 9,000 secondary schools, 3 specialist postgraduate institutions, 26 federal vocational colleges and schools, 15 University teaching hospitals and 61 research institutions [32].

The Nigerian educational system has undergone major structure changes over the last 30 years: (i) In 1973, the educational system was updated to the 6-3-3-4 (6 years primary, 3 years junior secondary, 3 years of senior secondary and 4 years tertiary education); (ii) In 1982 the first National Policy on education was developed and adopted, since this period, the educational system has witnessed a lot of changes and modifications at various levels; (iii) The current phase of evolution is most relevant to this paper as it focused on the transition from traditional pedagogical methodology to more sophisticated, but user friendly, technology based instructional methodology [9-11].

In line with the above, currently there are at least nine ICT for education initiatives at various stages of development being carried out by the education coordinating agencies of government and the ministry of education, which include: (i) The Nigerian Universities Network (NUNet) Project; (ii) The Polytechnics Network (PolyNet) Project; (iii) The School Net Project; (iv) The Nigerian Education, Academic and Research Network (NEARNet); (v) The Teachers Network (TeachNet) Project; (vi) National Open University; (vii) National Virtual (Digital) Library (Ministry of Education/ NUC); (viii) National Virtual Library (Ministry of Science and Technology/NITDA); (ix) National Information, communication and education programme of the Presidency [7,33].

In respect of eEducation, [7] opined that eEducation is electronic mode of knowledge sharing and transmission, which may not necessarily involve physical contact between teacher and student. The concepts computer-aided teaching and computer-aided learning have given birth to computer-aided instruction, which represents a combination of both teaching and learning. Access to instruction through the internet is flexible, ensures broad viability and availability of educational time and space.

Finance is an instrumental to innovations and transformations of ePedagogy and eLearning, [1] maintained that government expenditure has a significant role to play in the innovations and transformations process. These facilities are to be bought and distributed to various schools of teaching and learning, that is why innovations and transformations is proxied for total government expenditure on education. The impact of the innovation and transformation has not been felt by the students and teachers of these schools. Invariably, could this be as a result of corruption in the educational system? Government is charged with the responsibility of funding these schools (.i.e., total government expenditure on education- TGEXPE) and total government expenditure (TGEXP). TGEXPE

enables a conducive school environment for teaching or learning skills, talents and knowledge, while TGEXP enables stable network and infrastructural development of the community. Both are among the linear combinations of the model formulated for the study.

3. ANALYTICAL FRAMEWORK AND THE MODEL

An endogenous growth theory model is suitable for this paper. The model suggests that endogenous factors—such as: physical capital stock; human capital development; technological advancement may significantly affect ePedagogy and eLearning in tertiary institutions of Nigeria [1].

The framework for this paper is adapted from [6]. 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's 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. F_K and F_L = 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 stock, an increase in human capital stock, and technological advancement [1] as cited in Romer, 1986, 1990). 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 and transformations in teaching and learning on educational systems in Nigerian economic growth is incorporated according to the endogenous model framework and is given below as thus:

$$Y_{(t)} = K_{(t)}{}^{\alpha} \, H(t)^{\beta} \, (T_{(t)} \, L_{(t)})^{1-\alpha-\beta} \tag{3}$$

Where: Y is output; K = Physical capital and H = the Human Capital Stock; L = Labour force; T is level of technology and α, β < 1, implying decreasing returns to capital. By implication, there is a positive relationship between investment in human capital (talents, skills and knowledge) and output growth.

Based on the theoretical framework, the following model is designed to evaluate the impact of innovations and transformations on educational systems in Nigerian economic growth.

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

Where: RGDP = Real gross domestic product as a proxy for economic growth; TGEXPE = Total government expenditure on education proxied for innovations and transformations (.i.e., talents, skill and knowledge); TGEXP = Total government expenditure as a proxy for infrastructural development of the schools; Infl = Inflation (increase of cost of acquiring the facilities); POL = Population proxied for the proportion receiving the talents, skills and knowledge; μ = White noise error.

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

$$LOGRGDP = \alpha_0 + \alpha_1 LOGEXPE + \alpha_2 LOGEXP + \alpha_3 LOGINFL + \alpha_4 LOGPOL + \mu \tag{5}$$

The a priori expectations are as follows:

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

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 covers the period 1960 and 2012. The study employed secondary data which are derived from various issues of [34,35].

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 total government expenditure; 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 itself. To establish this, Johansen Cointegration test was used. From the Engel Granger steps, we forecasted as shown in 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 [36,37].

Table 1. Results of units roots tests using Augmented Dickey Fuller (ADF): 1960-2012

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_infl_	10	-5.340130	-2.925169	-.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: 1964 2012
Included observations: 48
Root Mean Squared Error   0.331205
Mean Absolute Error   0.251213
Mean Abs. Percent Error   5.207123
Theil Inequality Coefficient 0.032393
  Bias Proportion   0.000000
  Variance Proportion   0.042927
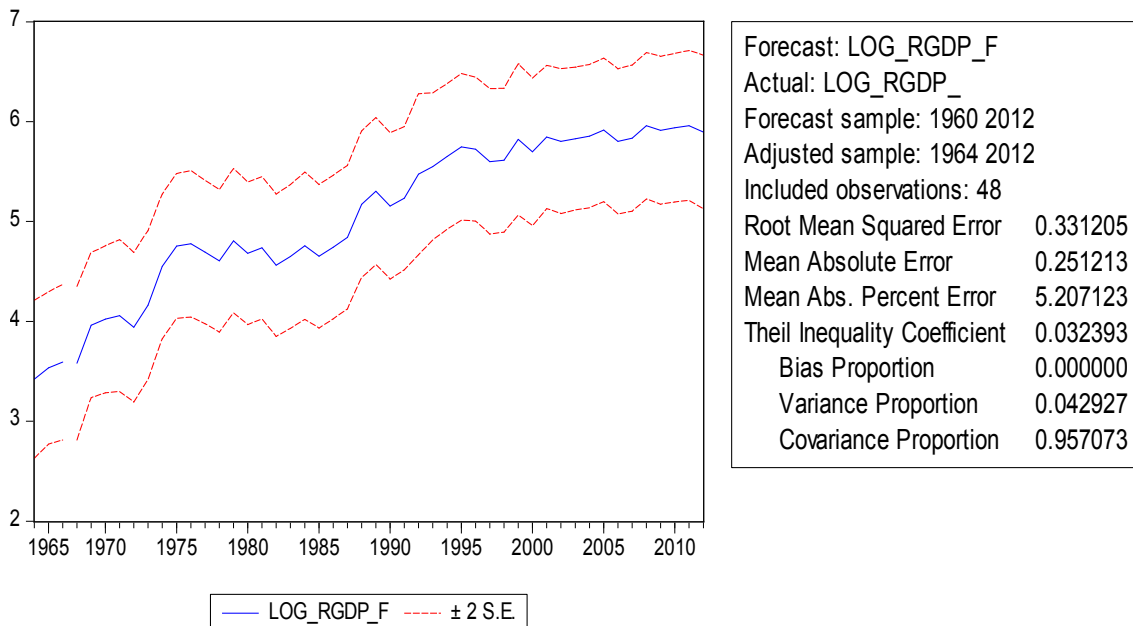 Covariance Proportion   0.957073

Diagram 1. Forecast

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. When conducting error correction technique, an over-parameterized and parsimonious model is usually expressed to deal 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. And it is not statistically significant at any level. The rationale behind this inverse relationship but no significant impact of government spending on economic growth is not far-fetched. This indicates that corruption in Nigeria is high. To address this problem, policy measures must be put in place to ensure total government expenditure should be used judiciously to acquire modern equipment to facilitate ePedagogy and/or eLearning in schools in Nigeria. It is obvious from the coefficient of multiple determinations (R^2) that the model is satisfactory as the independent variables were found to jointly explain only 73.0 percent of the movement in the dependent variables. The error correction variable ECM which minus -0.106389, was highly significant validating the error correction model specification and it is not statistically significant at five percent level. This shows that a feedback of -0.106389 (-106%) 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 1.948083 (1.95) which means there was an absence of serial correlation or autocorrelation.

Table 2. Modelling the impact of innovations and transformations in teaching and learning on educational systems in Nigerian economic growth (A Dynamic error correction model) – over-parameterized model

Dependent variable: D(LOG_RGDP_)
Method: Least squares
Date: 06/25/14 Time: 13:13
Sample (adjusted): 1965 2012
Included observations: 46 after adjustments

Variable	Coefficient	Std. error	t-Statistic	Prob.
C	1.313042	2.007886	0.653943	0.5174
D(LOG_RGDP_(-1))	0.066363	0.164731	0.402856	0.6895
D(LOG_TGEXP_)	0.041692	0.228317	0.182606	0.8562
D(LOG_TGEXP_(-1))	-0.247247	0.250386	-0.987465	0.3302
D(LOG_TGEXPE_)	0.058277	0.074256	0.784810	0.4378
D(LOG_TGEXPE_(-1))	0.014564	0.066360	0.219464	0.8276
LOG_INFL_	0.083026	0.086370	0.961281	0.3430
LOG_INFL_(-1)	-0.024428	0.073928	-0.330435	0.7430
LOG_POL_	-4.144078	8.155291	-0.508146	0.6145
LOG_POL_(-1)	3.983887	8.338048	0.477796	0.6358
ECM(-1)	-0.142356	0.070239	-2.026730	0.0504
R-squared	0.192621	Mean dependent var		0.055597
Adjusted R-squared	-0.038058	S.D. dependent var		0.149198
S.E. of regression	0.152011	Akaike info criterion		-0.724763
Sum squared resid	0.808755	Schwarz criterion		-0.287479
Log likelihood	27.66955	Hannan-Quinn criter.		-0.560954
F-statistic	0.835017	Durbin-Watson stat		1.937294
Prob(F-statistic)	0.598851			

4.2 Cointegration Test

Co-integration test is carried out in order 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. Co-integration tests are conducted by using the reduced procedure developed by [38,39].

This method should produce 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 [38]. Johansen 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 34.32729 is greater than the critical value of 29.79707 at 5 percent level of significance, which means the probability of obtaining that value 34.32729 is zero. We reject the null hypothesis of one*of the hypothesized number of cointegrating equations.

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 the remaining number of hypothesized cointegrating equation (at most 1), we do not 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 existence of long-run relationships amongst the variables. Initially, the variables wander away (no relationship exists among the variables) from themselves, but in the long-run, there is the existence of relationship amongst them.

Table 3. Modeling the impact of innovations and transformations in teaching and learning on educational systems in Nigerian economic growth (A Dynamic error correction model) – parsimonious model

Dependent variable: D(LOG_RGDP_)
Method: Least squares
Date: 06/25/14   Time: 13:16
Sample (adjusted): 1963 2012
Included observations: 50 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.052050	0.028391	1.833306	0.0734
D(LOG_RGDP_(-1))	0.089509	0.148367	0.603293	0.5493
D(LOG_TGEXP_(-1))	-0.087338	0.202791	-0.430681	0.6688
D(LOG_TGEXPE_(-1))	0.026636	0.058287	0.456985	0.6499
ECM(-1)	-0.106389	0.059901	-1.776091	0.0825
R-squared	0.072628	Mean dependent var		0.050686
Adjusted R-squared	-0.009805	S.D. dependent var		0.144538
S.E. of regression	0.145244	Akaike info criterion		-0.926157
Sum squared resid	0.949318	Schwarz criterion		-0.734955
Log likelihood	28.15393	Hannan-Quinn criter.		-0.853346
F-statistic	0.881057	Durbin-Watson stat		1.948083
Prob(F-statistic)	0.482892			

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level; * denotes rejection of the hypothesis at the 0.05 level;
**MacKinnon-Haug-Michelis (1999) p-values

Table 4. Results of Johansen cointegration

Unrestricted cointegration rank test (Trace)				
Hypothesized no. of CE(s)	Eigenvalue	Trace statistic	0.05 critical value	Prob.**
None *	0.438314	34.32729	29.79707	0.0141
At most 1	0.081111	5.486655	15.49471	0.7552
At most 2	0.024830	1.257161	3.841466	0.2622

5. SUMMARY AND CONCLUSION

The paper empirically examines the impact of innovations and transformations in teaching and learning on educational systems in Nigerian Economic Growth, using annual time series data from 1960 to 2012. The endogenous growth model developed by [22] as cited by [6]; 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 teaching and learning in Nigerian schools. 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 the real gross domestic product of Nigeria. Thus, the policy implication of the findings is that government should place a high priority on expenditure in education via innovations and transformation of educational sector. It can be concluded that government expenditure has vital relationship in the growth and development of any nation. It normally improves the learning, teaching, and/or productivity of labour.

6. RECOMMENDATIONS

From the econometric study of the impact of innovations and transformations in teaching and learning on educational systems in Nigerian Economic Growth, the following recommendations are stated below:

- There is a need for government as a matter of priority implements the minimum United Nations (UN) recommendations of 26 percent budgetary allocation to educational sector.
- There is the need for the government to ensure that Information and Communication Technology (ICT) is introduced at least for the teachers and students to have fundamental knowledge about computers, internets, etc; this will facilitate the new pedagogical techniques to teaching and learning.
- Government and management of schools should establish e-learning and e-teaching centers and/or intermittently organize educational conferences, symposia, fora,

etc 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 and infrastructural development on schools since empirically total government expenditure has a negative sign and it is not statistically significant at any level.
- The international donor agencies such as the World Bank, UNDP, UNESCO, UN, etc should also corroborate with Nigerian government to inject funds into the educational sector especially, the tertiary institutions

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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