



Retrospective Analysis of Research and Publications Output in Africa: A Comprehensive Review

Omagbemi Clement O

Centre for Foundation Education

Bells University of Technology

Ota, Nigeria.

ABSTRACT

This study gives an insight into the different meanings of scientific research. It analyses a survey report on research output and publications in relation to Africa and West Africa in particular. It covers the period 1960 – 2005. It identifies the key areas of disparities among scientists – salaries, self-sufficiency for graduate and post-graduate education, level of structure of research funding. It shows countries and trends of scientific research. Based on the review, the researcher recommended that it is necessary for governments, scientific ministries, and research institutes to foster the needed will and cooperation that will enable researchers and scholars in West African sub region to once again become active participants and contributors to the world of scientific research.

Keywords: Research; Publication Output; Scientific Research; Report Analysis; Comprehensive Review; Africa.

1. INTRODUCTION

The world today is often referred to as a knowledge society or knowledge economy. This refers to the ability of man today to practically apply his knowledge as a product to further human advancement in all fronts.

The knowledge economy has also brought with it other concepts like research and development (R & D) Science, Technology and Innovations (ST & I) which are all geared at maximizing the product of research.

1.1 What is Scientific Research?

Web definition on scientific research refers to it “as questions posed by scientific theories and hypotheses; systematic investigation to establish facts”. Big Science also defines it as “research that requires massive capital investment but is expected to yield very significant result”. The Business dictionary defines it as “application of scientific method to the investigation of relationships among natural phenomenon, or to solve a medical or technical problem”.

Scientific research is an organized, systematic search and investigation meant to increase the sum of human knowledge. The objective being to discover, reinforce or refine knowledge.

Scientific research is therefore the only source for generating and advancing the frontiers of man’s knowledge. This may relate to skills development and training as well as development of expertise for manpower.

The first organizational attempt to harness scientific skills to the positive needs of society took place in 1790s. This was when the young revolutionary government in France was defending itself against most of Europe. The results were remarkable. However, the lessons were not learnt permanently, and it was not until half a century later that industries started to call on services of scientists – Encyclopedia Britannica.

Scientific research since then has remained an important factor which facilitates and accelerates economic development and societal well-being and continued sustenance of mankind.

Scientific research can only be engaged in by those grounded in research and it is one of the traditional functions of a University. Scientific research in this clime therefore is being addressed from the view point of what could be done vis-à-vis enhancing research output and contributions from the West African sub-region for a sustainable development of research.

Kofi Annan, the former UN Secretary General did say:

The University must become a primary tool for Africa's development in the new century. Universities can help develop expertise; they can enhance the analysis of African problems; strengthen domestic institutions; Serve as a model environment for the resolution and Respect for human rights, and enable African Academics to play an active part in the global Community of scholars - (World Bank, 2004).

The above assertion from Kofi Annan is nothing but just the truth. However, preparation precedes success.

A higher education report in Sub-Sahara Africa by Crowe Helm Ltd. London cited by Hinchcliffe (1987) on returns on investment in higher education between 1960 – 1980 rated Nigeria with the highest – 46.0, followed by Botswana 38.0, Ghana 37.0, Lesotho 36.0 and Rhodesia South Africa 34.0. This report showed that Nigeria at a point in time attained an eminent position on returns in education.

A report from ASUU in 2002 states that:

By the mid-1970s, the post-independence investments in education and University education in particular had created enormous potential for the country. The expansion of university education occurred with increased quality of instruction.....Between 1960 – 1980, graduates of Nigerian tertiary were among the best in the European, and American universities and Nigerian academics proved their mettle that recalled national and international acclaim and recognition. These development created the actual possibility that Nigeria would realize her destiny as the power-house of possibility that Nigeria would realize her destiny as the power-house of African liberation and the pride of black men and women all over the world.

Status quo of Research and Publications output

The UNESCO Science Report, 2005, citing (Gaillard and Furo Tullberg, 2001) reports an African-wide questionnaire survey which illustrates disparities in relation to several key characteristics. Three of these are discussed below:

- Salaries
- Self-sufficiency for graduate and postgraduate education
- Level of structure of research funding

It was reported that while African scientists acknowledge that they enjoy a high degree of job security, they also express strong dissatisfaction (and indeed frustration) with their salaries and job benefits. It is to be noted that scientists in the Republic of South Africa are much less dissatisfied with 52.4% than their colleagues in North Africa 69.2%, while scientists in the Median Africa are most dissatisfied with 92% of respondents being displeased (Figure 1).

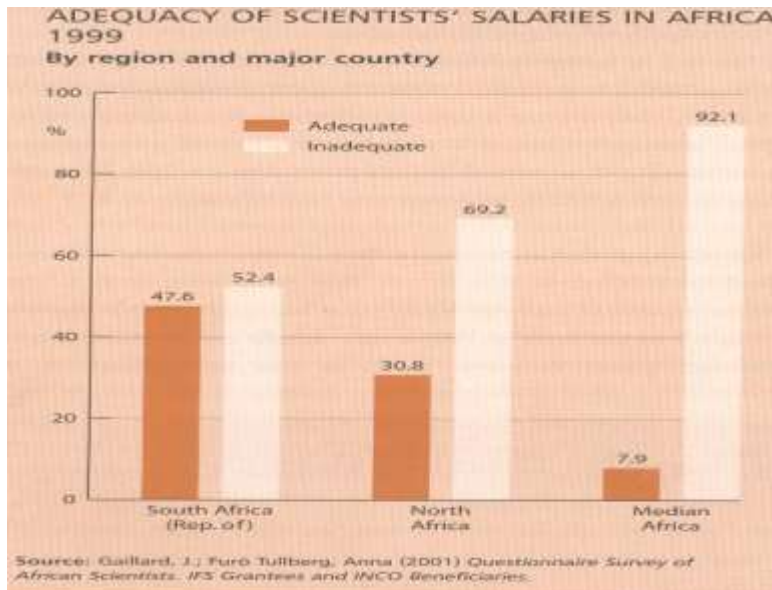


Figure 1. Adequacy of Scientists Salaries in Africa. By region and major country

It was reported that the number of students pursuing graduate and postgraduate education in African Universities has increased considerably in the last three decades. It was stressed that the higher the degree that is sought and ultimately earned, the more likely it is that student will pursue his or her studies abroad. It concluded that recent statistics however indicate an increasing number of Master's and Doctorate degrees received at home.

On the structure of research funding, it was reported that this varies from region to region. International institutions or foreign nations remain the most important source of research funding for science throughout Africa; while Median African Scientists depend more on outside donors than the Republic of South Africa and North Africa.

It noted a higher support in funding from home-based institutions in the Republic of South Africa and North Africa than being enjoyed by the Scientific Community in Median Africa.

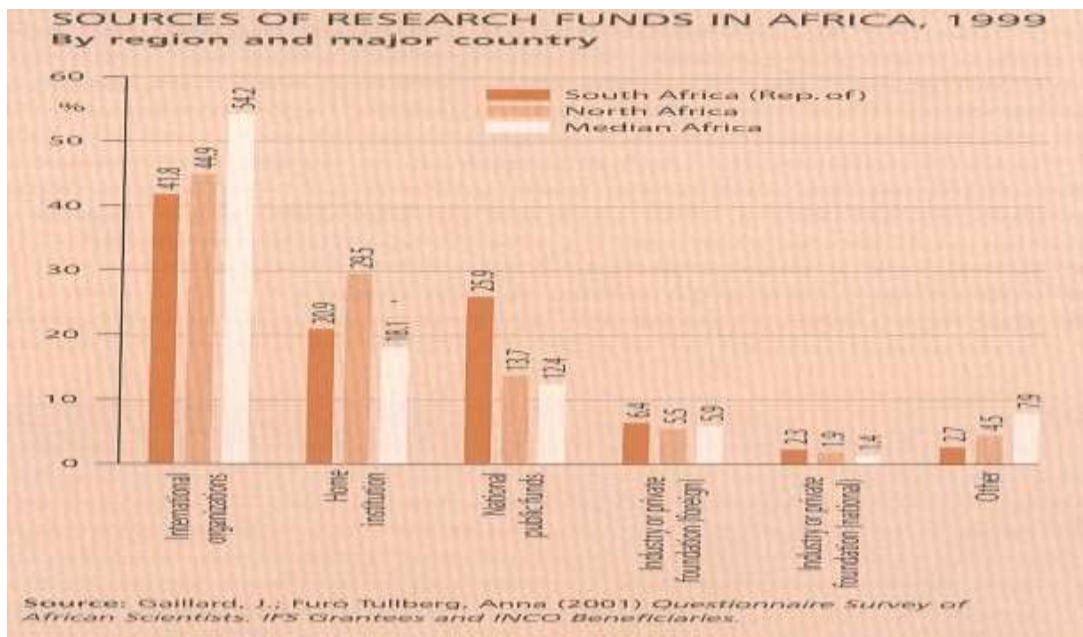


Figure 2. Sources of Research Funds in Africa in 1999. By region and major Country.

Additionally, other characteristics such as trends in a scientific output and relative importance of research quality revealed wide disparities in outputs from the Republic of South Africa, North Africa, indicating that the scientifically weakest areas are in the Median Africa. It reported 10,000 full-time researchers in Egypt and about that number in Algeria, Morocco and Tunisia; while the Republic of South Africa has about 13,000 researchers. It reported about this number for the whole of Median Africa. The import of this survey is that the West African sub-region still have issues concerning the three key areas reported in the Gaillard and Furo Tullberg survey as reflected in figures 1 and 2.

Bibliometric Panorama

It is a known fact that for any region to be significantly acknowledged to have contributed to the sum of human knowledge, its scientists must actively participate in scholarly research. This must be apparent in terms of the quantity and quality of research. A UNESCO report detailing scientific productivity in Africa by analyzing the number of scientific publications in Africa in the PASCAL databases from 1991 – 1997 is illustrated.

This report shows that in 1991 African Scientific production in terms of publications amounted to just 4% of the output of their counterparts from Europe; and in 1997, it fell to 3%. During the period covered, South Africa which is the continents main research producer had an impact comparable to Greece while Egypt was comparable to Portugal. It was reported that though Africa’s research priorities are often substantially different from those of other continents; European researchers in smaller countries have benefited from increased funding to further accentuate their research impact.

RESEARCH OUTPUT, AFRICA

The PASSCAL figures for the output of scientific publications in Africa is reproduced below as table 1. This report does not cover Humanities and social sciences as they are not recorded by PASCAL.

Table 1: Result of the IRD Survey on Researchers in Africa,1999. Selected Countries

RESULTS OF THE IRD SURVEY ON RESEARCHERS IN AFRICA, 1999					
Selected countries					
	Staff in higher education	Researchers full time in the public sector	Researchers full time in the private sector	FTE ¹ researchers	Researchers per million inhabitants
Algeria	16 000	1 200	700	3 000	100
Burkina Faso	700	200	0 ²	350	30
Cameroon	1 800	300	0	800	60
Côte d'Ivoire	1 200	500	0	600	55
Egypt	40 000	1 500	0	10 000	230
Kenya	1 800	600	0	1 000	35
Madagascar	900	260	0	300	35
Morocco	10 000	700	500	3 200	120
Mozambique	600	0	0	0	0
Nigeria	14 000	1 300	0	3 000	40
Senegal	1 000	435	0	600	80
South Africa (Rep. of)	17 000	8 500	5 000	13 000	350
Tanzania, United Rep.	1 400	0	0	600	70
Tunisia	9 000	800	400	3 000	350
Zimbabwe	1 100 ³	300	0	600	30

1 Full-time equivalent 2 0 = negligible 3 Includes private.
 Source: Waast, R. and Gaillard, J. (coord.) (2000) Science in Africa at the Dawn of the 21st Century. IRD, Paris.

From the table, the whole of Africa is classified into five hierarchical groups.

Group 1:

The table indicates that two countries Egypt and the Republic of South Africa account for half of the continents scientific research production – 49% covering all disciplines in 71 fields.

Group 2:

Countries that fall into this group are Kenya, Morocco, Nigeria and Tunisia and they account for a quarter 26% of Africa's publications output. The report indicated further that while these countries enjoyed well-established scientific communities in several fields at the commencement of the study in 1991, they are among those that experienced the most turbulent fortunes between 1991 and 1997.

The report noted further that the remaining 43 countries shared 25% of the recorded production. They may be divided into the following groups.

Group 3.

This group consists of countries that regularly produce between 70 and 200 papers per year. This regular outputs are sustained either by groups or networks of scientists specializing in a few disciplines or by group of scientists in a handful of cutting-edge institutes. The countries are Algeria, Cote d'Ivoire, Cameroon, Ethiopia, Senegal, United Republic of Tanzania and Zimbabwe. These are 7 in number.

Group 4.

Benin, Burkina Faso, Congo, Gabon, Gambia, Ghana, Madagascar, Malawi, Mali, Niger, Sudan, Togo, Uganda, Zambia represent a group of 14 countries which publish between 20 and 70 papers yearly. These are produced by a few eminent figures. In view of this the scientific infrastructures in these countries are fragile, highly sensitive to political change and dependent on external sources of funding.

Group 5.

The remaining countries consists of scientifically small countries whose scientific research productivity is erratic, and also closely tied to a few local scientists or Visiting Scientists. Factors like fundamental political changes, international isolation, civil war and massive destruction of infrastructure are some characteristics linked with countries in this group.

Countries And Trends Of Scientific Research 1991 – 1997

It was found out that different databases provide different perspectives on trends of research and publication output among African countries over the past decade, they agree at least on one point: in five years (1991 – 1996), compared with Europe or with the rest of the World, Africa has lost 20 – 25 % of its relative capacity to make contributions to World Science.

Gaillard, Hassan and Waast (2005) went further to say that the paths of different countries have diverged enormously. Stressing that whereas in the 1970s and 1980s middle-sized scientific powers had been seen regularly to grow and become established (Group 2 & 3 as already defined), the 1990 brought abrupt changes in fortune, completely upsetting previous classifications. They went on to summarize the changes as reflected below:

- The continent's two science giants – Egypt and the Republic of South Africa – encountered difficulties in maintaining their previous level of performance. The data from both PASCAL and the Institute of Scientific Information suggest that the relative contributions of both Egypt and the Republic of South Africa remains static.
- * Table:Scientific Articles Published in Africa in (1998).

Table 2 .Scientific Articles Published in Africa in 1998. Selected Countries

SCIENTIFIC ARTICLES PUBLISHED IN AFRICA, 1998 Selected countries			
	Number of scientific articles	Articles per million inhabitants	Articles per billion US\$ GNP
Algeria	241	8	5.5
Burkina Faso	72	7	26.0
Cameroon	167	12	18.0
Côte d'Ivoire	87	6	8.0
Egypt	1 313	120	17.0
Kenya	506	17	53.0
Madagascar	50	3	13.5
Morocco	510	20	14.5
Nigeria	450	4	14.5
Senegal	106	12	21.0
South Africa (Rep. of)	2 738	72	21.0
Tanzania, United Rep.	196	6	30.0
Tunisia	491	55	26.0
Zimbabwe	176	16	21.0

Source: Science Citation Index (North, South and East Africa); PASCAL (West Africa).

- Scientific output rose among the Maghrebs countries. It was observed that in five years, Morocco doubled its score, to become the third ranking producer in Africa. Tunisia showed a surge, while Algeria managed an improved performance in spite of disruptions and persecution of its academics and intellectuals. The report concluded that as it stands North Africa including Egypt now accounts for more than a third of Africa publications; catching up and overtaking South Africa.
- Nigeria it was stated experienced a staggering collapse in scientific ranking. The Nigerian Scientific Community in those five years suffered a 50% decline in its output of scientific literature. The reasons for this are common knowledge.
- Among countries in groups 3 & 4 were some notable developments – an up-swing in scientific output. Cameroon now leads this group, ranked 16th in 1981, it climbed to tenth place in 1987 and eighth in 1996. Similarly, both the United Republic of Tanzania's and Senegal's scientific literature production continue to grow despite severe restrictions in operating budgets and poor working conditions (Gaillard & Waast, 2000).
- The most marked changes are seen in figures recorded for the smallest countries in Africa. Ghana recovered somehow. For Malawi and Uganda, aid and cooperation from the USA and, to a lesser extent, the UK have stimulated a revival; while the ebb and flow of aid and cooperation explain the progress of Burkina Faso. It leapt 20 places in ten years, 16 in the course of the past years of the report.
- In contrast, Gabon, Mozambique and Niger do not have any good story to tell; as well as the Democratic Republic of Congo. It was noted that countries ravaged by famine, war, population exodus or obscurantism such as Angola, Burundi, Liberia, Rwanda and Sudan which at one time or the other seemingly relevant are sinking. The report concluded that performance in other countries are haphazard. However an exception was found in Gambia's Medical Institute in Banjul and the Institute of Geophysics in Djibouti.

THE WAY FORWARD

From this over-view on the African continent, the West African Sub-region must situate itself. Ultimately countries like Nigeria, Liberia, Cameroon, Ghana, Gambia, Senegal, Cote-d'Ivoire which are in the West African Sub-region have been touched in the earlier report. The constraints to scientific research in the African Continent are by extension applicable to West Africa. What then are the measures for the West Africa Region to surmount the problems and challenges confronting the Scientific Community to ensure that there is a future for scientific research in the Region.

GROOMING the Next Generation of Researchers

This unenviable state of research across the West African region is a direct result of government's inadequate attention to education especially at the tertiary level. This position was further encouraged by the World Bank's position which questioned the direct benefit of higher education to society, hence encouraging shifting of attention to the lower cadres of education.

.... But from 1995 – 1999, the proportion allotted to Higher education declined to 7% as focus shifted to Primary education in the wake of Jomtien World Education Conference in 1990 (UNESCO 2005)

In the West African Sub-region, the general disaffection for science and indeed education also occurred against the background of serious economic crisis. In view of this, higher education and research in spite of the ironical growth in the number of students lost their priority. The intellectual profession and the civil service which are often regarded as parasites either had pay reduced technically through devaluation of currencies and inflation. In Cameroon for instance not only were cuts in salary imposed by emergency economic measures, but devaluation and runaway inflation. In Nigeria, between 1985 – 1996, there was 34% devaluation and runaway inflation per year which led to a drop in researchers' purchasing power and the resultant brain-drain.

To date, these challenges have led to what could be describe as "academic tourism" by researchers – seeking for international market and other African countries with higher pay.

Apart from this is the change of profession without leaving the country.

Banks and industrial companies continue to attract academics away from their core profession, so did International Organizations and political appointments in the various countries.

A report conducted in Nigeria by (Lebeau et al 2000) indicated that many academics have "a second job" which prevent them from devoting adequate time and interest to scientific research.

With this process of de-professionalization within the West African region, the pool of active people in scientific research has continued to decrease.

Ultimately, the culture of Universities retaining and attracting their best graduating students to take up academics is almost disappearing. First Class and good Second Class Upper products that are expected to be mentored into becoming researchers and taking over from the ageing academics often found academics unattractive.

Table 3. Key Education Indicators for Africa 1990 and 2000
Selected Countries in Descending Order of Human Development Index

THE STATE OF SCIENCE IN THE WORLD

KEY EDUCATION INDICATORS FOR AFRICA, 1990 AND 2000					
Selected countries, in descending order of human development index					
	Public expenditure on education as a % of GDP	Public expenditure on education as a % of GDP	Public expenditure on tertiary education (as a % of all levels)	Public expenditure on tertiary education (as a % of all levels)	Tertiary students enrolled in science, maths and engineering (% of all tertiary students)
	1990	2000	1990	2000*	1990-2003
South Africa (Rep. of)	6.2	5.7	21.5	14.5	17
Gabon	-	3.9	-	25.5	-
Namibia	7.6	7.9	-	12.0	9
Botswana	6.7	2.1	-	18.6	19
Ghana	3.2	4.1	11.0	-	26
Cameroon	3.2	5.4	29.5	-	-
Togo	5.5	4.8	29.0	17.4	8
Congo	5.0	3.2	-	32.6	11
Lesotho	6.1	10.0	-	16.7	6
Uganda	1.5	2.5	-	-	8
Zimbabwe	-	10.4	12.3	-	-
Kenya	6.7	6.2	21.6	-	29
Madagascar	2.1	2.5	-	11.9	20
Nigeria	0.9	-	-	-	-
Gambia	3.8	2.7	17.8	-	-
Senegal	3.9	3.2	24.0	-	-
Rwanda	-	2.8	16.7	34.7	-
Guinea	-	1.9	-	-	-
Benin	-	3.3	-	16.4	25
Tanzania, United Rep.	3.2	-	-	-	22
Côte d'Ivoire	-	4.6	-	25.1	-
Zambia	2.4	1.9	-	-	30
Malawi	3.3	4.1	20.2	-	33
Angola	3.9	2.8	3.7	-	18
Chad	-	2.0	-	16.6	-
Ethiopia	3.4	4.8	12.1	-	19
Mozambique	2.9	2.4	9.9	-	-
Burundi	3.4	3.6	22.0	26.9	10
Mali	-	2.8	-	14.0	-
Burkina Faso	2.7	-	-	-	-
Niger	3.2	2.3	-	16.2	-

* For some countries, data may be for 1999 or 2001.

Source: Data provided by UNESCO Institute for Statistics in October 2009 and for UNDP (2004) Human Development Report.

The present crop of senior academics in the Nigerian University system for instance were mass produced through government policy. The Federal government of Nigeria during the Gowon administration took the very positive step of granting scholarships to Nigerian fresh University graduates with requisite qualifications to pursue postgraduate studies overseas without any serious strings attached. These graduates acquired higher degree – mostly PhDs and returned to serve the Nigerian academic community. There is therefore the need for the National Universities Commission, the Ministry of Education to evolve a government policy that will make it possible for the University system to be replenished through the award of scholarships and Bursaries for postgraduate studies especially overseas as the carrying capacity of most Nigerian Universities may not be able to sustain mass training at the postgraduate level.

- The academic reward system in the West African University system should be revisited. Nigerian academics must not do research for research's sake. Scientific research should not be an end-in-itself, but products to service the society. The quality and end-result of scientific research should be the guiding factor rather than the number or quantity of papers which add nothing to the society.
- In spite of the deteriorating trend in research, Universities across the region have made some modest contributions. The Nigeria Universities Technology Fair annually organized by the NUC in Nigeria has shown that there are a lot of products of great benefit lying idle in Nigerian Universities Inventions and Innovations by Scientific researchers across the West African region should be patented. Additionally there should be good incentives accruing to scientists and their parent institutions.

Science Academies and Foundations within the region should be made viable, functional and effective.

There is the need to revisit the beautiful Culture of mentoring in the University Systems across the region. There is the need to create or evolve core research leadership which will be considered suitable by foreign organizations and industrialized nations that might wish to fund research.

- There should be a Regional prospective plan for higher educational plan realignment.
- Need to change enabling laws in the different West African countries to give higher educational institutions capacity to be productive.
- Need for a platform for Universities, PolytechnicsMonotechnics and Colleges of Education to interact on research output.
- Universities must be seen as engine room for capacity building by society.
- Need for effective research policy which encourages proactive and applied research which must end up as products.
- Concerted effort at proper and adequate funding of applied research and proper utilization of research funds.
- Critical mass of data must be generated on science technology and innovations
- Establishment of a research databank on activities on research in higher institutions across West Africa.
- Need for standardization to ensure measurement and management of research.
- Research should be tailored along identified local problems.
- Strikes, and poor funding make research activities and goals difficult to achieve. Improved funding will prevent strikes.
- Basic and applied extension research must be encouraged, while local experts are involved at formulation of policy and design stages to avoid being designed- out.
- Government should commit 3%-5% of its annual total budget apart from the normal allocation for education to address scarce, technology innovations, weak background and higher education in science annually.
- For a period of ten years Regional Science Foundation / Academies must be functional.
- Provide minimum academic standard
- Focus and specialization within their own focus and capability.
- Prepare their graduates for employments, equip their graduates with business and entrepreneurial ability.
- Generate current and reliable data on their activities.
- Universities must interact with relevant bodies and governments for cooperation and capacity building.
- Engage in continuous human resources development.
- Boundaries of knowledge are no longer cast in stone, must engage in multi disciplinary approach to scientific research.
- Engage in advocacy.
- Incentives must be directed towards research.
- Innovations must be recorded and rewarded and commercialized
- Centers of excellence must not be created or established, but allowed to naturally evolve from areas of strength of universities and countries.
- Universities and Governments must manage change.

In other continents, countries that are not well-known for scientific endeavours are emerging on the International scene. West Africa cannot continue to dwell on the challenges and short comings of the past. It is therefore necessary for governments, Universities, Scientific ministries, Research institutes to foster the needed will and cooperation that will enable Researchers and scholars in the West African Sub-region to once again become active participants and contributors to the World of scientific research.

In conclusion, this paper is of great significance as a wake up call, a flashback and a timely reminder of the initial promising potentials of return on investments on education and university education which were squandered. This is therefore an invitation to generate good will to revamp the higher institutions education sector in Africa, and the West African sub region in particular, if Africa must cease to be pseudo allies in the global scientific community.

REFERENCES

Academic Staff Union of Universities (ASUU) 2002, Source: <http://www.asuunigeria.org/>

Business Dictionary (2013) www.businessdictionary.com/definition

Encyclopaedia Britannica.<http://www.Britannica.com/topic/research-and-development>

Free Dictionary (2013) www.thefreedictionary.com/scientific

Gaillard, J. and Furo Tullberg, Anna (2001) Questionnaire Survey of American Scientific, IFS Grantees and INCO Beneficiaries. IFS: MESIA Report No. 2, Stockholm, pp. 90

Hinchliffe Keith (1987) openlibrary.org/search

Lebeau Y, Onyeonoru I and Ukah, F. K. (2000) Nigeria Country report. In: Waast, R.; Gaillard, J. (Coord) "Science in Africa at the Dawn of the 21st Century", Institut de recherche pour le developpement, Paris.

UNESCO (2000) World Conference on Science: Science for the Twenty First Century World: A New Commitment. UNESCO: London

UNESCO Science Report on Africa (2005) Jacques Gaillard Mohammed Hassan and Roland Waast in collaboration with Daniel Schaffer; UNESCO Publishing; Paris, Pgs. 177 – 201.

World Bank (2004) Improving Tertiary Education in Sub-Saharan Africa Report of a Training Conference held in Accra, Ghana, Sept. 22 – 25, 2004.

Waast R, Gaillard J (Coord.) (2000) Science in Africa at the dawn of the 21st Century; IRD, Paris.

C. Author: coomagbemi@bellsuniversity.edu.ng