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Comparative Analysis of Research Output of Federal Universities in Southern Nigeria

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Introduction

Research is human activity based on intellectual application in the investigation of matter. The aim of research is discovering and development of methods and systems for advancement of human knowledge. This will bring about industrial innovation and entrepreneurship within Nigerian industries. The outcome and the extent of the functions of the academics in creating new knowledge and innovation are forms of research output. Research output is a means by which academics contribute their own knowledge to the existing body of knowledge. This can be in form of journal articles, technical reports, books, chapters in a book, supervision and training of students etc.The more research outcome are published in all format the probability of availability and access to information is assured.

Research output in this study is the quantity of research in terms of publication output and supervision of students that an academic is able to carry out within a defined period. Academics place emphasis on research and publication, not only because it is presumed that research enriches teaching and the learning process, contributing to the body of knowledge, but also because it is a major determinant of institutional prestige (Ochai and Nwafor, as cited in Alemna, 1998). The issue of research output is of benefit to every nation. This is due to the fact that the wealth and economic progress of the nation depends on the extent of research carried out in that country.

Due to this trend, there are various ways of bibliometric studies involving research output. Hertzel (2003) opined that bibliometric analysis is a productivity count which is descriptive and involves countries, institutions, time periods and disciplines or subjects while literature usage count which is evaluative involves reference and citation. In the context of this study, bibliometric analysis is a method, which the researcher used to find out the extent of research output of federal universities in southern Nigeria using academics in science and engineering faculties. The analysis is in terms of journal articles and supervision of postgraduate students. The quantity of research could be observed according to Naim and Oliviastro (1994) and Jacobs (1998) by counting the number of books published and papers produced over a period. Another method of evaluating scientist productivity is by counting the number of postgraduate students that he or she attracts to research under him or her. Arenas and Valles (2000) said that in Mexico the criteria for awarding distinction of National Research takes into account scientific research impact and training of young researchers. Another way is citation analysis, which involves counting the number of citation, related to scientists work. This involves using ISI database, Cruz (2008) emphasized that international surveys of universities, such as the Times Higher Education Supplement, World University Ranking 2006, have taken ISI data as crucial determinants of quality of faculties, universities and countries. But scientists from developing countries publish in the national and local

journals. That is why Russel and Galina (1998) stated that in developing countries the problem of impart analysis using citation is further complicated by the fact that applied research of a local nature is rarely cited even when published in the mainstream journals. There is also the problem of language, ISI index contains only articles written in international journals in English. Due to the fact that there is no data base in Nigeria to carry out such studies, researchers who have done studies in research output used questionnaire. Popoola (2002) used a self-developed questionnaire to find out the research output of social scientists in Nigerian Universities. The number of publications produced in a given period measured the research output of the respondents. To determine the research output of the respondents, they were asked to state the number of their publications that appeared in referred works in the last three years by types of publication. In another study Oduwole and Ikhizama (2007) used survey method and questionnaire to find out the research output of librarians in Nigerian Agricultural Research Institutes and found out that their research output are poor and that librarians research output is related to working experience. Hence questionnaire was used in this study to determine level of research output among universities.

Objectives of the Study

Specifically the study intended to

1. Find out the extent of research output of academics in the six universities.
2. Find out where these academics publish more.
3. Find out the rate of their postgraduate supervision.
4. Ascertain the multiple comparisons of journal articles publish in the last ten years.
5. Ascertain the multiple comparisons of journal articles publish in local journals.
6. Ascertain the multiple comparisons of journal articles publish in international journals.

Null Hypotheses

1. There is no significant difference in the mean research output between academics in the six universities.
2. There is no significant difference in the articles published by the academics in both local and international journals.

Scope

There are 13 federal universities in southern Nigeria .Southern Nigeria is made of three political zones, south-east, south-south and south-west. South West has three first Generation Universities which are: University of Ibadan, Ibadan, University of Lagos, Lagos and Obafemi Awolowo University, Ile-Ife. Others are University of Agriculture, Abeokuta and Federal University of Technology, Akure which are third generation universities. South-South has only one first generation university which is University of Benin, Benin. University of Calabar, Calabar, University of Port-Harcourt, Port-Harcourt and University of Uyo, Uyo are second and third generation universities: South-East has also one first generation university,University of Nigeria, Nsukka . Federal University of Technology, Owerri, Nnamdi Azikiwe University, Awka and Micheal Okpara University of Agriculture Umudike are second and third generation universities: The study was restricted to academics in science and engineering in federal universities in Southern Nigeria. The academics are in the physical and biological sciences and engineering.

Literature Review

There are many ways in which empirical studies on bibliometrics can be reviewed. Ashoor and Chaudhry (as cited in Okafor, 2008) in their study of the publication pattern of scientists working in Saudi Arabia based their study on a computerized database of journal articles derived from Scientific Citation Index (1980-1984). Publication productivity of Saudi scientists was found as follows: teaching institutions 76.5%, hospitals 14.9%, government departments 5.5% and private organization 2.7%. They went further to find out that the most productive institution was King Saud University (K. S. U.) the oldest and the largest university in the country, which produced more than half of the papers, (607 publications or 56.1%). It also has constituent college of medicine and agriculture. The presence of the medical scientists at KSU contributed in the scientific literature. The study of this type should consider the institution, its age

and the subject area.

Shastree (2000) reported that the evaluation strategies at Technical University of Denmark have focused on estimation of research activity and productivity which include research projects, number of publications and relevance to the teaching activities. Universities preferred to have outside assessors from other universities so as to ensure a free and independent evaluation. In order to know the result of the research activity, six categories of research publications were identified, which include dissertation, scientific monographs, and articles in journal with a referee system, other articles and proceedings from conference and reports. Sawyerr (2004) emphasized that Africa's future by strengthening indigenous educational systems and institutions for generating and applying knowledge by assuring, long-term public support with emphasis on research capacity. In addition to individual skills developed in research work, research capacity includes categories of research projects. A more recent study suggests some improvement in the enrolment of Ph.D students. This is said to be the result of reduced opportunities for Africans to do doctoral work in the usual western institutions, combined with increased pressure especially academics to obtain such qualifications for career purposes. University of Zimbabwe had 30 masters in MA/MS, 12 Ph.D in Basic Science, 68 MA/MS, 38 Ph.D in Applied Science, 16 in MA/MS, 14 Ph.D in Humanities. Yaounde' (Cameroun) had 21 MA/MS projects, 33 Ph.D in Basic sciences, 12 MA/MS projects, 2 Ph.D in Applied science, 26 MA/MS project, 36 Ph.D in Humanities. While, Suez Canal University (Egypt) had 94.5% with 79 MA/MS, 82 Ph.D in Basic science, 478 MA/MS and 174 Ph.D in Applied science and 180 MA/MS and 81 Ph.D in Humanities.

In a similar method Meyer, Plessis, Tukeva and Utecht (2008), in a paper compared the inventive output of two science systems in small European countries. More specifically they examined patented inventions of Finnish and Flemish university researchers. The comparison includes inventive output as such and its concentration on organisation inventor and corporate owners as well as foreign assignations and the degree to which individual inventors have retained the ownership of the patents. The total inventive output of Finnish university researchers was relatively high. They identified a total 530 patents, which could be related to university researchers as inventors. This is more than 8% of all Finnish US patents in their database. A total of 362 US patents could be linked to Flemish university researchers. This was about 5% of all Flemish patents in our Database. If one restricts the comparison to the years for which both Finnish and Flemish data is available (1991-2000) the patent counts are 432 Finnish patents and 306 Flemish patents. In spite of science, technology and innovation indicators and the intellectual property system, individual academic activity appears to be highly concentrated on a small number of universities. Chiemeke, Longe, Longe and Shaib (2009) investigated research outputs of Nigerian Tertiary Institution using nine journals randomly selected from African Journals Online (AJOL). They found out that the volume of research papers from Nigeria in the Journals analysed amounted to 39.1% of the total number of publications in those journals in (1999-2005). The problem with this study is they did not focus in a subject area, any particular institution and few journals.

Method of Data Analysis

The sampling technique used for the study was stratified random sampling. Two levels of stratification were used. The first level was geo-political zone namely South-West zone, South-South zone and South-East zone. The second level of stratification was the age of the universities, which were first generation universities, second generation universities and third generation universities in southern Nigeria. Within each zone and each generation, if there were more than one university, a university was selected randomly. Zones like South-South and South-East have one first generation university each. These were automatically included in the sample. South-west has three first generation universities and through random sampling university of Ibadan was selected. In the group of second and third generation universities a university was randomly selected from each zone. University selected were University of Ibadan (UNIBADAN) and University of Agriculture, Abeokuta(UNAAB) (South West); University of Benin (UNIBEN) and University of Uyo(UNIUYO) (South-South); University of Nigeria, Nsukka(UNN) and Nnamdi Azikiwe University, Awka (NAU) (South-East).On the whole a total of six universities were used, two from each zone.

The researcher personally visited all the universities selected for the study to distribute the questionnaire for data collection. 435 copies of the questionnaire were distributed. 353 copies were retrieved representing (81.1%) return; of this 291 copies were properly completed and used. Mean, bar chart and one-way Analysis of Variance (ANOVA) were used to determine if there is any significant difference between research outputs, among universities. Then least significant difference (LSD) for

multiple comparisons, were used to find out differences between pairs of variable means.

Data Analysis

What is the level of research output of academics in the six universities? Journal articles were used to ascertain the level of research output of academics journal articles were the main source of information and the principal type of publication needed in promotion assessment in the universities in Nigeria. Table 1 below showed mean journal publication of the academics according to university.

Table 1: Mean of Journal articles of academics last ten years according to University (1997-2006)

University	Number of Academics	Mean
UNIBADAN	49	8.92
UNN	84	9.21
UNIBEN	53	12.17
NAU	29	9.86
UNAAB	28	8.46
UNIUYO	48	8.13
Total	291	9.52

The publication outputs of the six universities were summarized in the Table 1 above. This showed that UNIBEN had the highest published articles with mean of 12.17. Other universities had the mean of published journal articles as follows: NAU 9.86; UNN 9.21; UNIBADAN 8.92; UNAAB 8.46 and UNIUYO had 8.13.

In order to find out where these academics publish more, that is whether in local or international journals a further analysis was done as shown in Table 2 below.

Table 2: Mean of Articles in International and Local Journals.

Name of university		Articles in local journals	Articles in internationals journals
UNIBADAN	Mean	4.33	3.49
UNN	Mean	4.53	2.05
UNIBEN	Mean	7.51	1.95
NAU	Mean	5.91	3.09
UNAAB	Mean	3.00	4.83
UNIUYO	Mean	4.83	1.66
Total	Mean	5.07	2.64

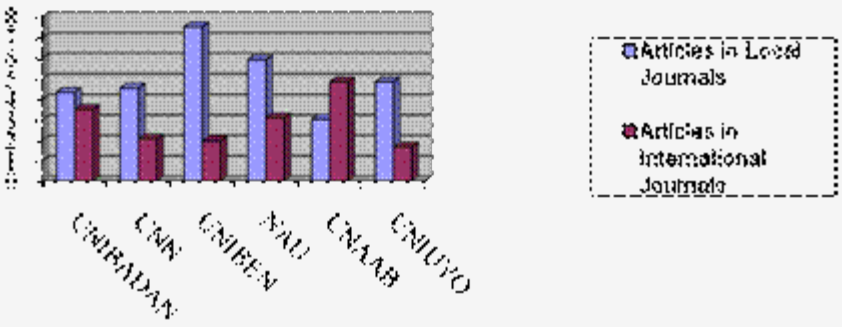

Fig1: Bar Chart of mean Journal Articles of the six Universities in local and International Journals.

Table 2 and Fig 1 showed that UNIBEN had the highest journal articles in the local journals with mean of 7.5 whereas UNAAB had the highest mean article publications in international. On the other hand, NAU was the second highest in local publications while UNIBADAN was the second highest in international journals article publications. UNIUYO and UNIBEN had the least in international journal

articles. University of Nigeria, Nsukka and University Uyo were below average in both local and international publications in journal. University of Benin was above average in articles in local journals while Nnamdi Azikiwe University was above average in both articles in local and international journals. University of Agriculture, Abeokuta was above average in articles published in both local and international journals.

Another way of assessing the productivity of respondents is to find out the rate of their postgraduate supervision. Supervision of postgraduate students was also used in this study as a way of assessing universities because it is one of criterion of assessment for promotion of academics and projects and theses are also sources of information for the researchers.

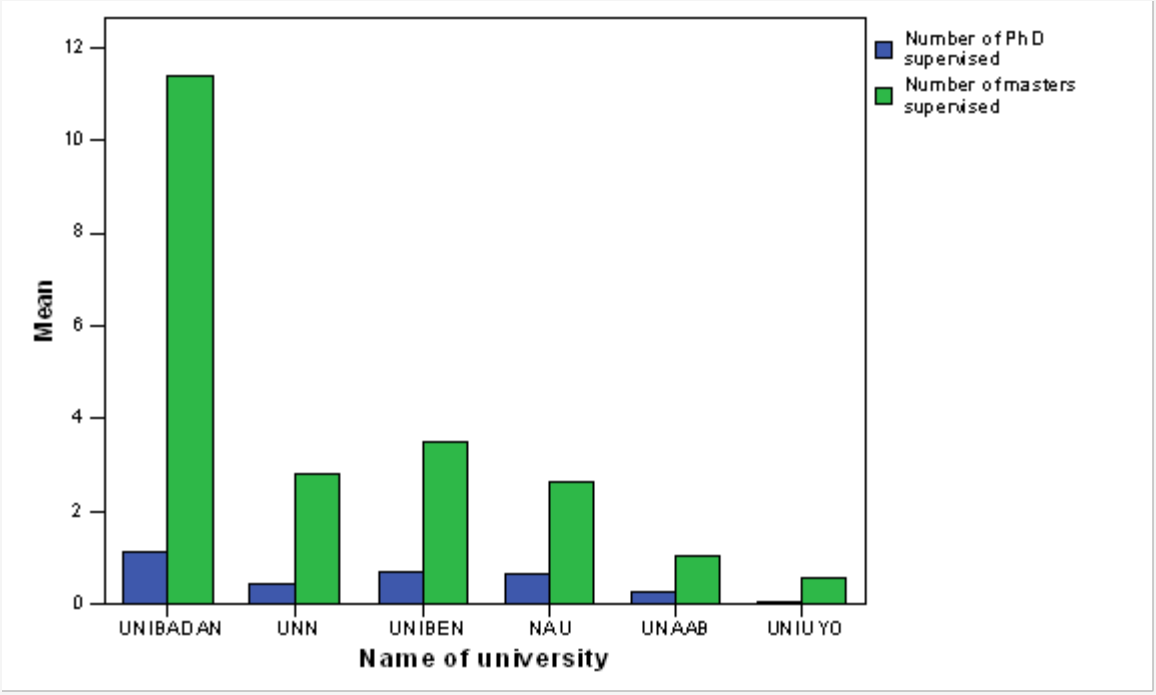

Figure2: Bar Chart of Postgraduate Supervision By University

From Fig 2 above, UNIBADAN, UNN, UNIBEN which are first generation universities have mean number of PhD supervised as 1.12, 0.46, 0.70 and mean number of masters supervised as 11.39, 2.81 and 3.47 respectively while 2nd and 3rd generation universities NAU, UNAAB and UNIUYO have mean number of PhD supervised as 0.62, 0.025 and 0.08 and mean of masters supervised as 2.66, 1.07 and 0.56 respectively. It is observed that NAU though a third generation university has 0.62 mean of PhD supervised is higher than that of UNN, which is 0.46 in science and engineering. This also showed that there is a difference in the mean productivity of articles in international journals from different Universities. In other to find out where the difference lies, LSD was used as shown in Table 3 below.

Table 3: LSD Number journal published in the last ten years

(I) Name of university	(J) Name of university	Mean Difference (I-J)	Std. Error	Sig.
UNIBADAN	UNN	-.296	1.377	.830
	UNIBEN	-3.251(*)	1.518	.033
	NAU	-.944	1.794	.599
	UNAAB	.454	1.814	.803
	UNIUYO	.793	1.555	.610
UNN	UNIBADAN	.296	1.377	.830
	UNIBEN	-2.956(*)	1.343	.029
	NAU	-.648	1.649	.695
	UNAAB	.750	1.671	.654
	UNIUYO	1.089	1.386	.432
UNIBEN	UNIBADAN	3.251(*)	1.518	.033
	UNN	2.956(*)	1.343	.029
	NAU	2.308	1.769	.193

	UNAAB	3.706(*)	1.789	.039
	UNIUYO	4.045(*)	1.526	.008
NAU	UNIBADAN	.944	1.794	.599
	UNN	.648	1.649	.695
	UNIBEN	-2.308	1.769	.193
	UNAAB	1.398	2.029	.491
	UNIUYO	1.737	1.801	.336
UNAAB	UNIBADAN	-.454	1.814	.803
	UNN	-.750	1.671	.654
	UNIBEN	-3.706(*)	1.789	.039
	NAU	-1.398	2.029	.491
	UNIUYO	.339	1.821	.852
UNIUYO	UNIBADAN	-.793	1.555	.610
	UNN	-1.089	1.386	.432
	UNIBEN	-4.045(*)	1.526	.008
	NAU	-1.737	1.801	.336
	UNAAB	-.339	1.821	.852

* The mean difference is significant at the .05 level.

Table 3 showed that there is a significant difference at 5% level between UNIBADAN and UNIBEN because 0.033<0.05 even though they are both first generation university. Table 3 also indicates that there is also significant difference between UNN and UNIBEN since 0.029<0.05. The analysis revealed that UNIBEN is significantly different from UNIBADAN, UNN, UNAAB since 0.039<0.05. So UNIBEN which is First Generation University is significantly different from University of Agriculture, Abeokuta and University of Uyo, Uyo which are third generation universities but UNIBEN is not significantly different from Nnamdi Azikwe University which is third generation university since 0.193>0.05. It can be said that academics in UNIBEN had greater mean journal publications than the rest universities. The extent of difference of articles in local journals is shown in Table 4 below.

Table4: Multiple Comparisons for Articles in Local Journals - LSD

(I) Name of university	(J) Name of university	Mean Difference (I-J)	Std. Error	Sig.
UNIBADAN	UNN	-.202	.999	.840
	UNIBEN	-3.188(*)	1.082	.004
	NAU	-1.588	1.258	.208
	UNAAB	1.325	1.258	.293
	UNIUYO	-.504	1.113	.651
UNN	UNIBADAN	.202	.999	.840
	UNIBEN	-2.986(*)	1.006	.003
	NAU	-1.386	1.194	.247
	UNAAB	1.527	1.194	.202
	UNIUYO	-.301	1.039	.772
UNIBEN	UNIBADAN	3.188(*)	1.082	.004
	UNN	2.986(*)	1.006	.003
	NAU	1.600	1.264	.207
	UNAAB	4.513(*)	1.264	.000
	UNIUYO	2.684(*)	1.119	.017
NAU	UNIBADAN	1.588	1.258	.208
	UNN	1.386	1.194	.247
	UNIBEN	-1.600	1.264	.207
	UNAAB	2.913(*)	1.417	.041
	UNIUYO	1.084	1.290	.402
UNAAB	UNIBADAN	-1.325	1.258	.293
	UNN	-1.527	1.194	.202
	UNIBEN	-4.513(*)	1.264	.000

	NAU	-2.913(*)	1.417	.041
	UNIUYO	-1.829	1.290	.158
UNIUYO	UNIBADAN	.504	1.113	.651
	UNN	.301	1.039	.772
	UNIBEN	-2.684(*)	1.119	.017
	NAU	-1.084	1.290	.402
	UNAAB	1.829	1.290	.158

* The mean difference is significant at the .05 level.

In order to find out the difference, LSD was used as shown in Table 4 above. Although there is a difference in mean among different universities in Table 2 above, in terms of local journals there is a significant difference at P< 0.05 between University of Benin and University Ibadan, University of Nigeria, Nsukka, University of Agriculture, Abeokuta and University of Uyo, as shown in Table 4 above. On the other hand, University of Benin was not significant from Nnamdi Azikwe University, Awka. However Nnamdi Azikwe University, Awka was significantly different from University of Agriculture, Abeokuta. The extent of difference of articles in international journals is shown in Table 5 below.

Table5: Multiple Comparisons for Articles in International Journals - LSD

(I) Name of university	(J) Name of university	Mean Difference (I-J)	Std. Error	Sig.
UNIBADAN	UNN	1.433	.808	.078
	UNIBEN	1.538	.874	.080
	NAU	.400	1.015	.694
	UNAAB	-1.339	1.015	.188
	UNIUYO	1.830(*)	.899	.043
UNN	UNIBADAN	-1.433	.808	.078
	UNIBEN	.106	.808	.896
	NAU	-1.032	.958	.283
	UNAAB	-2.772(*)	.958	.004
	UNIUYO	.397	.834	.634
UNIBEN	UNIBADAN	-1.538	.874	.080
	UNN	-.106	.808	.896
	NAU	-1.138	1.015	.263
	UNAAB	-2.877(*)	1.015	.005
	UNIUYO	.292	.899	.746
NAU	UNIBADAN	-.400	1.015	.694
	UNN	1.032	.958	.283
	UNIBEN	1.138	1.015	.263
	UNAAB	-1.739	1.138	.128
	UNIUYO	1.430	1.036	.169
UNAAB	UNIBADAN	1.339	1.015	.188
	UNN	2.772(*)	.958	.004
	UNIBEN	2.877(*)	1.015	.005
	NAU	1.739	1.138	.128
	UNIUYO	3.169(*)	1.036	.003
UNIUYO	UNIBADAN	-1.830(*)	.899	.043
	UNN	-.397	.834	.634
	UNIBEN	-.292	.899	.746
	NAU	-1.430	1.036	.169
	UNAAB	-3.169(*)	1.036	.003

* The mean difference is significant at the .05 level

While LSD for articles in international journals shown in Table 5 above indicates that University of Agriculture, Abeokuta was significantly different from University of Nigeria, Nsukka; University of Benin and University of Uyo, Uyo but not significantly different from University of Ibadan and Nnamdi Azikwe

University, Awka. On the other hand, University of Ibadan was significantly different from University of Uyo, Uyo.

Null Hypothesis 1

There is no significant difference in the mean research output between academics in the six universities.

To find out whether there is significant difference in the mean research output of academics in the six universities, one-way analysis of variance was used.

Table: 6 ANOVA Number of Journal Articles Published in the last ten years for Universities (1997-2006).

	Sum of Squares	df	Mean Square	F	Sig.
University	525.730	5	105.146	1.793	.114
Within Groups	16714.951	285	58.649		
Total	17240.680	290			

From Table 4 above the calculated F value is 1.793 while F value at 5% level of significance is 2.21. Since Fc < Ft this means we do not reject the null hypothesis.

This showed that there is no significant difference between mean productivity of academics from different universities. But this was subjected to further analysis to find out whether there is pair wise difference in the mean publication

In other to find out whether there is a difference in the articles published by the respondents in both local and international journals, one-way analysis of variance was used as shown in Table 7 below.

Table7: ANOVA Table of Local and International in the Last Ten Years.

	Sources	Sum of Squares	df	Mean Square	F	Sig.
Articles in local journals	University	388.063	5	77.613	3.359	.006
	Within Groups	4829.025	209	23.105		
	Total	5217.088	214			
Articles in Oversea Journals	University	213.801	5	42.760	2.871	.016
	Within Groups	3097.494	208	14.892		
	Total	3311.294	213			

Table 7 showed that the tabulated F value at 5% level of significance is 2.21 while calculated F is 3.359. Since 3.359 is greater than 2.21 we do not accept the null hypothesis. This showed that there is a mean difference in the productivity of articles in local journals from different universities. The result in Table 7 also showed that calculated F-value of international journals is 2.871, which is also greater than tabulated F value of 2.21 at 5% level of significance.

Discussion

The analysis of data using ANOVA shows that there is no significant difference between mean productivity of academics from different universities. Even though there is no significant difference when the analysis of data was done together, the least significance difference showed that some universities were significantly different from the others. The University of Benin is significantly different from University of Ibadan, Ibadan, University of Nigeria, Nsukka, University of Agriculture Abeokuta and University of Uyo, Uyo. In other words, academics from the University of Benin produced more journal articles than other universities.

Further analysis revealed that the mean publication in local journals in the last ten years of the academics was 5.07 and that of articles in international journal was 2.64. The fact that the academics produced more articles in local journals may be due to the fact that this study was not based on on-line abstracts and science citation index, where few of the local journals were indexed. The present research was based on report from the respondents. It could also be that the respondents find it difficult to publish in international journal due to high rejection of articles.

The analysis of where the respondents publish their articles revealed that there is significant difference in articles published by the academics in both local and international journals, when one-way analysis variance was conducted for different universities. Then using Least Significant Difference comparison, it was found that, in terms of local journals, University of Benin is significantly different from University of Ibadan, University of Nigeria, Nsukka, University of Agriculture, Abeokuta and University of Uyo, Uyo. In terms of international publication, University of Agriculture, Abeokuta was significantly different from University of Nigeria, Nsukka, University of Benin, Benin and University of Uyo, Uyo. University of Ibadan was second highest in international publication. University of Agriculture Abeokuta was the highest because the researcher observed that the academics must have a certain number of journal articles in international journal for assessment and the university does not accept some local journals.

Research output analysis in this study also involved finding the mean number of postgraduate students supervised by academics in different universities. University of Ibadan with mean of 1.12 Ph.D and 11.39 of master supervision is the highest university in terms of masters and Ph.D supervision in science and engineering faculties. The mean of master and Ph.D supervision of University of Benin and Nnamdi Azikiwe University were a little bit above the overall mean for all the universities. It can be said that the number of Ph.D students supervised influences the research output of the academics. Joshi (2000) revealed that the research work published from most universities in India is based primarily of the Ph.D theses of research students with their university teachers. In other words, the more the number of Ph.D students supervised, the more the number of publications. In Nigeria, it is not exactly the same since the universities with the highest number of Ph.D theses of research students, do not have the highest publication in both local and international journals. There is individual research, but one way of improving quality of research in our institution is through collaborative research. On the other hand, collaborative research will be effective if the postgraduate students involved are intellectually sound and dedicated.

Conclusion and Recommendations

The result of the review indicated that bibliometric could involve counting of articles or citation analysis. It further revealed that citation analysis is not sustainable for developing countries. This result to the fact that researches from developed countries are not well represented in most international databases and science citation index hence, publication count was used in this study.

There is no significant difference in the mean research output of academics in the universities used for this study in southern Nigeria, but there is statistical difference in the mean research output between the universities when local journal publications were considered. Academics in the University of Benin had the highest mean publication output in local journals while University of Agriculture, Abeokuta had the highest in international journals. For Nigeria to move forward like other advance countries that depend on research, government has to sponsor or subsidize publishing of national journals in different areas of specialization and also increase the allowances that can help academics publish in international journals. The government ought to have a policy that would enable industries to sponsor researches in science and engineering. Coordination between universities, researchers and industries will lead to maximum output from different faculties. This will lead to creation of new knowledge, which the academics pass to others through publishing their findings for the economic and social well-being of others. It is then recommended that:

1. The government should create awareness and encourage industries to sponsor research work. They should also motivate researchers by giving award to local and renowned researchers.
2. All stakeholders in research and education should create conducive environment for researchers, through funding, providing the necessary equipment, necessary information materials by equipping the libraries etc.
3. Exposure of researchers through sponsorship to local, national and international conferences and workshops. This will help the researchers in their field and enhance publishing within and outside Nigeria.
4. The federal government should in collaboration with NUC establish databases as has been done in other countries. This will make it easer for studies of this type to be carried out.

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