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Effects Of Sustainable Research Funding On National Development; Cross Continental Analysis

Chinyere Clareth Elluh

Abstract- It has become very clear that research is very critical to national developmental process hence, sustainable research funding will no doubt engender such development. Not many researchers have examined the lingering problem of poor research funding and national development in Nigeria. Therefore, this paper examined the effects of sustainable Research Funding on National Development between 1980 and 2017. The study adopted econometrics methodology as the analytical tool using secondary data from Central Bank of Nigeria statistical bulletin, and National Bureau for Statistics. These time series data were collected between 1980- 2017. The Auto Distributed Lag Model(ARDL) econometric technique was used to estimate the model. Evidence from the study found that Public Recurrent Education Expenditure(PREE) has a short run and long run significant effect on National Development(RGDP) Meanwhile, Technical Grant(TG) has a long run significant effect on National Development(RGDP).The model was found significant in explaining the changes in National development with 59% in the short run model and 98% in the long run. However, Education Expenditure and Public Current Education Expenditure (PCEE) were found to have insignificant effect on National Development between 1980 and 2017. The paper therefore recommends a statutory increase in the budgetary allocation to the education sector especially on research and development(R&D) since the current budgetary provision of 7.05% is below the 15% to 20% allocation recommended by UNESCO to developing nation's annual budget because of the important role of the sector to the nation's economic growth and development. Government should provide adequate infrastructures especially in the tertiary institutions in the country and enabling environment that will engender research and development.

Keywords: Sustainable Research Funding, National Development, Education Expenditure, Nigeria

1. Introduction

The place of research in National development of any nation can not be overemphasized. The quality of research and the applicability of the outcome of such research is what creates gap among nations. Research funding for greater economic, social and environmental development is recognized as antidot to growth and development of any nation.

This is because research and development open doors to new discoveries, methods, procedures and approaches to better creations which sets the country ahead of others. The developed countries approach to research is through a sustainable funding by both the central government and other organizations with a view to underpin knowledge creation and technology transfer which is linked to achievement of their national goals (Steve, 2004).

The reasons for the USA advancement in Medical, technological and scientific development is because of funded research by the federal government (Rew, 2015). It is in line with this that Denis,(2015) lamented that funding uncertainties is deadly as it has the ability to cripple the nations activities. This was evident in the panic created by the short fall of government Research funding of $160 billion in 2010, against the $140 billion of 2015. Meanwhile Association of American Universities (AAU) and the Association of public and land Grant Universities sent a warning letter to USA to continue investment in Research and Development else US science and technology development would be outpaced by China and Singapore.

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According to Maharey,(2004), research is the core feature that distinguishes a university and as such supports communities and national development goals, by being a repository of knowledge and being innovative. It is on this pedestrian that New Zealand engaged in series of research funding ranging from $212 million in 2007 to 100% increase in 2014. Hodgson, (2014) also announced the advanced Network for Research and Education which will enhance sharing of information at speeds of 20,000 times faster than dial up and 400 times faster than domestically available speed internet, all with the aim of speeding up funding research for easier innovation and development. New Zealand government also, funded (PBRF) Performance based Research fund, (CORE) centres for Research Excellence and Growth and Innovation Pilots.

The benefit derivable from research funding has engender growth in developed countries and has motivated them to embark on research that gave birth to Big Data. The funding of Big Data is responsible for development of companies, countries and the world at large to access the numerous data that can enhance their sales, projected output and economic forecasting.

It is on the above numerous benefits of sustainable research funding as experienced by developed countries that this study aims at finding out how Nigeria can tap into sustainable research funding to engender National growth and development.

2.Review of Theoretical Literature

Scholars have defined research as a systematic enquiry into the cause of a phenomenon (Naidoo, 2011). Meanwhile, research can also be regarded as a careful study of a subject with a view to discover new facts or information about it. Research is also described as a systematic investigation involving development, testing and evaluation, with the aim to contribute to general knowledge [Oxford Dictionary, (2010); Olayinka (2006)].

The emphasis on research has grown over the years which has attracted the attention of stakeholders across the world (Kapur, 2018). The main focus is the sustainability of research funding to enhance national development. This is because funding is one of the most important part of research which when absent can render its purpose meaningless. Sustainable research funding therefore, has to do with the ability to fund research on a continuous basis. That is, the continuous funding of research work by both local and international donors such as the government, community leaders, individuals or private sector (OECD, 2015). From NGOs perspective, sustainable funding of project means continuing to finance, perform and deliver projects benefits to the primary target group. Nigeria is heavily endowed with human capital (Chikwe, Ogidi & Nwachukwu, 2015).These human endowments have been lying fallow and untapped without sponsors to develop and harness their potentials. This account for the backwardness of Nigeria in Science and Technology, Innovations and advancement. A funded Research would help in mining these rare genes; utilize them for national development and stop the brain drain which Nigeria is currently suffering by loosing her best brains to the developed countries.

According to Nwakpa, (2015), research serves as catalyst for achieving national development while sustainable research funding will speed up the achievement of national development through productivity (human capital) required to break new grounds in innovations and value chain. Chikwe, Ogidi & Nwachukwu, (2015) corroborates the above when they argued that Research is an intensive and extensive search for solutions to the problem in a society, adding that the difference between Nigeria and Japan, Sweden, Singapore or other developed countries is the level(quality) of research and application of such research findings in solving National problems. A sustained research funding therefore is needed not only for the sake of awarding degree in in Nigerian educational institutions (Ahiakwo, 2003) but as a panacea for national development. Since a carefully organized and well-focused research, monitored and supervised by donor institutions will have a positive influence on the socio-economic indicators such as Gross Domestic life expectancy, Product, Per Capita Income, improved industrialization, quality infrastructural provisions and human capital development. It becomes pivotal for Nigeria government to key into it as a tool to correct the anomalies at this stage of her crisis.

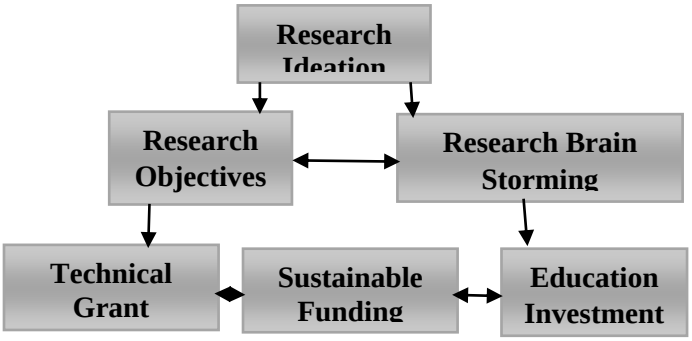

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Figure 1 showing link between Research Ideation, Sustainable funding and National Development

Many developed countries have imbibed the usefulness of research into their national planning abound. For instance, New Zealand government sees research funding from the perspective of funding Tertiary education which she believes plays a crucial role in creation and dissemination of knowledge. It describes research as core of what defines and distinguishes a university (Hodgson, 2007). It was on the benefits and necessity of research funding that lead New Zealand to establish seven centers for Research Excellence, building research capacity in the social science initiative and the Performance-based Research Fund (PBRF). Hodgson, (2007) submits that New Zealand is committed to research funding, as a support for New Zealand Researchers to participate in international collaboration initiatives. This is a position which Nigeria government should emulate if she so craves for national development.

The United Kingdom approach to research funding in the early years was high government funding and low tuition fees. UK like New Zealand also believes that the best research projects are carried out in the higher educational institutions. The essence of the higher funded research was to encourage innovations. This pattern changed giving way to declined funding and increase in tuition fees (Carpentier, 2012). After the decline in government funded research, grant was introduced to domestic students and loan was equally granted to EU students. That ended the era of free education in UK. By 2011, the grant giving to students was replaced completely with loan converting subsides to higher education institution into decisions by students on how, they pay, to whom they pay, and of course whether to pay (Qilong, Kang & Ruth, 2016).

Canada like UK sees research funding as that of a higher education funding. Though with a different approach, Tuition fees for domestic students are regulated by the government while international students pay fees as fixed by the institutions which are highly competitive (Piche, 2015). This approach has placed tuition fees as an important source of revenue to Canadian higher educational institutions.

US pattern of funding is not different from that of Canada, as reduced government funding has resulted to increase tuition fees. US has maintained what will be described as sustained funding for research in health care, medicine, technology and others (Mitchell, Palacios, & Leachman 2014). A reason for her position today as world power. US through sustainable research funding has maintained a competitive edge and pace, unbroken by any Nation (Nisar, 2015).

From Germany perspectives, research funding is more of state funding than individual or Organization (Nisar, 2015). Though Germany believes that funding should be based more on what the researcher (Universities or Institution) do than what they are, giving preference to the outcome and applicability of the research findings, (Qilong, Kang, &Ruth, 2016). Germany government advocates for Performance-based research than input-based.

In Japan large sum of money is allocated for success in global competition for research excellence as a national strategy for development, (Qilong, Kang & Ruth, 2016). This led to the establishment of 21st century Centers of Excellence between 2002 and 2009, and Global Centers of Excellence between 2007 to 2014. Several other efforts have been made by the Japanese government to support projects with the aim to produce world-class graduate schools and research institutes, (Yonezawa & Shimmi, 2015). The five – year Japanese support project titled Re-Inventing Japan (2011-2016) is a funded program to develop internationally competitive talents among Japanese youth. Additional to this was government budgetary system meant to improve the competitiveness of Japanese research universities. This singular budgetary effort of the government afforded 22 universities 10 years of sustainable research funding (Yonezawa & Shimmi, 2015). This is a step worthy of emulation by the Nigerian authorities to invest in research to spur national development.

Australia in the 1980s adopted a selective approach to research funding, pushing the burden from the government to individuals and private sector. This was done to internationalize the universities and increase the number of international students who would pay high tuition fees (Kimber & Ehrich, 2015). This was in line with the common aim of making research and higher education corporate entities pursuing profit, efficiency and productivity, (Long, 2010).

However, there are common thread that linked these countries so far analyzed. That is, the fact that most of the countries see research as activities carried out in the higher education institution. It was also clear that all the countries

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adopted a sharing approach to research funding, where the government alongside individuals and private sector funded research activities. It was also glaring that most countries invested more on higher education and research as a strategy to develop their economy and position their countries (Universities) for International Competitiveness.

2.1Theoretical Review

This study reviewed two influential theories. The Resource Dependence Theory and New Institutional Economics theory. The Resource dependence theory has its origin from management and organizational behavior. It states that the behavior of organization is shaped by the external sources that sustains her and from where she gains her survival (Fowles, 2014). Several Scholars have adopted this theory to explain education funding, such are the likes of Qilong, Kang & Ruth (2016); Fowles, (2014); Pilbeam, (2012); Santos, (2007) and lot more. To Qilong, Kang & Ruth, (2016) Resource dependence theory is influential to higher education funding. Fowles (2014) sees the theory as a powerful lens through which behaviors of public institutions of higher education can be explained. Fowles (2014) in his study speculates that given that institutions are indebted to the funding party, a shift in revenue away from public appropriations and towards increased reliance on tuition payments has had serious and unintended consequences on public universities. Nisar (2015) also adopted resource dependence theory to analyze the influence of Performance-based funding and opines that the success or failure of such polices depends on the amount of money tied with such resources as well as the dependence of universities on such sources of revenue.

New Institutional Economics posit that New Institutional Economics features theory of property rights, Transaction costs theory and Principal-Agency theory (Strehl, Reisinger & Kalatschan, 2007). The new institutional Economics theory is important to explain the exchange relationship between the state and higher education institutions. Emphasizing on neo-institutional premise, Proper (2009) stated that institutions / researchers faced with similar pressures will copy each on their struggle to the top. This mutual interest to excel will enhance the quest to achieve a better individual or institutional research objectives that will engender national development through research.

3.Methods and Sources of Data

Data was collected from the central bank of Nigeria statistical bulletin (Various issue and years) and from National Bureau of statistics (NBS). Annual Data such as Real Gross Domestic Product(RGDP), Education Technical Grant(ETG), Education Expenditure(EE) and Public Recurrent Education Expenditure(PREE) and Pubic Capital Education Expenditure(PCEE) were used as to help measure the effects of sustainable Research Funding on National Development between 1980 and 2017.

3.1 Model Specification

In line with the objectives and the theoretical underpinnings, a classical multiple regression model was specified. The model incorporates the relationship between Research funding and Development indicators in Nigerian Economy with the proxy for Research funding as Education expenditure and Technical grant and Real Gross Domestic Product(RGDP) as a measurement of National Development. This is because the Expenditure on education is expected to include funding for research in the higher institutions to be positively related with economic development, that is, the greater the education funding, the greater the research funding and the higher is likely the economic development in Nigeria.

RGDP=(ETG,EE,PREE,PCEE) eq1

Expressing equation above in econometric form, we have:

$$InRGDP_t = \beta_0 + \beta_1 InRGDP_{t-i} + \alpha_1 InETG_{t-i} + \alpha_2 InEE_{t-i} + \alpha_3 PREE_{t-i} + \alpha_4 PCEE_{t-i} + u_t \quad (2)$$

The dynamic long run form of equation (2) after expressing same in log-linear form is specified thus

$$\Delta InRGDP_t = \beta_0 + \beta_1 \Delta InRGDP_{t-i} + \alpha_1 \Delta InETG_{t-i} + \alpha_2 \Delta InEE_{t-1} + \alpha_3 \Delta PREE_{t-i} + \alpha_4 \Delta PCEE_{t-1} + \gamma ECM_{t-1} + Vt \quad (3)$$

Where:

InRGDP =Log of Real Gross Domestic Product

InETG = Log of Education Technical Grants

InEE = Log of Education Expenditure

PREE= Public Current Education Expenditure

PCEE: Public Capital Education Expenditure

U_t = Disturbance Term,

β_0 =Intercept term

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β_1, β_2, and β_3 = Estimation Parameters

Δ = first deference operator

γ = adjustment parameter which shows the extent to which the disequilibrium in the dependent
variable (ΔRGDPt) is being corrected each period
Vt = ΔUt = (Ut- Ut-1)

4.Empirical Results

4.1 Correlation Analysis

Correlation analysis was used to show the associations between the dependent and the explanatory variables. The results are presented in table 1.1 below;

Table 4.1: Correlation Matrix

	LOG(GDP)	LOG(EE)	PCEE	PREE	LOG(TG)
LOG(GDP)	1				
LOG(EE)	0.920513	1			
PCEE	0.005272	-0.01649	1		
PREE	0.216896	0.201678	0.146679	1	
LOG(TG)	0.847075	0.786226	-0.30379	0.143933	1

Source: Researchers Computation(Eviews10.1)

The results in table 1.1 shows a positive relationship between Real Gross Domestic Product(RGDP) and Education Expenditure(EE) (92%).This suggest that RGDP and EE moves in the same direction. However, there is a positive but weak relationship between Real Gross Domestic Product(RGDP) and Public Current Education Expenditure(PCEE)(0.5%). Meanwhile, there also exist a positive but weak relationship between Real Gross Domestic(RGDP) and Public Recurrent Education Expenditure(PREE) (21%). The result shows that as PCEE and PREE change, RGDP is likely to change but at a weak pace. Meanwhile, a strong relationship exists between Real Gross Domestic Product(RGDP) and Technical Grant(TG) (84%). This shows that as TG changes, RGDP also changes in the same direction. In a nutshell, the result shows that on the average, the Real Gross Domestic has a positive but weak relation with the explanatory variables.

4.2 Stationarity Test

To guide against an erroneous or misleading result, the study first tested the stationarity of the data. This is important because most time series data exhibit non-stationary behavior in their level form. The Augmented Dickey-Fuller (ADF) test and Phillips Perron Unit Root test were adopted.

Variables	ADF Statistic	Probability Values	5% Values	Decision
LOG(RGDP)	-3.930598	0.0046	-2.945842	I(1)
LOG(EE)	-5.978057	0.0000	-2.945842	I(1)
PCEE	-6.143811	0.0000	-2.943427	I(0)
PREE	-4.017498	0.0035	-2.943427	I(0)
LOG(TG)	-5.302896	0.0001	-2.945842	I(1)

Table 4.2a Augmented Dicky Fuller(ADF) Unit Root Test

Source: Researchers Computation (Eviews 10.1)

Variables	PP Statistic	Probability Values	5% Values	Decision
LOG(RGDP)	-3.930598	0.0046	-2.945842	I(1)
LOG(EE)	-6.182273	0.0000	-2.945842	I(1)
PCEE	-6.311723	0.0000	-2.943427	I(0)
PREE	-4.084355	0.0030	-2.943427	I(0)
LOG(TG)	-5.319025	0.0001	-2.945842	I(1)

Table 4.2b Phillips-Perron(PP) Unit Root Test Result

Source: Researchers Computation (Eviews 10.1)

The stationarity test reported in table 1.2 shows that RGDP as the dependent variable was stationary at first difference while EE was found stationary at first difference. Meanwhile PCEE and PREE were found stationary at levels. Meanwhile, RG was found stationary at first difference. This indicates that the model is stationary at level *I*(0) and at first difference *I*(1).

4.3Tests for Co-Integration

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Following the findings in (i) above that all variables of interest are of I(0) and I(1), a co-integration test which is the long run (co-integration) relationship among the variables was conducted. The F Bounds co-integration was adopted because the variables are *I*(0) and *I*(1) series. The F Bounds co integration test result was summarized in Table 1.3. The null hypothesis of no co-integrated is assumed.

Table 4.3.1 ARDL F Bounds Test Result

F- Statistics	4.088923	
Critical Values		
Significance	*I*(0)	*I*(1)
10%	2.45	3.52
5%	2.86*	4.01*
2.50%	3.25	4.49
1%	3.74	5.06

Source: Researchers Computation (Eviews 10.1)

The co-integration test for Research funding model shows that the null hypotheses of no co-integration between the variables are rejected since the F test statistics (4.0889) is higher than higher than the 5% *I*(0) and *I*(1) bounds. This implies that there is co-integration between among the variables. Given the existence of co-integration, an ARDL long run analysis is considered appropriate.
Since long run relationship has been established, the direction of the relationship was determined using Granger Causality test to determine the direction. Granger causality test is done by retaining the Vector Error Correction (VEC) framework when there is co-integration relationship. Below is the test result.

Table 4.3.2: Pairwise Granger Causality Tests

Null Hypothesis:	**Obs**	**F-Statistic**	**Prob.**
LOG(GDP) does not Granger Cause LOG(EE)	37	9.59048	0.0039
PCEE does not Granger Cause LOG(GDP)	37	5.24337	0.0284
PREE does not Granger Cause LOG(GDP)	37	3.71647	0.0623
LOG(TG) does not Granger Cause LOG(GDP)	37	15.2969	0.0004
PCEE does not Granger Cause PREE	37	5.45008	0.0256

Source: Authors Computation(Eviews10)

The result in table 1.5 shows that RGDP granger cause EE while PCEE, PREE and TG Granger Cause RDP. Meanwhile PCEE also Granger cause PREE. These shows the direction of the long run relationship between RGDP and the explanatory variables.

Table 4.3.3: Short Run Parsimonious Error Correction Results of Economic Development and Research Funding

Variable	**Coefficient**	**Std. Error**	**T-Statistic**	**Probability**
C	4.730157	0.957212	4.941596	0.0001
DLOG(GDP(-1))	-0.003318	0.194847	-0.017029	0.9866
DLOG(EE)	0.001208	0.028309	0.042684	0.9664
DLOG(EE(-1))	-0.022509	0.025983	-0.866289	0.3961
DLOG(TG)	0.008210	0.031854	0.257731	0.7991
DLOG(TG(-1))	-0.036259	0.030581	-1.185687	0.2490
D(PREE)	0.013572	0.006219	2.182411	0.0406
D(PREE(-1))	-0.017791	0.007110	-2.502312	0.0207
D(PCEE)	-0.001447	0.016820	-0.086052	0.9322
D(PCEE(-1))	-0.020855	0.014694	-1.419283	0.1705
ECM(-1)*	-0.236651	0.047969	-4.933440	0.0001
R^2 =0.59; R^2-adjusted = 0.43; F-statistic = 3.67; DW-Statistic =1.7; AIC = -2.64				

Source: Eviews Output, (2019)

Table 4.3.4: Long Run Parsimonious Error Results of Economic Development and Research Funding

Variable	**Coefficient**	**Std. Error**	**T-Statistic**	**Probability**
C	1.805714	1.297043	1.392177	0.1745
LOG(GDP(-1))	0.915986	0.067097	13.6516	0.0000
LOG(EE)	-0.00734	0.023052	-0.31827	0.7526
LOG(TG)	0.021019	0.009417	2.232081	0.0335
PREE	0.014654	0.007819	1.874191	0.0710
PREE(-1)	0.015739	0.007186	2.190247	0.0367
PCEE	-0.00737	0.018453	-0.39947	0.6925
PCEE(-1)	-0.02509	0.015621	-1.60632	0.119
R2 =0.98; R2-adjusted = 0.98; F-statistic = 338.2; DW-Statistic =1.84; AIC = -2.50				

Source: Authors Computation (Eviews 10)

5. Empirical Result and Analysis

The results reported in the short run table 1.6, shows that the National development is positively influence by public recurrent expenditure by changes in the current public education expenditure (PREE) while the first lag of public recurrent education expenditure(PREE) has negative influence on national development(RGDP). Meanwhile, 59 per cent changes in the national development in the short run model was explained by the explanatory variables. The

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Durbin Watson (D.W) statistics of 1.7 was found substantially very close to the traditional benchmark of 2.0 in the model. This suggest no sign of auto- correlation or serial correlation in the model specification Meanwhile, the F statistics that measure the significance of the model was found to be 3.67 with probability of 0.000. This suggest that the model is significant. The ECM coefficient shows negative relationship implying that the model corrects its short run disequilibrium by 23 per cent speed of adjustment annually in order to return to the long run equilibrium.

The result reported in the long run table 1.7 shows that that the National development is positively influenced by its past value while Technical grant(TG) and the first lag of Public recurrent expenditure was found to have positive significant influence on national development. However, Education expenditure(EE) and Public Current Education expenditure (PCEE) were found to be insignificant. This suggest lack of influence on national development between 1980 and 2017.

Meanwhile, 98 per cent changes in the national development in the long run model was explained by the explanatory variables. The Durbin Watson (D.W) statistics of 1.84 was found substantially very close to the traditional benchmark of 2.0 in the model. This suggest no sign of auto- correlation or serial correlation in the model specification. The model was alos found to have overall significance with F-Statistics of 338.2 with 0.000 p value.

To incorporate the short run dynamics in testing the stability of the long run model, the paper applied the cumulative sum of recursive residual (CUSUM) and CSUM squared. For stability of the short run dynamics and the long run equilibrium parameter of the National Development model, it is important that the CUSUM and CUSUM of squares stay within the 5 percent critical bound which is represented by two straight lines as shown in figures 1.1 and 1.2. The results suggest that neither the recursive residuals nor CUSUM of squares plots moved away from the 5 percent critical bounds. This shows that the estimated parameters for the short run dynamics and long run equilibrium of the national development model are relatively stable. This suggest that a stable National Development model exists between 1980 and 2017.

6.Discussion of Findings

The positive influence of public recurrent education expenditure (PREE) shows that government recurrent expenditure on education outweighed its capital expenditure. This is seen from the significance of recurrent expenditure on education and the insignificance of the capital expenditure within the period under study. Unlike Nigeria, developed and BRICS nations spend more in capital expenditure than recurrent to spur growth in the sector which can influence and enhance qualitative outcome in national development (Ifionu, Ebele and Nteegah, 2013). For instance, the maximum spending on recurrent expenditure is higher than the spending on capital expenditure in the education sector. Meanwhile, the positive impact of technical grant to Nigeria shows the importance of foreign assistance to the education sector in Nigeria. This also shows that an increase in technical grant will spur national development implying the importance of funding of national research in Nigeria. Chikwe, Ogidi & Nwachukwu, (2015) asserts in support of the finding that the difference between Nigeria and Japan, Sweden, Singapore or other developed countries is the level(quality) of research and application of such research findings in solving National problems. Ahiakwo, (2003) also confirmed the findings that a sustained research funding is needed not only for the sake of awarding degree in in Nigerian educational institutions.

Meanwhile, the pattern of funding obtainable in the developed countries such as US and the European countries educational institutions have been described as sustained funding for research in health care, medicine, technology and others (Mitchell, Palacios, & Leachman 2014). A reason while the countries have reached the pinnacles of their development as world superpowers. For example, US through sustainable research funding has maintained a competitive edge over many countries (Nisar, 2015). These countries give preference to the outcome and applicability of the research findings (Qilong, Kang, &Ruth, 2016).

The current budgetary provision of 7.05% is below the 15% to 20% allocation recommended by UNESCO to developing nation 's annual budget hence, the need for sustainable research funding to spur national development in Nigeria.

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7. Policy Recommendations

1. A statutory increase in the budgetary allocation to the education sector especially on research and development(R&D) since the current budgetary provision of 7.05% is below the 15% to 20% allocation recommended by UNESCO to developing nation's annual budget.
2. Measures should be put in place to guide against misallocation of resources in the education sector in Nigeria.
3. There should be in place an effort to monitor funds allocated for the sector to guide against mismanagement, misappropriation and diversion.
4. Also, a rating performance appraisal should be formulated in other to establish a rating measure to help drive quality and ranting growth drive in the sector.
5. The condition of service of the employees in the sector should be enhanced. This will enhance growth and reduce the current brain drain in the education sector
6. Government should provide adequate infrastructures especially in the tertiary institutions in the country and enabling environment that will engender research and development

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