

Enabling Scientific Workforce for African Research-Intensive Universities.

Rasheed Olabisi Owolewa^{1*}, Ester Ndaxuwelao Ndaimbwehafo Kavalela², Zariyah Ibrahim Mohamed Zein³, Muhammad Abdullahi⁴

^{1,2}Razak Faculty of Technology and Informatics,
^{3,4}Perdana Centre of Science, Technology and
Innovation Policy.
Universiti Teknologi Malaysia. Kuala Lumpur, Malaysia.

Corresponding author: roowolewa@graduate.utm.my

Submitted: 6th Dec 2019
Correction received: 6th Jan. 2020

Abstract

There is a strong desire for research development in Africa. Nigeria and South Africa remain the largest producers of scientific research publications in West Africa and Africa respectively. However, this does not amount that there is a strong research output from the regions. African institutions suffer from chronic underinvestment and poor implementation of research as development agenda. This study evaluates research productivity in Africa based on scientific contributions and innovative research published between 2008 - 2019 in Scopus database and compares them with selected top ten countries across the world. This selections are considered top most countries Africa countries has research collaboration with, the comparison was done using Clarivate Analytics Incites and sourced data from Scimago Institutional Ranking database. Findings revealed that Africa universities are not performing to expectations. This led to the formulation of two main research questions based on how African governments are connecting with capable scientific workforce across the selected countries, what are the research funding and training mechanism put in places, and how do the region appreciates self-funding researchers who are becoming assets in the foreign countries and “brain drain” to the African region. The study gives input that will enable Africa institutions to rise among top ranking research universities in the world and presents how government and institutions in Africa can produce quality scientific researchers.

Keywords: Research Development, Scientific Research and Innovation, Scientific Publications, Nigeria Research Index, Research and innovation output

© 2019 Perdana Centre UTM. All rights reserved

■ 1.0 INTRODUCTION

The International Alliance of Research Universities has noted that one of the best assets of a country is to invest in Research and Development (R&D) to boost the reputation of the country in the global perspective. Among other assets is the presence of research-intensive universities which are the key to ensure the future of a nation, especially in the increasingly vulnerable and unpredictable global environment. Research-intensive universities

bring substantial economic benefit to the country. Through research, development can be easily reached, new discoveries would be made, the advancement of the nation and human endeavour can be easily reached, and intellectual capital would be achieved through basic and applied research (IARU, 2018).

Quacquarelli Symonds (QS) World Rankings has remained an evaluation system that has been constantly used in assessing university's research performance, using it to predict their global reputation. An analytical weightings system is often used to compare Universities and present their reputations. They conduct Survey of research output and scientific publications, peer-reviewed in scientific journals and evaluate the global research innovation and output (IARU, 2018). Though, another key to measure to present research-intensive university is the possession of educational standards with physical space, state-of-the-art infrastructure, innovative spirit and technology that will contribute to the critical knowledge ecosystem of researchers and students. Ability to make ground-breaking discoveries, transmit knowledge and new understanding to the world.

Today, a wide range of metrics are being used in measuring universities and countries with good reputation in research and technology, quality of education and (knowledge exchange) through technology transfer. This has attracted many governments across the world, they have now shifted their budget not only towards producing good university education, but creating a research environment with state of the art infrastructures that will make their higher institution a research-intensive institution. Thus they have channel more funding to higher education and research institutions. Research in higher education has become higher priority on the political agenda of the world-leading countries. However, these indicators have been seen taking seriously by many African countries and universities. Africa's overall research record remains poor, suggesting African governments are contributing limited resources to research and development. According to the World Bank, African Gross domestic expenditures on research and development (R&D) are less than 1%, (UNESCO, 2017). Even though Africa has a strong collaboration with selected countries like the USA, and China they account for 28% and 20% of global investment in R&D respectively, (UNESCO, 2017). Universities around the world are increasingly being held accountable through "hard" facts performance beyond politics of ranking, number of researchers are increasing with evidence based results. Thus attract more companies and external society.

Country expenditure on research and development (R&D) has thus remained a key indicator that can boost university research status to secure a competitive advantage in the science and technology landscape. Research intensive universities play an important role in respective countries and beyond by enabling the country to contribute to society through higher education and research (IARU, 2018).

Estimates from the UNESCO Institute of Statistics, (UNESCO, 2017) revealed that resources allocated to research and development from African Universities are too low, explaining that African governments don't spend a significant percentage of their gross domestic product (GDP) on research. Consequently, In the world University rankings, African research institutions have also been rated so low in terms of research performance, publication and innovative research (SCIMAGO, 2019) Although many would want to politicise the ranking, the significance of the World Rankings is to foster innovation among researchers and countries and then to encourage competition among universities on a global basis. Though there are about six major university ranking systems currently used in evaluating research performances from world Universities, some are based on web presence, (Webometrics, 2011), some are based on outstanding research performance of universities in the world (ARWU, 2011). The Quacquarelli Symonds (QS) World University Rankings has concentrated on four dimensions of rating Universities including the criteria for inclusion among Research-Intensive Universities. This includes University performance based on research publication, research quality, graduate employability, teaching quality, and international reputation. The academic peer review and scientific publication has remained a general ranking procedure. Thus, the falling out of African institutions from this criteria, attract our enthusiastic attention. Researchers and academia need to bother why African institutions are performing so low in research, innovation and publication output and why government attitude towards research is low despite global economic instability.

Recent studies revealed that enrolment into African universities is on the high rise, signalling a good prospect to have more scientists on board but capacity that will improve the institutions is dropping, government attitude in supporting research and institutions are decreasing raising a preliminary research question on why talented academic staff are living the African continents to explore quality research outside. In a similar concern, the little researcher remained are protecting over low incentive, students are protesting overstrike, overcrowded classes and inhospitable study conditions. Hence the need for action is inimical. Although, it has been noted that higher education in Africa is improving, it justify the increase in scientific publications from the region. According to a

study of (Odeyemi et al., 2019), but the publications should rather address scientific issues rather than publication to obtain promotion. Based on this background, the following main research questions are considered:

1. How are African governments funding research and training potential researchers in contributing to the national research and development?
2. How are African governments connecting with capable scientific workforce across the selected countries including self-funding researchers who might likely remain affiliated with international research body that grant them?

In answering these research questions, there is a need to also investigate the institutional capability to undertake scientific research as competent with some selected countries in which African institutions have collaboration with. As a whole, are African governments supporting institutions adequately by investing in research and innovations that will improve the performance of students and lecturers? In major cases, strategies that will drive a research-intensive atmosphere are often neglected. Although, one can submit that African Universities are more occupied with undergraduate teaching of theories, while the government is still being urged to revive wages and dwindling theoretical education environment. Evidently Students are less exposed to practical and research that will enable them to develop a mindset of innovation and productivity.

African institutions currently enjoy international research collaborations with countries like the USA, China, United Kingdom, Canada, Australia, Germany, Italy, Malaysia, and India. This is enough to triggered African higher Institutions towards research and development. There is a need to review the process in the regional policy and prioritized scientific and basic research as a regional development. Although previous studies have noted that low funding mechanism is responsible for poor research output from African Universities making more African talents comfortable in research institutions outside the continents. A whole fault did not lie on government considering administration in the University management settings too, Notably, the regional government's support for research in general is very low to the extent that the attitude is discouraging regional and continental bodies, including bilateral and multilateral developmental partners, and international organizations in supporting research institutions in Africa (UNESCO, 2017). Hence the need to act by all stakeholders.

■ 2.0 METHODOLOGY

This research was conducted in two stages; first we explored research performance from 10 selected western countries that have good collaborating research links with African institutions such as the USA, UK, Canada, Australia, Malaysia, Germany, China, India, Italy and South Africa. We explored the numbers of publication from there top ranking institutions in Scimago Institutions ranking (SIR) available between 2008-2019. The research performance metrics was pulled from the number of publications, quality of research and the research innovation factor using Clarivate analytics Incites. This result was further compared using the three main research performance indicators, although; there exist close to 13 indicators that could have been used. Secondly, we interviewed registered African researchers in Diasporal using semi structured interview. Specifically 10 researchers from Malaysia, 3 from China and 2 from Germany participated in this survey, this was conducted to obtain qualitative data that will answer our second research question on how African governments are connecting with capable scientific workforce across the selected countries. Our interview also target self-funding researchers who might likely remain affiliated with international research body that grants them.

■ 3.0 AFRICAN RESEARCH INTENSIVE UNIVERSITIES, MORE TO BE DONE METHODOLOGY

Data sourced from the 2019 Scimago Institutions Ranking (SIR) shows that South African remain the largest producer of scientific research in Africa, notably 45% of her research output came through international collaborations. In a similar vein, 70% of Nigerian research output came from the same international sources. Nigeria is the largest producer of scientific publication in West Africa, also representing the largest population in Africa with the highest number of higher education institutions in the African region. Coincidentally, 30% of our respondents are Nigerian researcher in diaporal, the remaining respondent cut across Ghana, Namibia, Sudan and Libya. Thus

there are more highly ranked universities in Africa aside Nigeria. However, research performance in Nigeria could enhance African institutional research base.

The World Universities ranking body released the ranking of 100 universities in Africa, South Africa, Kenya and Tanzania feature among the top leading universities in Africa. Nigeria's best research university, University of Ibadan is only ranked 36th in Africa and 1916th in the world while South African University is ranked 315th in the world university ranking (SCIMAGO, 2019).

For a closer look, Nigeria enjoys international collaboration with selected top ten research-intensive universities, this includes institutions in the USA, UK, Germany, and Malaysia, yet Nigerian universities are not performing to expectation. One would agree that with over 160 universities, 128 polytechnics and 177 colleges of education, Nigeria remains the largest higher education system in Africa. These institutions undertake skills-intensive and experiential learning programs which position Nigeria universities to be at the centre point of African leading research intensive university. Nigeria also has a strong research collaboration with G20 Countries. Yet, the research output is far lagging behind.

The G20 countries are among the 20 leading economic and global research and development countries that spread around the globe (Adams et al., 2019). The influence of these G20 countries can be seen beyond just a group. They consist of countries like the United States, United Kingdom, Canada, Germany, India, South Africa, Australia, Italy and China which many researchers from Africa were traced to have affiliating with. The majority of the international research publication in Nigeria come from international is linked to one or more foreign based researcher. Nigeria, Sudan, Algeria, Libya and Egypt trail behind countries like Malaysia, despite the continuous influx of African in Malaysian universities.

Though Malaysia is not among the G20 group, the investment model Malaysia placed on research has led to significant improvements in the quality of research institutions that now attract a lot of African. Sixty percent of African researcher's doing their research in these selected countries explained that the region has a greater tendency to improve their research potentials. Some of our respondents submitted that African region is lagging behind in terms of research equivalent with their chosen university. One researcher hinted that African institutions lag behind traditional world universities. Some researcher submitted, they were sponsored on TETFUND program, hence, they chose foreign research Universities to accomplish their research potentials. Tertiary Education Trust Fund (TETFUND), was originally established as Education Trust Fund (ETF) conceived with the intervention to rescue the nation from the vestiges paucity of research and publication and development, this has geared a great development in Nigeria as more researchers count on it sponsorship, yet African research quality and innovation output are still far lagging behind (Clark and Ausukuya, 2013)

■ 3.1 How Are African Governments Connecting With Capable Scientific Workforce Across The Selected Countries?

It is a common question to ask why Africa has fallen behind the rest of the world's economies. Our research question addresses this concern indirectly, but first of all, one must ask, how the African government is connecting with researchers outside the region. Are African countries investing in science and technology research just like these countries? Eight (8) out of the total fifteen (15) respondents disagree with this, saying, African government do not value research. 7 said the government from their region is doing well to improve research in science and technology. There is a secret behind science and the prosperity of nations which can be discovered through home base oriented research. Most of the self funding researcher's interview submitted they would rather remain in their chosen institution or country, if granted the opportunity to continue their research journey. One (1) of our respondents submitted that of the secret to regional development lies in scientific invention and technology which most African institutions don't have. We therefore presents research Index from African countries with some of the collaborating Countries below.



Figure 1: Nigeria Research Index with her top 10 Collaborating Countries

Data was sourced from Scimago Institutions Ranking and presented, (See Table 1). Nigeria is still far behind in research, publication, and innovative research output. None of the Nigerian universities was ranked (1500) in the QS world ranking. They neither made 30 in the African top 100 ranking universities. The University that was ranked best in Nigeria, University of Ibadan was ranked (1916) in the world explaining that Africa’s overall research performance is still far behind, thus signaling that the Institutions are not performing well enough. Research capacity and innovation are output that can easily position a national institution as a research-intensive university that will drive in more International scholars and collaborators. Table 1 tracks the research performance of selected top ten countries and compares them with research universities in Africa.

Table 1: Scimago Institutions Ranking based on Research and Innovation

	Collaborating Countries with Nigeria	SIR Overall Ranking based on Percentile	Research performance and Global Research reputation	Based on Innovation factor
1	USA	1 st	1 st	1 st
2	China	6 th	1 st	2 nd
4	United Kingdom	7 th	1 st	3 rd
3	Canada	11 th	1 st	4 th
5	Australia	31 st	1 st	9 th
6	Germany	75 th	2 nd	6 th
7	Italy	89 th	2 nd	19 th
8	Malaysia	213 th	4 th	24 th
9	South Africa	315 th	6 th	43 rd
10	India	523 rd	14 th	31 st
11	Nigeria	1916 th	54 th	83 rd

3.2 How Are Africa Government Adequately Funding Research And Training And R&D Investment?

There are about 7.8 million researchers worldwide contributing to the world research and development and are still growing in numbers. This remarkable growth is reflected in the explosion of scientific publications presented in table 2 below.

Table 2: Activity and Research performance of selected countries

Country	Population	Activity and Research performance across the last ten years					
		Total Number of Researchers	Researchers / 1000 population	Total Papers Domestic Publications	Total papers International publications	Total Publication in last ten years	% > world average
Australia	24,601,860			288,459	335,564	624,023	40.40%
Canada	36,708,083			352,119	384,737	736,856	38.20%
China	1,350,695,000	2,069,650	2.00	2,039,968	701,497	2,741,465	31.10%
Germany	81,686,611	586,030	7.17	534,443	637,700	1,172,143	37.40%
India	1,339,180,127			481,840	151,460	633,300	24.20%
Italy	60,627,498	185,916	3.07	364,725	348,644	713,369	37.50%
South Africa	55,291,225	51,877	0.94	57,665	72,510	130,175	30.40%
United Kingdom	65,595,565	510,980	7.79	550,634	723,391	1,274,025	41.10%
United State	325,147,121			2,819,840	1,607,757	4,427,597	39.20%
Nigeria	203,597,125						

The past ten years have seen a converging trend in research and development in the selected countries which is attracting many researchers from Africa. Though, Nigeria has a very low percentage of its publications available on-line and in Open Access that makes it difficult to ascertain the total number of researchers. Many African Scholars are presently enrolled in research placement in the selected countries mostly in (Australia, Canada, Malaysia and the USA,). These countries are continuously investing in research and development, personnel and providing grants in supporting scientists researchers to commensurate with their ambitions for development.

R&D is progressing faster in selected countries with government commitment to research and funding new ideas. The bilateral relations between Nigeria and China have expanded beyond growing bilateral trade and strategic cooperation. Many Nigerian have enrolled for research placement in China through TETFUND. Two of our respondents submitted they chose China for their research placement because of the enormous research environment. China is creating a strong research workforce that attracts many African researchers. Already, Over there are over 2 million Chinese researchers that are currently producing domestic and international driven innovation making China contribution of 20% global investment in R&D a good development (UNESCO, 2017). Destinations of Nigerian researchers have been towards the USA, Canada, Germany and the UK. Unfortunately, we only have our total respondents of African researchers from Malaysia, Germany and China. USA contributes 28% of global investment in R&D making a strong level of investment in research and development. Despite the global financial crisis, the US did not fail to see research and development as a recovery plan. "Germany is attractive to many Nigerians as a result growing German technology" said one of our respondents. Pressure is on public investment in knowledge and research across Germany. Canada has pressured its national budget on research, presently attracting more African migration to Canada for lucrative research placement.

Though there is a growing recognition of Africans being skilled with brain and ideas with strong research potential but underinvestment in national research innovation is setting the region low, forcing African based researchers at home to be low in innovation and research output. Some would say research and development have to do with just one word, money. Sadly this is part of the reason. One of our respondents concluded that lack of funding certainly played the major role affecting research development in Africa, but not entirely.

In a similar direction, one would observe African countries like Nigeria for instance, is central to the U.S. Government's global development strategy being the largest Africa economy and most populous country with the largest democracy. However, little contribution to global R&D suggests that the country might not have prioritized research and development in its economic agenda explaining why African universities are declining in the enormous research workforce. Sudan is constantly losing potential researchers to other countries due to what looks like a lack of regional propensity to pursue technology and research-driven environment. This is similar to what is presently obtained in other African countries.

Whereas most African Universities were successful in acknowledging the need to invest in research and development to sustain regional economic growth over the longer term. But decades of under-funding in universities has had dramatic consequences. Except for the two Nigerian Universities that meet up the world's top thousand university ranking, Covenant University and the University of Ibadan (University, 2019), universities are still under-performed on research. Although, South African Universities are doing well in research and development representing 316th in the world university ranking with about nine of South African universities competing with top universities in the world, however, there is still a concern in attracting the equivalent in other African countries. Nigeria ranked 1916th in the overall SIR ranking on Percentile, the country ranked 83rd far from research innovating countries and 54th far from research performing universities in the global ranking

A common international indicator used to measure the level of investment in research is the Gross Domestic Expenditure on Research and Development. Only 0.76% and 0.2% are traced to South Africa and Nigeria respectively. This is measured as a percentage of the total economic activity in a country or Gross Domestic Product. Another factor that might hinder research development in Africa is the weak Institutional service delivery, systems oversight, and leadership. The gap between Africa and selected research institutions is too wide. USA dominates 28% of global investment in R&D. China follows the second place (20%), even ahead of the EU (19%) and Japan (10%). Africa only accounts for less than 1% of the remaining 23% of global investment in R&D.

■ 4.0 FACTORS AFFECTING RESEARCH AND DEVELOPMENT IN AFRICA

Major challenges impeding research and development in Africa is lack of commitment to funding research and institutions, low national and institutional incentive will not produce quality scientific researchers, it will rather result in lack of motivation among researchers. Poor visibility of scholarship is also causing a low impact of research outputs. A critical constraint to research development in Nigeria and Africa is the lack of reliable electrical power and Internet facilities (Habib and Morrow, 2007, Okiki, 2013). Insufficient power from the national grid is forcing individuals and institutions to rely on generating set. Hence, poor electricity supply serve as a major impediment to research operation and growth in Africa. Deployment of information and communication technologies in the nation's universities are still marred with poor electricity supply. Whereas, the increase in the power supply can immediately complement the recent ICT deployment in the nation Universities. Although experts have argued that such provisions are palliative, they will not provide full solutions to the dwindling research performance in African Universities (USAID, 2019, Fatunde, 2008).

Also, the African university system is not big enough, it might seem redundant to mention this, but the demand for university placement currently exceeds available capacity. In Nigeria with over 200 million population, about 1.6 million applied to study in higher institutions, only 40% are able to gain admission. There is an implication to this; most classes are often crowd sourced and thus students complaining of overpopulated classrooms. Lecturers are often work loaded.

Particularly, Africa has fallen behind in research despite historical abilities in science and critical thinking, the rate at which the western universities have been able to invent and innovate through their universities in the last 30 years is far more than African universities. Collaborating countries like Malaysia or Asian Universities have

learned the importance of research and applied the same lesson to their universities making Malaysia securing 213th I global research-intensive universities with strong research innovation and output. Rising economics and wealth is the result.

■ 4.1 How to Fix the Problems of Research development in Africa

First of all, there must be an optimal cooperation between Universities, Government and the Industry to promote basic and applied research for development. According to (Altbach, 2015), two main types of research must be supported by institutions to set it as a research-intensive environment, they are basic and applied research. Basic research must be embraced at the university level to produce certain concepts like principles, theories, and practices that will generate new knowledge that will give rise to development. Governances and institutions must ensure this collaboration.

Applied research encompasses the results of basic research for technological and economic development. While many collaborating countries are supporting basic research through higher institutions, industries are enthusiastic in taking lead in applied research and technological development. Hence attracting more researchers with funds, grants, and fellowship. African Universities are still struggling with basic research infrastructures. Though lack of funding is affecting universities making the Government cut back federal funding.

To achieve a significant research atmosphere, (Jacob and Meek, 2013) have emphasized that the government must pay more attention to institutional support and funding. It is argued that improving the outcomes of African universities requires an investment that will be powered by each country strategic vision and matched with good governance. While institutions like TETFUND and University Commission in Africa need to focus on scholarly output accompanied by quality. Thus institution like TETFUND in Nigeria offers academic lecturer opportunity to study in foreign university, the core source of income available to fund lecturers is the two percent education tax paid from the assessable profit of companies operating in Nigeria. Aside from university lecturers, no special institution takes care of self-sponsor researchers.

The higher institution sector and the government is losing local talent and fail to support them individually. According to UNESCO data, over 60,000 of Nigeria's brightest students are studying abroad, with a lot of researchers self-funding their studies. There is not much wrong with this, but the implication is that self-funding researchers will be attracted to foreign grants and institutional support which may reduce their preference for contributing to their regional economy. It becomes a "brain drain" rather than the "brain gain". The government should encourage the self-sponsored researcher to patent their scientists' discoveries, the best way to get the most out of this is to create a federal research agencies that will welcome or shop for this talented researcher across their institutions, understand their lacks and offer a support system for them.

Most of all, African universities with the support from the government need to make technology and innovation a strategic priority from the standpoint of a world-view that African universities can invent and innovate by creating robust research governance and supportive structures.

■ 4.2 Robust Research Governance and Support Structures

A robust research governance and support structure must be established to promote an effective research process. The robust research system requires a robust governance framework. Government institutions must partner with research institutions the way they do with contractors. Government must charge universities to provide practical blueprints to solve local problems by developing a national science and technology policy that will support innovation from Universities. Notable, Nigeria's science, technology and innovation policy have recognises this needs, but there is a need to bridge the gap between industry and universities to perfect the country's economic planning towards science and technology. Though there are more to be done from the part of Universities, Government, and individuals as detailed in the framework below.



Figure 2: A developmental model that will support African research development

■ 5.0 CONCLUSION

Strengthening African research capacity can be viewed from three levels: individual, institutional, and the government. Several studies have suggested that individuals, institutions cannot sustain or improve the research capacity of a country without the support of government (OECD, 2012). Most research-intensive universities compared in our study with African institutions have highly qualified individual researchers, robust institutional structures and systems to guide and support the researchers. It is considered that African government recognition for self-funding research is very low, hence their contribution has not been given attention to. This has been attributed to a number of brain gain as self-funding researchers now attract grants in overseas and contribute meaningfully to research and development abroad, thus accounting for more than 50% publication from international collaborators. The region should focus also on developing individual skills and providing institutional and national structures and systems that will support the research and innovation. Though research has become more complex and increasingly competitive, which requires robust institutional mechanisms for oversight and management.

Some of the universities in Africa lack infrastructures for carrying out scientific research projects. It is well known that countries with high-quality infrastructures will attract funding from international agencies or research institutions.

African institutions should collaborate with scientists in advanced countries where working conditions for research are more conducive. Such collaboration will involve technology transfer or transferable training skills. Technology transfer simply means a process by which basic science research and fundamental discoveries are developed into practical and commercially relevant applications and products. The government should see research as a luxury that will apply local solutions and innovations in all sectors. Hence to achieve evidence-based research development and African intensive research universities, there must be adequate institutional funding, research infrastructure, and staff motivation so as to task researchers to produce close to practice research.

REFERENCES

- Adams, J., Rogers, G., & Szomszor, M. (2019). The Annual G20 Scorecard–Research Performance 2019.
- Altbach, P. G. (2015). What counts for academic productivity in research universities? *International Higher Education*(79), 6-7.
- ARWU. (2011). Academic Ranking of World University Academic Ranking of World Universities. Retrieved from <http://www.arwu.org/index.jsp>
- Clark, N., & Ausukuya, C. (2013). Education in Nigeria. World Education News & Reviews.
- Fatunde, T. (2008). Nigeria: Poor electricity supply hits ICT growth. *University World News*.
- Habib, A., & Morrow, S. (2007). Research, research productivity and the state in South Africa. *Journal of Higher Education in Africa*, 5(1), 113-130.
- IARU. (2018). The Knowledge Ecosystem Measuring the Value of Research Intensive Universities [Press release]
- Jacob, M., & Meek, V. L. (2013). Scientific mobility and international research networks: trends and policy tools for promoting research excellence and capacity building. *Studies in Higher Education*, 38(3), 331-344. doi:10.1080/03075079.2013.773789
- Odeyemi, O. A., Odeyemi, O. A., Bamidele, F. A., & Adebisi, O. A. (2019). Increased research productivity in Nigeria: more to be done. In: Future Science.
- OECD. (2012). *Transferable Skills Training for Researchers*.
- Okiki, O. C. (2013). Research productivity of teaching faculty members in Nigerian Federal Universities: An investigative study.
- SCIMAGO. (2019). SCImago Institutional Rankings. Available from SCImago Lab Retrieved October 4, 2019, from Scopus <https://www.scimagoir.com/?sector=Higher%20educ.&display=chart&country=all>
- UNESCO. (2017). *Research and development expenditure (% of GDP)*. Retrieved from https://data.worldbank.org/indicator/GB.XPD.RSDV.GD.ZS?name_desc=false&view=map&year=2017.
- University, T. H. E. W. (2019). World University Rankings 2019 by subject: education. <https://www.timeshighereducation.com/world-university-rankings/2019/subject-ranking/education#survey-answer>
- USAID. (2019). *Country Development Cooperation Strategy*. 2019: USAID Retrieved from https://www.usaid.gov/sites/default/files/documents/1860/Nigeria_CDCS_2015-2020.pdf.
- Webometrics. (2011). *Webometrics Ranking Web of World Universities*. In. Retrieved from <http://www.webometrics.info/index.htm>