Exploration of Research Areas of Universities in Nigeria based on Scopus Subject Document Classification

Hilary I. Okagbue, Aderemi A. Atayero, Pelumi E. Oguntunde, Abiodun A. Opanuga,
Patience I. Adamu and Angie O.I. Adebayo

Abstract— Over 5,000 publishers worldwide are sources for Scopus content; their publications under Scopus coverage could either be serial with an International Standard Serial Number (ISSN) or non-serial with an International Standard Book Number (ISBN). Searching, discovery and analysis are three key areas Scopus supports researchers and librarians. Scopus covers peer-reviewed literature and web content under four broad research areas known as life sciences, physical sciences, health sciences and social sciences & humanities; 27 major subject areas and 300+ minor subject areas are further sub-divisions of the four broad research areas (Elsevier [1]. Evaluation of research performance and analysis of journal quality are significant activities that determine the impact as well as ranking of universities across the globe. Bibliometrics, which dates back to the 1890s, was adopted in this study to quantitatively analyze the research areas of universities in Nigeria in order to determine their world impact and ranking. Research output from Universities in Nigeria is poor and Medicine, agricultural and biological allied courses seems to be the major research area. On the other hand, some other research areas were identified where efforts have to be intensified to stimulate research interest on them. The paper presented the research subject areas in terms of rank which comparative analysis can be performed.

Keywords— Bibliometrics, Nigeria, rank, ranking analytics, Scopus, statistics, subject.

I. INTRODUCTION

RESEARCH outputs of universities are usually an avenue for the determination of the cumulative research area of countries. Historically, the research area of a country is often as a result of premeditated efforts of the country to advance their course in terms of their vision, mission, goals and collective objective. Most often, technological advancement and development are the outcomes of such efforts and can be collectively seem as economic development or altruism. Research output are mostly as a result of scholarly activities which comes in form of journal articles, reviews, conference proceedings, books, book series, book chapters and trade publications. Prestige, relevance, influence and impact are the main reasons of including research outputs into some databases known as indexing database which usually contains bibliographic data of peer-reviewed scholarly works. Indexing databases are broadly classified into controlled and uncontrolled. Google Scholar (GS) is uncontrolled while Scopus, Mathematical Reviews, Web of Science, PubMed Central are some examples of controlled indexing database.

Scopus Elsevier is one of the most sought for indexing bodies, largely because of its coverage, citation tracking, collaboration [2] and others. Some of the strength and weaknesses of Scopus are discussed in [3]. It appears that Scopus is heavily assessed because of its use in data collection for reviews [4-6] and bibliometric or scientometric analysis which heavily features the use of Scopus subject classification [7-39].

Two of the many transparent measures of research outputs are the quality and quantity of peer-reviewed academic papers in reputable journals or conferences as noted by [40] and abstraction and indexation in reputable database of which this research considered Scopus.

Analysis of research outputs provides the research area based on the subjects that constitute the respective research area. Research area of Nigeria is merely summarized and in depth ranking of such has not been done in order to determine its strengths and weaknesses. Summary are available in SCImago and Web of Science. This paper goes a step further to describe the core areas of the top 20 institutions with most documents in Scopus.

Documents from Nigeria in Scopus are much fewer compared to other African Countries like South Africa, Egypt and Morocco. This is not limited in Scopus but other index databases and research in totality. Undoubtedly, it can be traced to low research outputs from the research institutes and higher institutions in Nigeria. The causes are listed in [41-44]. This has led to low ranking of Nigerian universities by ranking bodies. However other aspect that can contribute to effective research output that were not discussed in [41-44] can be seen

in [45-64].

II. METHODOLOGY

A. Scopus

Scopus Elsevier is a largest controlled database containing millions of bibliographic data of peer-reviewed scholarly outputs in form of journals, conference proceedings, book, book series, book chapters and trade publications. Currently, about 23,700 registered titles (4000 gold open access) and 500 publishers are covered which contains over 71 million records. Scopus can boost of over 1.4 billion cited references dating as back as 1970. The database is updated daily and titles are evaluated for inclusion, continuation and discontinuous using some transparent procedures. The database is easy to use, navigate and can support strategic research objectives which comes in form of collaboration, interdisciplinary and multidisciplinary research activities.

Table 1: Geo-political location, year of establishment and funding status of the selected 20 universities in Nigeria

UT	GPR	YOE	Funding
UI	SW	1948	Federal
OAU	SW	1962	Federal
UNN	SE	1960	Federal
ABU	NW	1962	Federal
UNILAG	SW	1962	Federal
UNIBEN	SS	1970	Federal
UNILORIN	NC	1975	Federal
UCH	SW	1948	Federal
UNIPORT	SS	1975	Federal
FUTA	SW	1981	Federal
UNICAL	SS	1975	Federal
LUTH	SW	1962	Federal
CU	SW	2002	Private
IITA	SW	1967	International
UNIJOS	NC	1975	Federal
UNIMAID	NE	1975	Federal
LAUTECH	SW	1990	State
NAU	SE	1992	Federal
DELSU	SS	1992	State
UNIUYO	SS	1991	Federal

B. Selection Criteria

The universities (UIN) with affiliations in Nigeria are all in the Scopus database with unique affiliation numbers. Only those with more than 1700 indexed documents were included and as such, only 20 were selected and studied.

The selected UIN are in descending order of the number of documents they have in Scopus. They are: University of Ibadan (UI), Obafemi Awolowo University (OAU), University of Nigeria, Nsukka (UNN), Ahmadu Bello University (ABU), University of Lagos (UNILAG), University of Benin (UNIBEN), University of Ilorin (UNILORIN), University College Hospital (UCH), University of Port-Harcourt (UNIPORT) and Federal University of Technology, Akure (FUTA). Others are: University of Calabar (UNICAL), Lagos University Teaching Hospital (LUTH), Covenant University (CU), International Institute of Tropical Agriculture (IITA), University of Jos (UNIJOS), University of Maiduguri (UNIMAID), Ladoke Akintola University of Technology (LAUTECH), Nnamdi Azikiwe University (NAU), Delta State University (DELSU) and University of Uyo (UNIUYO). The summary of the 20 UIN are shown in **Table 1**, which contains the universities, geo-political region (GPR), funding and year of establishment (YOE). The six geo-political region of Nigeria are: North West (NW), North East (NE), North Central (NC), South West (SW), South East (SE) and South South (SS).

Table 2: Scopus document subjects and their acronyms

AN	Subject	Acronym
1	Agricultural and Biological Sciences	ABS
2	Engineering	ENG
3	Environmental Sciences	ENV
4	Earth and Planetary Sciences	EPS
5	Biochemistry, Genetics and Mol. Biol.	BGM
6	Medicine	MED
7	Materials Science	MAT
8	Computer Science	CSC
9	Social Sciences	SOS
10	Pharmacol. Toxicol. And Pharmaceutics	PTP
11	Chemistry	CHM
12	Chemical Engineering	CHE
13	Physics and Astronomy	PHA
14	Immunology and Microbiology	IAM
15	Mathematics	MTH
16	Energy	ENE
17	Nursing	NUR
18	Multidisciplinary	MUL
19	Business, Management and Accounting	BMA
20	Arts and Humanities	AAH
21	Econs. Econometrics and Finance	EEF
22	Veterinary	VET
23	Decision Sciences	DES
24	Neuroscience	NEU
25	Health Professions	HEP
26	Psychology	PSY
27	Undefined	UDF
28	Dentistry	DEN

Table 3: The summary of the ranking of the document subjects of the selected 20 universities in Nigeria from Scopus

SCHOOL	1	2	3	4	5	6	7	8	9	10	11	12	13	14
UI	2	10	6	9	3	1	18	15	4	5	8	21	17	7
OAU	2	6	5	9	4	1	11	15	3	7	8	14	12	10
UNN	2	9	6	8	3	1	16	18	5	4	10	20	11	7
ABU	2	5	6	9	3	1	12	15	10	8	11	17	13	4
UNILAG	4	2	6	9	5	1	11	13	3	7	10	16	15	8
UNIBEN	3	6	7	10	2	1	11	17	5	4	9	13	14	8
UNILORIN	2	4	6	7	5	1	12	10	3	8	9	16	14	11
UCH	10	17	13	18	3	1	26	21	7	6	24	20	22	2
UNIPORT	2	8	5	3	4	1	13	15	6	11	10	14	12	9
FUTA	1	2	3	4	5	6	7	8	9	10	11	12	13	14
UNICAL	2	12	5	6	3	1	11	15	4	7	8	18	13	9
LUTH	5	15	9	20	2	1	27	25	7	3	13	21	17	4
CU	11	1	6	16	14	15	7	2	3	20	12	19	8	21
IITA	1	8	3	5	2	6	23	16	7	12	10	14	24	4
UNIJOS	4	8	7	9	2	1	20	22	6	3	10	17	15	5
UNIMAID	2	9	8	10	4	1	15	13	7	6	11	14	21	5
LAUTECH	2	5	4	15	3	1	13	12	9	6	7	10	17	8
NAU	3	5	6	12	4	1	10	14	8	2	11	9	15	7
DELSU	1	7	5	11	4	3	13	8	2	6	14	18	16	10
UNIUYO	2	7	3	14	6	1	10	15	4	5	8	12	9	11

Column 1 = ABS, 2 = ENG, …14 = IAM

C. Data Analysis

The data of the selected universities were obtained according to the 27 subject areas of Scopus and undefined subject adding up to 28. The subjects with the highest number of documents are ranked one and the one with the least number of documents is ranked the last number, probably 26, 27 or 28 depending on the profile of the institution. The subjects and their acronym and most importantly their assigned numbers (AN) are presented in **Table 2.**

III. RESULTS

It can be seen that from **Table 1** that 80% of the studied universities are funded by the Federal Government of Nigeria. Those universities have existed long before the emergence of some states and private universities and normally are expected to have more research output than others because of their longer time of existence. Covenant University (CU) is the only private university to make the list while two (2) State funded and one (1) international research organization domiciled in Nigeria completes the list.

The data are organized using the Scopus specifications in **Table 2** and presented in **Table 3.** It can be seen from **Table 3** that the UIN research output are mostly centered on medicine, agricultural and biological sciences, Biochemistry, Genetics and Molecular Biology and social science.

In order to get the true picture, the mean and median of the subject categories are calculated as chosen in **Table 4**. Thereafter the mean and median are ranked from least to highest. The subject with the least mean or median is the one with the highest research output and the subject with the highest mean or median is the one with the least output. Mathematically, the mean or median is inversely proportional to the research output because the rank is from the subject with the highest indexed documents to the one with the least value.

Analysis of variance of the universities output across the subjects was performed and the result showed a significant difference in the mean distribution of the different subjects at p value < 0.05 as shown in **Table 5**.

Table 3: Continued

SCHOOL	15	16	17	18	19	20	21	22	23	24	25	26	27	28
UI	14	16	13	19	24	12	20	11	28	23	25	22	26	27
OAU	18	13	19	24	16	17	20	27	28	26	23	22	25	21
UNN	12	17	19	24	22	14	15	13	23	27	25	21	26	28
ABU	14	16	19	18	20	21	22	7	26	23	28	27	25	24
UNILAG	12	14	21	22	17	19	20	28	26	27	25	23	24	18
UNIBEN	12	16	18	19	22	15	23	27	28	24	21	26	20	25
UNILORIN	13	17	20	18	22	15	19	21	26	24	27	25	23	28
UCH	15	28	9	19	25	14	27	23	16	5	12	8	4	11
UNIPORT	19	7	21	18	20	16	22	25	26	28	24	27	17	23
FUTA	15	16	17	18	19	20	21	22	23	24	25			
UNICAL	17	21	14	19	20	10	16	22	28	26	24	25	23	27
LUTH	22	26	8	18	28	19	24	16	23	14	10	11	12	6
CU	10	5	25	9	4	18	13	26	17	24	23	22	27	
IITA	21	17	11	15	18	19	9	13	20	22	25	26	27	
UNIJOS	16	26	14	21	18	11	25	19	27	24	23	12	13	28
UNIMAID	19	25	16	18	23	12	17	3	28	26	22	27	20	24
LAUTECH	16	11	14	19	21	22	24	18	23	20	25	26	27	28
NAU	13	17	18	19	20	16	21	27	25	26	23	24	22	28
DELSU	21	17	19	12	20	9	15	22	26	24	23	23		27
UNIUYO	20	17	21	18	19	13	16	24	25	26	22	23	27	

Column 15 = MTH, 16 = ENE, …28 = DEN.

Grouping was done using the subjects with closer mean and that yielded 5 distinct and non-overlapping research areas of the universities in Nigeria shown in **Table 6.** From **Table 6**, it can be seen that the UIN research strength are in medicine, agricultural and biological sciences, Biochemistry, genetics and molecular biology, social science and environmental science. On the other hand, the UIN has low research outputs in Psychology, Health professions, Neuroscience, Dentistry and Decision sciences.

Using the median in lieu of the mean produced another 5 distinct groups as presented in **Table 7**. Medicine, agricultural and biological sciences and Biochemistry, genetics and molecular biology are the subject with the most output and documents in Scopus while Veterinary, Psychology, Health professions, Neuroscience, Decision sciences and Dentistry are research areas with very low output and few documents in Scopus. In addition, other measures of central tendency or median estimators can be used in lieu of the mean and median.

IV. CONCLUSION

The research has led to the following conclusions and recommendation

- The research outputs of universities Nigeria are low when compared with other African countries such as South Africa, Egypt, Morocco and Algeria.
- Medical, biological and agricultural allied subjects seem to be the major research strength of Nigeria and most authors are most likely to publish in those areas.
- Nigerian universities and research institutes seems to be less prolific in basic sciences with the exception of biology.
- Efforts are needed to improve research in those areas with low output knowing the importance of those affected fields in human endeavor.
- Increased funding, inter-and-multi disciplinary collaboration and research training are some areas that can help to increase the quality and quantity of research outputs of research institutes and universities in Nigeria.

Table 4: Summary of the mean and median analysis

AN	Acronym	Mean	Median
1	ABS	3.15	2.00
2	ENG	7.30	7.00
3	ENV	5.95	6.00
4	EPS	10.20	9.00
5	BGM	4.05	3.50
6	MED	2.30	1.00
7	MAT	14.30	12.50
8	CSC	14.45	15.00
9	SOS	5.60	5.50
10	PTP	7.00	6.00
11	CHM	10.70	10.00
12	CHE	15.75	16.00
13	PHA	14.90	14.50
14	IAM	8.20	8.00
15	MTH	15.95	15.50
16	ENE	17.10	17.00
17	NUR	16.80	18.00
18	MUL	18.35	18.50
19	BMA	19.90	20.00
20	AAH	15.60	15.50
21	EEF	19.45	20.00
22	VET	19.70	22.00
23	DES	24.60	26.00
24	NEU	23.15	24.00
25	HEP	22.75	23.50
26	PSY	22.11	23.00
27	UDF	21.56	23.50
28	DEN	23.31	26.00

Table 5: Analysis of variance of the universities output across the subjects

Source of Variation	SS	Df	MS	F	P-value
Between Groups	24770.47	27	917.4248	45.80157	<0.05
Within Groups	10515.97	525	20.03042		
Total	35286.44	552			

Table 6: The identified mean groupings of research areas of the selected universities in Nigeria using the Scopus indexed document subjects

Group	Mean	Subjects
A	2.3 to 5.95	MED ABS BGM SOS ENV
B	7.0 to 8.2	PTP ENG IAM
C	10.2 to 10.7	EPS CHM
D	14.3 to 19.9	MAT CSC PHA AAH CHE MTH NUR ENE MUL EEF VET BMA
E	21.56 to 24.6	PSY HEP NEU DEN DES

Table 7: The identified median groupings of research areas of the selected universities in Nigeria using the Scopus indexed document subjects

Group	Median	Subjects
A	1.0 to 3.5	MED ABS BGM
B	5.5 to 9.0	SOS ENV PTP ENG IAM EPS
C	10.0 to 15.5	CHM MAT PHA CSC MTH AAH
D	16.0 to 20.0	CHE ENE NUR MUL BMA EEF
E	22.0 to 26.0	VET PSY HEP NEU DES DEN

REFERENCES

[1] Elsevier, B. V. (2016). Scopus content coverage guide. Retrieved June 22, 2018 from, https://www.biochem.mpg.de

[2] S. Aref, D. Friggens, S. Hendy, Analysing scientific collaborations of New Zealand institutions using Scopus bibliometric data. ACM Int. Conf. Proc. Series, 29 January 2018, Art. 31679202018.

[3] M.E. Falagas, E.I. Pitsouni, G.A. Malietzis, G. Pappas, Comparison of PubMed, Scopus, web of science, and Google scholar: strengths and weaknesses. *FASEB J.*, vol. 22, no. 2, pp. 338-342, 2008.

[4] M. Lundin, A. Bergviken Rensfeldt, T. Hillman, A. Lantz-Andersson, L. Peterson, Higher education dominance and siloed knowledge: a systematic review of flipped classroom research. Int. J. Educ. Tech. Higher Educ., vol. 15, no. 1, Art. 20, 2018.

[5] K. Mahmood, Correlation Between Perception-Based Journal Rankings and the Journal Impact Factor (JIF): A Systematic Review and Meta-Analysis. *Serials Review*, vol. 43, no. 2, pp. 120-129, 2017.

[6] T. Ozkan, H. Uzunboylu, Review of scopus databases published documents related to school administrators' technology leadership strategies: A content analysis. *Ponte*, vol. 73, no. 9, pp. 124-141, 2017.

[7] S.-U. Hassan, P. Haddawy, Analyzing knowledge flows of scientific literature through semantic links: a case study in the field of energy. *Scientometrics*, vol. 103, no. 1, pp. 33-46, 2015.

[8] R. Sarwar, S.-U. Hassan, A bibliometric assessment of scientific productivity and international collaboration of the Islamic World in science and technology (S&T) areas. *Scientometrics*, vol. 105, no. 2, pp. 1059-1077, 2015.

[9] L. Bornmann, M. Stefaner, F. de Moya Anegón, R. Mutz, Excellence networks in science: A Web-based application based on Bayesian multilevel logistic regression (BMLR) for the identification of institutions collaborating successfully. *J. Informetrics*, vol. 10, no. 1, pp. 312-327, 2016.

[10] D.N. Ocholla, J. Mostert, D.C. Rotich, Visibility of University of Zululand and Moi University researchers in web of science and scopus from 2003 to 2013. *Afr. J. Lib. Arch. Info. Sci.*, vol. 26, no. 1, pp. 3-15, 2016.

[11] R. Chakravarty, D. Madaan, SCOPUS reflected study of selected research and higher education institutions (HEIs) of Chandigarh: a city

of education and research. *Library Hi Tech News*, vol. 33, no. 2, pp. 12-14, 2016.

[12] M. Thelwall, The discretised lognormal and hooked power law distributions for complete citation data: Best options for modelling and regression. *J. Informetrics*, vol. 10, no.2, pp. 336-346, 2016.

[13] S.M. Dhawan, B.M. Gupta, R. Gupta, Global pervasive and ubiquitous computing during 2005-14. Ann. Lib. Info. Stud., vol. 63, no. 2, pp. 117-125, 2016.

[14] A. Noruzi, ArXiv popularity from a citation analysis point of view. *Webology*, vol. 13, no. 2, pp. 1-7, 2016.

[15] Y. Huang, Q. Huang, S. Ali, X. Zhai, X. Bi, R. Liu, Rehabilitation using virtual reality technology: a bibliometric analysis, 1996–2015, *Scientometrics*, vol. 109, no.3, pp. 1547-1559, 2016.

[16] N.M.A.M. Nadzar, A. Bakri, R. Ibrahim, A bibliometric mapping of malaysian publication using co-word analysis. *Int. J. Adv. Soft Comput. Appl.*, vol. 9, no. 3, pp. 90-113, 2017.

[17] R.K. Bhardwaj, Information literacy literature in the social sciences and humanities: a bibliometric study. *Info. Learn. Sci.,* vol. 118, no. 1-2, pp. 67-89, 2017.

[18] E. Starbuck, S. Purtee, Altmetric scores: short-term popularity or long-term scientific importance. *Digital Lib. Persp.*, vol. 33, no. 4, pp. 314-323, 2017.

[19] S. Nagarkar, M. Kengar, Analysis of physics research output of SP Pune University during the period 1990-2014. *Ann. Lib. Info. Studies*, vol. 64, no. 2, pp. 106-112, 2017.

[20] I.K. Razumova, A.Y. Kuznetsov, O.V. Kirillova, Information support of Russian universities in core research areas. *Integration Educ.*, vol. 21, no. 3, pp., 505-521, 2017.

[21] E. Abadal, R. Melero, R.S. Rodrigues, M. Navas-Fernández, Spanish scholarly journals in WoS and scopus: The impact of open access. *J. Scholar. Publish.*, vol. 47, no. 1, pp. 77-96, 2015.

[22] G. Ennas, M.C. Di Guardo,Features of top-rated gold open access journals: An analysis of the scopus database. *J. of Informetrics*, vol. 9, no. 1, pp. 79-89, 2015.

[23] P. Dorta-González, Y. Santana-Jiménez, Prevalence and citation advantage of gold open access in the subject areas of the Scopus database. *Research Eval.*, vol. 27, no. 1, pp. 1-15, 2018.

[24] A. Bonaccorsi, P. Haddawy, T. Cicero, S.U. Hassan, The solitude of stars. An analysis of the distributed excellence model of European universities. *J. Informetrics*, vol. 11, no. 2, pp. 435-454, 2017.

[25] A. Noruzi, YouTube in scientific research: A bibliometric analysis. *Webology*, vol. 14, no. 1, pp. 1-7, 2017.

[26] K.S. Baran, H. Ghaffari, The manifold research fields of facebook: A bibliometric analysis. *J. Info. Sci. Theo. Pract.*, vol. 5, no. 2, pp.33-47, 2017.

[27] G. Halevi, H. Moed, J. Bar-Ilan, Suitability of Google Scholar as a source of scientific information and as a source of data for scientific evaluation—Review of the Literature. *J. Informetrics*, vol. 11, no. 3, pp. 823-834, 2017.

[28] H. Najafi, M. Aghdasi, B. Teimurpoor, Designing knowledge map for knowledge management projects using network analysis. *J. Info. Tech. Magt.*, vol. 9, no. 3, pp. 637-657, 2017.

[29] M. Thelwall, R. Fairclough, The research production of nations and departments: A statistical model for the share of publications. *J. Informetrics*, vol. 11, no. 4, pp. 1142-1157, 2017.

[30] P. Kokol, K. Saranto, H. Blažun Vošner, eHealth and health informatics competences: A systemic analysis of literature production based on bibliometrics. *Kybernetes*, vol. 47, no. 5, pp. 1018-1030, 2018.

[31] M. Thelwall, P. Sud, A comparison of title words for journal articles and wikipedia pages: coverage and stylistic differences?. *Prof. de la Info.*, vol. 27, no. 1, pp. 49-64, 2018.

[32] R.L. Vega-Almeida, H. Carrillo-Calvet, R. Arencibia-Jorge, Diseases and vector: a 10 years view of scientific literature on Aedes aegypti, *Scientometrics*, To appear in 2018.

[33] D.A. Kwary, A corpus and a concordancer of academic journal articles. *Data in Brief*, vol. 16, pp. 94-100, 2018.

[34] L. Rokni, S.H. Park, Trend of medical tourism publications: An attempt to explore the involved academic disciplines and interests. Iranian J. Public Health, vol. 47, no. 2, pp. 225-230, 2018.

[35] A. O'Connor, O. McGarr, P. Cantillon, A. McCurtin, A. Clifford, Clinical performance assessment tools in physiotherapy practice education: a systematic review. *Physiotherapy*, vol. 104, no. 1, pp. 46-53, 2018.

[36] W.M. Sweileh, S.W. Al-Jabi, S.H. Zyoud, A.F. Sawalha, A.S. Abu-Taha, Global research output in antimicrobial resistance among uropathogens: A bibliometric analysis (2002–2016). *J. Glob. Antimicro. Resist.*, vol. 13, pp. 104-114, 2018.

[37] U.R. de Oliveira, L.S. Espindola, I.R. da Silva, I.N. da Silva, H.M. Rocha, A systematic literature review on green supply chain management: Research implications and future perspectives. *J. Cleaner Prod.*, vol. 187, pp. 537-561, 2018.

[38] Q. Hernández-Escobedo, A.-J. Perea-Moreno, F. Manzano-Agugliaro, Wind energy research in Mexico. *Renewable Energy*, vol. 123, pp. 719-729, 2018.

[39] Z. Abrishami, E. Nasli-Esfahani, R. Razmandeh, B. Larijani, F. Bandarian, Iran diabetes research roadmap (Idrr) study; Gap analysis of diabetes complications in iran: A review article. Iran. J. Pub. Health, vol. 46, pp. 32-38, 2017.

[40] A. Cetto, Scientific journal publishing in the developing world. Lesotho Coasted, Chennas, India, 1998.

[41] S. Chiemeke, O.B. Longe, F.A. Longe, I.O. Shaib, Research Outputs from Nigerian Tertiary Institutions: An Empirical Appraisal. *Libr. Phil. Pract.,* 233, 2009.

[42] B. Sabo, Universities, research and development in Nigeria: Time for a paradigmatic shift. Paper prepared for 11th General Assembly of CODESRIA, on Rethinking African Development. Beyond impasse: Towards alternatives, Maputo, Mozambique, 2005.

[43] P. Okebukola, *The state of university education in Nigeria*. National Universities Commission, Abuja, Nigeria, 2002.

[44] [43] P. Okebukola, O.M. Solowu, Survey of university education in Nigeria. *Journal of Curriculum Studies, 223* (2), 2001.

[45] A.K. Yusuf, An Appraisal of Research in Nigeria's University Sector. *J. Res. Nat. Devpt*, vol. 10, no. 2, pp. 321-330, 2012.

[46] A.A. Oduwole, Impact of internet use on agricultural research outputs in Nigerian Universities of Agriculture. *Lib. Hi Tech News*, vol. 21, no. 6, pp. 12-15, 2004.

[47] C.O. Ogbogu, An analysis of female research productivity in Nigerian universities. *Journal of Higher Educ. Policy Magt.*, vol. 31, no. 1, pp. 17-22, 2009.

[48] H.I. Okagbue, A.A. Atayero, M.O. Adamu, P.E. Oguntunde, A.A. Opanuga, S.A. Bishop, Dataset and analysis of editorial board composition of 165 Hindawi journals indexed and abstracted in PubMed based on affiliations, *Data in Brief*, vol. 19, pp. 520-525, 2018.

[49] H.I. Okagbue, A.A. Atayero, M.O. Adamu, S.A. Bishop , P.E. Oguntunde, A.A. Opanuga, Exploration of editorial board composition, Citescore and percentiles of Hindawi journals indexed in Scopus, *Data in Brief*, vol. 19, pp. 743-752, 2018

[50] A.A. Atayero, S.I. Popoola, J. Egeonu, O. Oludayo, Citation analytics: Data exploration and comparative analyses of CiteScores of Open Access and Subscription-Based publications indexed in Scopus (2014–2016), *Data in Brief*, vol. 19, pp. 198-213, 2018.

[51] H.I. Okagbue, A.A. Atayero, M.O. Adamu, A.A. Opanuga, P.E. Oguntunde, S.A. Bishop, Dataset on statistical analysis of editorial board composition of Hindawi journals indexed in Emerging sources citation index, *Data in Brief*, vol. 17, pp.1041-1055, 2018.

[52] M.A. Iroaganachi, R. Izuagbe, A Comparative Analysis of the Impact of Electronic Information Resources Use Towards Research

[53] Productivity of Academic Staff in Nigerian Universities. *Lib. Philos. Pract.*, Art. 1702, 2018.

[54] O.S. Nicholas-Omoregbe, A.A. Azeta, I.A. Chiazor, N. Omoregbe, Predicting the Adoption of E-Learning Management System: A Case of Selected Private Universities in Nigeria. *Turk. Online J. Dist. Educ.*, vol. 18, no. 2, pp. 106-121, 2017.

[55] C.A. Omonhinmin, O.E. Omotosho, A. Akomolafe, A.A. Atayero, Policy for development and use of open educational resources in

covenant university: An open access policy in covenant university. In *Web and Open Access to Learning (ICWOAL), 2014 International Conference on* ., Art. 7009198.

[56] C.A. Omonhinmin, E. Agbaike, A.A. Atayero, Implementing open access in a private nigerian university: A case study of covenant university. In *Web and Open Access to Learning (ICWOAL), 2014 International Conference on* . Art. 7009197.

[57] C.A. Omonhinmin, D. Olopade, A. Afolabi, A.A. Atayero, Open education and digital scholarly communication in covenant university. In *Web and Open Access to Learning (ICWOAL), 2014 International Conference on*. Art. 7009199.

[58] Y. Sun, L. Zhou, S. Zhang, A Development Study for Higher Education Informatization in China. *Int. J. Educ. Info. Tech.*, vol. 10, pp. 131-138, 2016.

[59] M.A.H. Al-Hagery, Google Search Filter Using Cosine Similarity Measure to Find All Relevant Documents of a Specific Research Topic. *Int. J. Educ. Info. Tech.*, vol. 10, pp. 229-242, 2016.

[60] L. Berényi, N. Deutsch, Effective Teaching Methods in Business Higher Education: a Students' Perspective. *Int. J. Educ. Info. Tech.*, vol. 12, pp. 37-45, 2018.

[61] P. Nikolaidis, D. Xanthidis, A.S. lali, A preliminary study of the research production in Saudi universities. *Int. J. Educ. Info. Tech.*, vol. 12, pp. 21-29, 2018.

[62] K. Myska, L. Samkova, Modern methods used in foreign language learning in the 21. Century. *Int. J. Educ. Info. Tech.*, vol. 9, pp. 209-215, 2015.

[63] A. Salawu, O. Oyero, M. Moyo, R. Moyo, A survey of research foci and paradigms in media and communication Master's dissertations and doctoral theses in South Africa. *Communicatio*, vol. 42, no. 1, pp. 136-154, 2016.

[64] B.S. Galadanci, S.A. Muaz, M.I. Muktar, Comparing research outputs of Federal Universities based on the Scopus database. *CEUR Workshop Proceedings*, vol. 1755, pp. 79-84, 2016.

[65] V.N. Okafor, V.W. Dike, Research Output of Academics in the Science and Engineering Faculties of Federal Universities in Southern Nigeria. *Afr. J. Lib. Arch. Info. Sci.*, vol. 20, no. 1, pp. 41-51, 2010.