Comparison of Geopolitical, Regional and Funding Differences of Universities in Nigeria, Based on Citations per Paper, Using Web of Science and Scopus

Hilary I. Okagbue
Research Associate, Sydani Institute for Research and Innovation, Sydani Group, Abuja, Nigeria.
Corresponding Author: tobyhilly93@gmail.com
ORCID iD: https://orcid.org/0000-0002-3779-9763

Anita O. Az-Abiaziem
Department of Mathematics, Covenant University, Ota, Nigeria.
onyinyechukwu.az-abiaziem@stu.cu.edu.ng
ORCID iD: N/A

Jaime A. Teixeira da Silva
Independent researcher, Kagawa-ken, Japan.
jaimetex@yahoo.com
ORCID iD: https://orcid.org/0000-0003-3299-2772

Abstract

Extant studies have focused on exploring the research output of universities in Nigeria, but the measure of the quality of research output using citations per paper (CPP) from the Web of Science (WoS) and Scopus is scarcely discussed. This paper investigated the quality of papers published by the top 76 universities in Nigeria. Five hypotheses on CPP were tested using Kruskal-Wallis and Mann-Whitney tests. These hypotheses tested whether CPP is the same or different i) across six geo-political regions (GPRs), ii) between the two major regions, iii) across three university funding types, iv) in Scopus and WoS, and v) if these two databases are correlated. Results using these two databases indicated that no significant median differences were detected among universities across the six GPRs, between northern and southern Nigeria, and between the three funding types (federal, state, and private). Moreover, no significant median differences in CPP between Scopus and WoS were detected, and CPP in both databases was highly positively correlated (0.879; p = 0.05). A comparison of the mean CPP of Nigeria (5.90) from Scopus with 57 other African countries ranked it 47th despite being ranked third in terms of volume of published articles. Policy prescriptions are made on the implications of using CPP for practice.

Introduction

Different metrics are available to evaluate the research output of universities, such as Webometrics and Scimago institution rankings. However, cumulative analysis of metrics based on years is cumbersome. Therefore, controlled bibliometric databases like Clarivate's Web of Science (WoS) and Elsevier's SciVal, a data analytic platform provided by Scopus, present ample opportunities to analyze the volume of university articles. Citations per paper (CPP) from 76 top universities in Nigeria were extracted from WoS and SciVal and analyzed to prove or disprove five hypotheses. CPP, in the context of this paper, refers to the ratio of the total number

of citations to the number of peer-reviewed academic documents indexed in WoS. CPP was restricted to papers published by these universities in the two databases between January 2016 and November 25, 2021. This restricted period ensured normalization, reduced unequal distribution, and accommodated new universities recently established in Nigeria. The CPP of universities in both databases was compared based on geopolitical, regional, and funding differences. The number of publications (NOP) during that period was also assessed. Nigeria is divided into six geo-political regions (GPRs): North West, North Central, North East, South West, South-South, and South East. These six GPRs can be further divided into Northern and Southern Nigeria, the 36 states and federal capital territory. In Nigeria, research is divided into three funding statuses: federal (universities funded by the Federal Government), state (universities funded by the 36 states that make up the country), and private (universities financed by private individuals and organizations).

CPP is an indirect measure of universities' impact, relevance, and prestige and is often used as an author-based performance metric by organizations. CPP is similar to Clarivate's Journal Impact Factor (JIF) and Elsevier/Scopus CiteScore. CPP, CiteScore, and JIF can be computed for authors and institutions. The significant difference between the trio is that CPP is computed without some considerations or constraints used in the computation of CiteScore and JIF, such as excluding conference papers or editorials or limiting the number of citations within a particular period. CPP is computed as the ratio of citations and documents that yielded those citations over a given or fixed time t. High CPP values imply high citations of articles used in the computation of CPP (Fatima & Abu, 2019). Citations result from prestige, international collaboration, impact, relevance, visibility, and acceptance of articles (Jawwad, Soroya & Ahmad, 2021). Universities with high CPPs tend to display high research activity and produce impactful research that affects all aspects of human lives. In Nigeria and elsewhere, a university with a high CPP is highly valued because it indicates that its researchers publish in high JIF journals (Rama & Ramasesh, 2021). One "reward" of publishing in a high JIF journal is citation output (Gazni & Didegah, 2021). The rigidity of JIF and CiteScore prompted a search for an alternative measure of the quality of research output. CiteScore and JIF are computed yearly and cannot be used to assess impact daily, weekly, monthly, or quarterly, whereas CPP can be calculated at any time and for any period, as was alluded to above. CPP can help to investigate the trend, as well as seasonal and cyclical effects, of research output.

No meaningful and lasting development can be achieved without impactful research. Investment in research measured as research output is a popular strategy to improve a population's well-being and achieve sustainable development goals (Agasisti, Barra & Zotti 2019; Mammadov & Aypay, 2020). CPP is one of the indices used to compute the Quality Science Index (QSI), which measures the extent of advancement or regression of the economic well-being of a country (Allik, Lauk & Realo, 2020). Wealthier countries are reaping the fruits of massive research investment, while poorer countries display low advancement due to low quality and quantity research output due to inadequate funding (Chubb & Reed, 2018). Hence, developing nations depend on developed countries for knowledge creation, inspiration, insight, advancement, and expansion, which have cost implications or particular prerequisites, as seen in BRICS (Brazil, Russia, India, China, South Africa) countries (Moed, Markusova & Akoev, 2018).

Like other less developed countries, Nigeria aspires to improve its socio-economic indices. The development of human resources is one key to achieving that purpose, and a key strategy

adopted by successive Nigerian governments has been establishing universities, monotechnics, polytechnics, colleges of education, and research institutes. Since research and socio-economic development are linked (Armitage, Lorenz & Mikki, 2020), establishing higher educational institutes stimulates research output to drive Nigeria's economic growth. Each educational establishment is mandated to train students and carry out topic-specific research.

However, not all efforts substantially affect socio-economic development in Nigeria. Nigeria imports almost all it needs, but a substandard business environment, corruption, and infrastructural decay have made the country more dependent on others for technical assistance (Okejiri, 2000) despite government investment in the educational sector (Agha & Ugu, 2019). There are numerous challenges, including an acute shortage of funding, corruption, the proliferation of unaccredited universities, threats by predatory publishing, underdeveloped information technology, and ethnic, social, political, cultural, and religious variables (Chia & Oyeniran, 2019; Igwe, Hack-Polay, Mendy, Fuller & Lock, 2019). Good quality research output is desirable so that it is commensurate with the investment made to achieve a given mandate. Unfortunately, low research output is typical (Badau, 2020), and research findings have not been impactful to the extent of technological advancement (Oyewale, Adelowo & Ekperiware, 2018). Low citation rates, a crucial measure of impact, are also a common feature of Nigerian universities, as seen in an analysis of the research output of select Nigerian universities using WoS in library and information science (Ani, Ngulube & Omwoyo, 2017). However, the authors only considered a small fraction of this subject category.

For these reasons, this paper measures the impact of research in Nigeria across six GPRs and differences between regional and university funding, using CPP data of 76 universities obtained from Scopus and WoS. These two databases were used to provide insight into the impact of research performed in Nigeria, proposed as five research queries: i) Is CPP the same across universities in six GPRs in Nigeria? ii) Is CPP the same between universities in northern and southern Nigeria? iii) Is CPP the same across Nigeria's three university funding types? iv) Is CPP the same in Scopus and WoS for universities in Nigeria? v) Is CPP from Scopus and WoS of the universities correlated without considering GPRs, regions, and funding type?

Statement of the problem

At first, assessing the quality of research output in Nigeria is scarcely discussed. What is more frequently available are analyses of the quantity of research output in Nigeria.

Second, the available research has focused on GPRs, states, or a few random selections of universities or research institutes. A survey used to assess research output across some federal universities in the six GPRs in Nigeria found disparities since only 12 federal universities were selected, so the result obtained did not represent the full university population (Okiki, 2013). In contrast, our study considered articles from the top 76 universities in Nigeria that are indexed in WoS. These universities are spread across the six GPRs in Nigeria and its two major regions, north and south. Some surveys exclusively considered the research output of federal universities in southern Nigeria (Okafor, 2011, 2015), but those findings cannot be generalized to the entire country.

Third, most of the available research analyzes the research output of library and information science staff at Nigerian universities, which is a limited subset of the academic staff of Nigerian universities (Omotunde & Alegbeleye, 2021). For example, surveys assessed the productivity of library staff in federal and state-funded universities in the southwest (Okonedo, 2015) and

southeast Nigeria (Ibegbulam & Jacintha, 2016). This research included all faculty irrespective of academic roles. However, the analysis considered the research output as a whole without further disintegration into specific subject categories.

Finally, none of the available research considered evaluating the quality or quantity of papers published in Nigeria using data from any bibliometric database. Surveys have been the most frequently used method to investigate the extent of research output in Nigeria or to determine trends (Atanda & Olasupo, 2018). An assessment of research output from Nigeria using Scopus did not evaluate the quality but rather other quantity indicators, namely publication trends and patterns and collaboration patterns (Salisu & Salami, 2020). Another study considered the research output in Scopus of only the federal universities in Nigeria (Galadanci, Muaz & Mukhtar, 2016), but the uneven distribution of federal universities in Nigeria disadvantaged some of the GPRs. Thus, including state and privately funded universities presents a clearer picture. Our research used CPP to measure the quality of research output across a broad spectrum of geographically diverse universities in Nigeria. We believe this is a fortified methodology relative to other research articles that used survey methods, which may suffer from subjective bias.

Until now, the lack of data on research findings in Nigeria has made such an analysis cumbersome, almost impossible. However, with bibliometric databases, such an analysis is now possible. This paper represents the first research to assess the quality of research output throughout Nigeria using Scopus and WoS. An earlier study employed WoS but exclusively considered the research output of library and information science researchers in Nigeria (Eniayejuni, 2018). Another two papers considered the research output of library and information science researchers in Nigeria in the Current Index of journals in Education and Library, Information Science and Technology Abstract databases (Okeji, 2019) and Google Scholar (Abubakar, Etuk, Arilesere & Abiodun, 2021), finding that the quantity and quality of their research output was minimal. Those papers also noted that many national collaborations were not a substitute for international collaborations, with the latter consistently resulting in higher citations and, by association, higher quality and impact (Kwiek, 2021).

Literature Review

A scan of the available literature revealed four main causes of the low quality of papers published and the low research output of researchers in Nigeria. Different databases (Google Scholar, WoS, and Scopus) were used to source the relevant thematic literature.

A. Lack of adequate funding and policy issues

The uncoordinated approval of state-funded universities in Nigeria is primarily to score political points and secondarily for the academic advancement of the country (Iruonagbe, Imhonopi & Egharevba, 2015). The problem of underfunded state and federally funded Nigerian universities is a consequence of the unplanned expansion of the tertiary education system in Nigeria in response to the growing demand for university education fueled by a rapidly growing population (Ogbogu, 2011). The deregulation of the educational sector in Nigeria has led to removing education from an exclusive list and has now become a breeding ground for establishing new universities, thereby expanding educational opportunities (Ogbogu, 2013). However, funding is a recurring issue because highly subsidized tuition fees, mandated by government-funded universities, are not a robust mechanism to

achieve self-sufficiency and university autonomy (Akinwumi & Olaniyan, 2001). The government policy of subsidized tuition fees ensures that access is extended to low- and middle-income families, which constitute the largest percentage of the general population. Worryingly, the lack of adequate funding is worsened by a shortfall in crude oil prices, which is the governments and Nigeria's main source of revenue (Oseni, 2012). As a result, several capital projects and other sectors compete for revenue, and little funding is available to achieve world-class universities (Musa & Isa, 2018).

Funding for basic research infrastructure is poor because universities lack the resources to compete favorably with their counterparts in other parts of the world. Internet access is almost nonexistent in some universities, exacerbated by poor information literacy skills required for quality research (Afolabi & Oladokun, 2020). Libraries are mostly underfunded and lack current or relevant materials to stimulate creative thinking and effective learning (Amuche, Ngwuchukwu, Ihekwoaba & Okwor, 2020). There is also poor availability of electronic resources in most libraries in Nigeria due to the lack of funding (Onuoha, Ifeanyi & Yunisa, 2020). Poor academic performance can be traced to weak funding, as the capital and infrastructure to facilitate sound teaching and research are grossly inadequate (Halidu, 2015). Insufficient funding and a steep demand for researchers with specialized skills needed for quality research in Nigeria are some factors underlying poor quality publishing (Oluwasanu et al., 2019).

Incessant industrial actions and strikes by academic and non-teaching staff at Nigerian universities are policy issues that reduce the quality and quantity of research output due to their disruptive nature (Offem, Anashie & Aniah, 2018). Research activities are hindered during such periods, and the lack of adequate funding is one of the major areas of constant contention between workers and funders (federal or state) (Okoli, Oguejiofor & Okoli, 2019).

Nigerian journals are hardly listed in major bibliometric databases such as Scopus, WoS, or PubMed because of the paucity of funds to maintain consistent coverage. In addition, most Nigerian universities are not subscribers to reputable journals and bibliometric databases needed to stimulate research interest and serve as sources of information for research (Tella & Onyancha, 2021). In addition, since Nigeria is listed as a middle-income country by the World Bank (https://data.worldbank.org/?locations=XN-NG), authors from Nigeria are usually only offered a 50% discount on open access article processing charges by major publishers. Consequently, most authors cannot afford article processing charges due to a lack of funding.

Private universities have yet to devote the vast revenue from their investments to research activities because they are profit-oriented organizations (Adeogun, Subair & Osifila, 2009). Hence, little or no research activities are carried out to increase the country's research output.

B. Economic and Career Factors

Research output provides a good platform for appointing and promoting academic staff members. Research primarily conducted by academic staff is mainly to progress careers and to enhance the quality of life. Nigeria's poverty, unemployment, and weak social structure have limited employment to a few percent (Salam, Alase, Lamidi & Joseph, 2021), and extended families depend on upkeep and survival. The burden of expectations has pushed academics to seek promotion to improve their socioeconomic status. In addition, motivation from employers is poor, and Nigerian academic staff are among the lowest-paid in the world (Ekwunife, Egunlusi & Chikwe, 2019). As a result, most staff opt to publish textbooks used as

supplementary lecture materials instead of journal articles, reducing their research articles' output (Simisaye, 2019). Loyalties or proceeds from the sale of textbooks to students provide a much-needed alternative source of income (Nwaka & Nwagbata, 2020). The patriarchal nature of most sub-Saharan cultures implies that the family's financial burden lies mostly on men. Unsurprisingly, men in Nigeria are more likely to publish textbooks than their female colleagues (Okpe, Simisaye & Otuza, 2013). Hence, there are gender differences in journal articles and textbook publishing in Nigeria (Opesade, Famurewa & Igwe, 2017). The brain drain is rampant in the educational sector as highly skilled professionals migrate abroad for a better quality of life (Anokye, Okri & Adie, 2019). This drain prompted an assessment in 2014 by education policymakers of the university sector, revealing that Nigeria needs 32,000 additional doctoral degree holders if sustainable and quality education is anticipated (Baridam & Don-Baridam, 2020). The situation has worsened since 2014, as more universities have been licensed to operate, compounding an already dire situation (https://www.4icu.org/ng/a-z/).

C. Predatory Publishing and Corruption

The quest for promotion or career progression is one predictor for publishing in low-quality, unscholarly or predatory journals (Mills & Inouye, 2021). This is possible because universities in Nigeria have neither uniform criteria for promotion nor a platform for detecting predatory journals. Hence, academic staff are readily evaluated for promotion using low-quality papers published without the due process of adequate peer review. Corruption proliferates in the Nigerian educational sector and takes different forms (Agbo, 2018). These are triggered by poor funding, a lack of auditing and monitoring mechanisms, the lack of a transparent reward system, and a poor attitude towards work (Oarhe, 2014). Corruption, favoritism, tribalism, and religious or ethnic biases are common features in academic promotion in Nigeria (Nwachukwu, 2021). The effects are low quality and quantity of papers Nigerian academic staff produce. Money meant for research activities is diverted for personal gains, and benefactors of state-sponsored doctoral studies or conference support usually inflate the cost and often divert funds for personal gain (Ndubuisi & Jacob, 2021). This is caused by a lack of adequate auditing and peer review mechanisms due to corruption, and cases of fake and unapproved universities and certificate racketeering continue to erode the credibility and confidence of research documents emanating from Nigeria (Adeeko, Esharefasa & Williams, 2021).

D. Lack of Research Focus and Ideology

There also appears to be a lack of focus on the academic mandate given to universities. Research is supposed to be conducted by academic staff to address problems within their stipulated mandate. Unfortunately, this is not the case, as universities run programs and conduct research outside their given mandates (Ekpoh & Asuquo, 2020). For instance, it is possible to find departments of mass communications, banking and finance, English, music and medicine, and surgery in an agriculture university. These programs are not within their mandate to research all areas of agriculture.

Private universities mainly focus on returns from their investments without a clear commitment to addressing the country's problems through effective and quality research (Ajadi, 2010). Most academic staff stop research activities once they become professors, one reason being that they are reaping the fruits of their years-long labors, another being that most of their motivation to research is for academic promotion, but once they reach the full professorship

cadre, that zeal gradually declines (Chiemeke, Longe, Longe & Shaib, 2009). However, research-active professors publish high-quality papers but in a smaller quantity than others (Jaiyeoba & Atanda, 2009). The low level of professional engagement in research has led to poor quality graduate studies, few international collaboration endeavors (Uthman, 2008; Mêgnigbêto, 2013; Onyancha, 2021), and the lack of progressive academic mentorship (Okagbue, Opanuga, Oguntunde, Adamu, Iroham & Adebayo, 2018b).

No platform allows research output to be commercialized or converted into patents to improve people's general well-being, and there is little collaboration with industry to solve industrial problems (Yusuf, 2012). Generally, the country lacks a national research focus and a robust set of ideologies. Though there are universities and research institutes aimed at developing Nigeria, there are few checks and balances, audits, and peer review mechanisms to ensure that the mandates assigned to universities match their goals, vision, mission, and philosophies.

Five Research Questions (RQ) were crafted from the gaps found in the literature. There has been scant literature here, and the questions will help bridge the literature gaps.

RQ1: Is CPP the same across the universities in six GPRs in Nigeria?
RQ2: Is CPP the same between universities in Northern and Southern Nigeria?
RQ3: Is CPP the same across Nigeria's three University funding types?
RQ4: Is CPP the same in Scopus and WoS for universities in Nigeria?
QR5: Is the CPP of Scopus correlated with the CPP of WoS for universities in Nigeria?

The results from the Research Questions will answer whether there are geopolitical, regional, and funding differences between universities in Nigeria, based on Citations per Paper, using Web of Science and Scopus.

Materials and Methods

a) SciVal (Scopus, Elsevier) was searched for Nigeria in the affiliation. This yielded 201 affiliations with CPP, NOP, and other metrics. Only 121 affiliations with at least 100 papers between January 1, 2016, and November 25, 2021, were obtained when the search was restricted to that period.

b) All research agencies, teaching hospitals, polytechnics, companies, and foreign organizations were excluded, reducing the data to 76 universities spread across the six GPRs of Nigeria.

c) CPP and NOP were extracted from Scival and WoS for the period. An individual search for CPP and NOP of all 76 universities was performed in WoS.

d) Data were inputted into Excel and presented as Supplementary Data 1, used in the data analysis and can be used to verify the data analysis independently.

e) SPSS was used to obtain descriptive statistics and conduct normality tests (Kolmogorov-Smirnov and Shapiro-Wilk), Kruskal-Wallis, Mann-Whitney, and nonparametric correlation analyses.

f) The first validity check was to compare the CPP of Nigeria (obtained in this paper) with African countries downloaded from SciVal (Supplementary Data 2).

g) The second validity check was to obtain correlations between the CPP of the 76 universities and the trio of data variables (impact rank, openness rank, and excellence rank)

from the 2021 Webometrics ranking of Nigerian universities (Supplementary Data 3). Nonparametric correlation was used to determine the extent of the linear relationship between CPP and the three Webometric variables.

h) The last validity check was to obtain a correlation between the CPP of the 76 universities and the recently launched Nigeria Universities Commission (NUC) ranking index (Supplementary Data 4) for 2021 (https://nusrankings.ng/).

Results

Descriptive Statistics of CPP Across Universities in Nigeria

The descriptive statistics of CPP of the top 76 Nigerian universities based on GPRs, regions, and funding are presented in Table 1. The descriptive statistics obtained are the mean and standard deviation of CPP for Scopus and WoS.

Table 1

Descriptive statistics of the distribution of CPP across GPRs, regions, and funding types of 76 universities in Nigeria

			Scopus			WoS	
GPR	**N**	**Mean**	**SD**	**NOP**	**Mean**	**SD**	**NOP**
NC	17	5.51	3.57	10,990	5.42	4.01	8,652
NE	7	4.80	1.44	2,553	4.97	1.83	1,828
NW	9	7.14	5.41	7,344	7.45	5.47	5,905
SE	9	6.50	6.25	11,910	6.34	6.79	9,158
SS	11	4.97	1.72	7,856	5.43	1.74	6,231
SW	23	6.26	3.53	35,231	6.81	3.96	27,289
Region	**N**	**Mean**	**SD**	**NOP**	**Mean**	**SD**	**NOP**
North	33	5.81	3.85	20,887	5.88	4.14	16,385
South	43	5.98	3.88	54,997	6.36	4.25	42,678
Funding	**N**	**Mean**	**SD**	**NOP**	**Mean**	**SD**	**NOP**
Federal	32	6.56	3.96	52,293	6.62	4.20	42,572
Private	16	4.61	2.14	12,101	5.18	3.60	7,645
State	28	5.89	4.35	11,490	6.17	4.51	8,846
Total	76	5.90	3.84	75,884	6.15	4.18	59,063

CPP = citations per paper; Mean = mean of the respective CPP; N = number of universities; NOP = number of papers; SD = standard deviation of the respective CPP

The southwest has the highest representation of CPP (23), while the northeast has the lowest CPP (7). The northwest GPR has the highest mean CPP in both Scopus and WoS, while the northeast has the lowest mean CPP in both databases. Similarly, the southwest has the highest NOP in both databases, while the northeast has the lowest NOP. The southern region has greater representation (43) in the top 76 universities in Nigeria than the northern region (33). In both databases, the southern region has a higher mean CPP and NOP than the northern region. Federal universities have higher mean CPP and NOP than state and private universities. Based on Scopus and WoS, the mean CPP was 5.90 and 6.15, respectively. In addition, Scopus

contains higher NOP (75,884) than WoS (59,063). A bivariate test to compare the equality of the mean or median is dependent on the normality of the data, so Kolmogorov-Smirnov and Shapiro-Wilk tests were conducted on the raw CPP data without considering GPR, region, or funding (Table 2).

Table 2
Normality test for CPP of top 76 universities in Nigeria based on Scopus and WoS data

Test	Scopus	WoS
Kolmogorov-Smirnov	0.240*	0.235*
Shapiro-Wilk	0.722*	0.753*

$*p < 0.05$

Both tests showed that the distribution of CPP is not normal, so an ANOVA and *t*-test were not applied. Hence, Kruskal Wallis and Mann-Whitney tests were used instead.

QR1: Is CPP the same across the universities in six GPRs in Nigeria?
The Kruskal-Wallis test was used to investigate this question. The results are presented in Table 3.

Table 3
Summary of the result obtained for QR1

Test	Chi-square	*p*-value
Scopus	1.6423	0.8961
WoS	4.4093	0.4921

No significant median differences were detected for the CPP of universities across the six GPRs in Nigeria.

QR2: Is CPP the same between universities in Northern and Southern Nigeria?
Mann-Whitney tests were used to investigate this hypothesis. The results are presented in Table 4.

Table 4
Summary of the results obtained for QR2

Test	U Score	*p*-value
Scopus	0.14148	0.8886
WoS	0.59735	0.5485

No significant median differences were detected between northern and southern Nigeria universities for the CPP.

QR3: Is CPP the same across Nigeria's three university funding types?
Kruskal-Wallis and median tests were used to investigate this hypothesis. The results are presented in Table 5.

Table 5
Summary of the results obtained for QR3

Test	Chi-square	*p*-value
Scopus	5.1640	0.0756
WoS	3.3944	0.1832

No significant median differences were detected for the CPP across the funding types of Nigerian universities.

QR4: Is CPP the same in Scopus and WoS for universities in Nigeria?

The Mann-Whitney test was used to investigate this hypothesis. The results were: Mann-Whitney U = 2844; Wilcoxon W = 5770; Z = -0.162 (p = 0.871). No significant median differences were detected for the CPP in Scopus and WoS for universities in Nigeria. Thus, the distribution of CPP between Scopus and WoS is similar.

QR5: Is the CPP of Scopus correlated with the CPP of WoS for universities in Nigeria?

Spearman rank and Kendall tau correlation coefficients were used because the CPPs are not normally distributed. The Spearman rho was 0.879**, and Kendall tau was 0.754**. CPP of Scopus was positively correlated with the CPP of WoS of universities in Nigeria (p < 0.05).

Comparison of Nigeria's CPP with that of other African countries

The CPPs of African countries were downloaded from SciVal. A comparison with Nigerian CPP (5.9) showed that the country ranks 47th out of the 58 countries but third in NOP.

Correlation between CPP and three ranking parameters of Webometrics ranking of Nigerian universities

The correlations between the CPP of universities and the trio of data variables (impact rank, openness rank, and excellence rank) from the 2021 webometrics ranking of Nigerian universities are presented in Table 6. One university was excluded because Webometrics did not rank it.

Table 6
Summary of the correlation between CPP and three Webometrics ranking parameters

	CPP (Scopus)	CPP (WoS)
Impact rank	-0.181 (0.120)	-0.139 (0.236)
Openness rank	-2.97 (0.010)	-0.271 (0.019)
Excellence rank	-3.96 (0.000)	-0.356 (0.002)

For the CPP of Scopus and WoS, there were no significant correlations with impact rank but significant negative correlations with openness and excellence ranks. Hence, universities in Nigeria with high openness and excellence scores in Webometric ranking is most likely to have low CPP values.

Correlation between CPP and NUC ranking index

A correlation was obtained between the CPP of the 76 universities and the NUC ranking

index published in 2021. Eight universities were excluded because they had no data for the NUC ranking index. There was no significant correlation between CPP (Scopus or WoS) and the NUC ranking index (Table 7).

Table 7
Correlation between CPP (Scopus and WoS) and NUC ranking index

	CPP (Scopus)	CPP (WoS)
NUC ranking index	0.091 (0.461)	0.071 (0.566)

Discussion

This research showed that the quality of research output, as assessed by CPP from both Scopus and WoS, is the same across all universities in the six GPRs in Nigeria. This paper deviated from the usual practice of measuring the research output of universities in Nigeria using the quantity of peer-reviewed articles or assessments using survey methods. Instead, this study employed indices that measured the quantity of peer-reviewed articles. For instance, a study assessed the quantity of medical research in Nigeria using scientometrics methodology but did not factor in regional or funding differences (Durodolu, Adeleke & Ojo, 2019). Using quantity will give federal and state universities an unfair advantage and private universities a disadvantage because most private universities in Nigeria are less than 15 years old. The advantage or disadvantage is a function of the number of researchers because state-owned schools in Nigeria have more staff and run more programs than privately funded universities. CPP is justified because it is one of the core metrics to evaluate a given country's quality of research output (Jajo & Peiris, 2021). This research made four significant contributions to the current body of knowledge.

First, the low quality of research output in all universities in Nigeria's six GPRs corroborated the findings of Okagbue, Atayero, Oguntunde, Opanuga, Adamu and Adebayo (2018a). The low quality of research output in these GPRs is primarily due to a lack of funding, focus, national research philosophy, and research ideology and the abandonment of mandates established for universities in respective regions (Ubogu, 2019). This research showed a uniformity of variables that negatively affect the research output of Nigerian universities, such as poor funding, and interact with other factors to degrade the quality of research output from Nigeria. Strategies to increase funding to universities are recommended (Faboyede, Faboyede & Fakile, 2017), and efforts must be intensified to restore normalcy in a system plagued with incessant industrial unrest and strikes (Uhunmwuangho & Diakpomrere, 2019). Quality measure is needed to boost the country's socioeconomic status and solve numerous industrial problems since no meaningful scientific advancement is possible without quality research output (Tonta & Akbulut, 2020). The economic resilience and sustainability of any country depend on quality research that can discover hidden or latent phenomena required to sustain economic processes after disturbances or disruptions caused by natural disasters, pandemics, epidemics, and human-induced events. However, a scarcity of research interests or activities jeopardizes this vital function. (Usman, Shwarka, Dabs, James & Gyang, 2018). The status quo has to change, and research partnerships with industrial entities are needed, so improving the quality of research output in Nigeria is expected to help create employment opportunities by equipping graduates with the analytical and problem-solving skills required for innovation, entrepreneurship and value creation (Aminu, 2019; Nwajiuba, Igwe, Akinsola-Obatolu, Ituma

& Binuomote, 2020), and improving food security, enhanced service delivery, product development and patents (Odeyemi, Odeyemi, Bamidele & Adebisi, 2019). These are all necessary because innovation from quality research drives employment (Gao, Bai & Huang, 2017).

Second, this research showed that the quality of research output was low and similar across all universities in northern and southern Nigeria, even though more universities in the south were in the top 76 regarding CPP. Universities appear to have identical funding problems (Egbetokun, Olofinyehun, Sanni, Ayo-Lawal, Oluwatope & Yusuff 2022), ideological issues, suffer from corruption and are subject to the same socioeconomic pressures (Jacob & Lawan, 2020). A thorough review of Nigeria's educational policy is overdue, and any review should be per the current global trend (Odukoya, Bowale & Okunlola, 2018). Quality research is urgently needed to solve Nigeria's structural, security, economic, health, environmental, and political challenges. Policymakers must explore the merits of funding research, encourage research collaboration, invest in open-access publishing, and subscribe to publishers to access relevant knowledge required to produce quality publications. Furthermore, efforts to stimulate research interest in postgraduate studies and fund research of postgraduate students will help to reduce problems experienced in graduate courses in Nigeria and increase the quality of universities' research profiles (Musa & Ibrahim, 2017).

Thirdly, this research showed that the quality of research output is similar across Nigeria's three university funding types. The quantity favors the federal and state-funded institutions, but the quantity does not necessarily translate to quality. This has also shown that some privately funded universities, funded to deviate from the philosophy of government-funded schools in research, are yet to fulfill the mandate.

Finally, this study showed that the quality of research output is similar in Scopus and WoS, confirmed by a high positive correlation between the CPP obtained from both databases. The two databases are highly controlled and supposedly contain bibliometric data of high-quality peer-reviewed articles. Compared with other African countries, Nigeria's low rank could be addressed by increasing funding, patents, commercialization of research products, international collaboration, and stringent policies that discourage corruption in the educational system. Even though Scopus has more published articles than WoS, the low CPP exposed years of poor investment in tertiary education, corruption, and neglect of this sector of national development.

Collaboration between state, federal, and private universities is highly recommended since collaborations with researchers of diverse cultures, research areas, and geography lead to quality research output (Mahala & Singh, 2021). Pressure caused by academic promotion requirements should not lead to the corruption of collaboration or gift authorship (Aiyebelehin, 2021). This comes from the x-ray of the hypothesis showing that the research quality is the same between Northern and Southern Nigeria. Collaboration is necessary since their research areas appear to be similar. Moreover, the number of new privately funded universities in the mainly southern states of the country is yet to outrun the mostly publicly funded universities in the North. The status quo needs to change if the development and advancement of the country is anticipated. Collaborations with international authors of repute will improve the quality of research output, improve the nation's international standing in producing world-class graduates, and enhance performance in world university rankings (Ejikeme & Ezema, 2019; Onyancha, 2020). Historically, universities in Nigeria are absent from international ranks or are poorly ranked because the quality of research is a critical metric in global higher education

ranking (Abubakar & Ahmed, 2017; Olaleye, Ukpabi & Mogaji, 2020). The examples of the policies from Egypt should be followed to increase the quality of research in the country (Ali & Elbadawy, 2021). Mentoring is needed, and a platform to train research staff of private universities by their federal and state colleagues is also suggested, as was discussed by Suleiman, Hanafi and Taslikhan (2017). Regulatory bodies in Nigeria should encourage private universities to devote some percentage of their income to research to bridge the gap between them and public universities. Deregulation of university education should be extended to public-owned universities to enable them to compete favorably with their counterparts in terms of the quality and quantity of research output, an improved outlook, and improved quality of graduates' employability and global ranking (Adetunji, Adetunji, Adeleke & Madubuike, 2017). Increased funding and improved working conditions of lecturers in Nigeria will help to halt the current brain drain and improve the quality of research and graduate outputs (Ogunode & Adah, 2022).

This study showed an unusual distribution of published articles across the six GPRs in Nigeria. The low number of published articles in northeast Nigeria could be attributed to the high level of insecurity caused by insurgency and banditry, so addressing security challenges might help to improve the quality of research in Nigeria.

Conclusion

The quality of research output in Nigeria is low, quantity notwithstanding. Nigeria ranked 47 out of 58 African countries based on CPP. This research showed that the quality of research output across universities in Nigeria, based on CPP, is similar across the six GPRs and the two major regions, but the quality differs across the three university funding types. Improving quality and quantity will help Nigeria advance socially, economically, and technologically, enhancing its educational standings in world university rankings. Further studies could consider individual Nigerian research institutes and compare the quality of their research output based on these two bibliometric databases. Moreover, future research could consider comparing the results in Nigeria with those of other countries, Commonwealth countries, BRICS nations, and other developing countries.

Limitations

Independent data verification was not possible since access to the backend of the databases is exclusive to Clarivate and Elsevier. Secondly, CPP can be influenced if the authors in a university engage in excessive self-citations or targeted citations to influence the prestige of their published papers. Clarivate has not developed analytics that can exclude self-citations in the computation of CPP of universities and is only available for the computation of CPP for authors. Another major issue with the data is that CPP changes over time, and the two databases (for now) could not track changes over time. Once papers are indexed in Scopus and WoS, the CPPs of individuals and affiliations are updated. This update can lead to a decrease or increase in CPP. Further studies should conduct a time series analysis of CPP on a monthly, quarterly, semi-quarterly, or yearly basis. Finally, the authors cannot control missing documents that were not indexed as expected, i.e., some documents may be incorrectly indexed in these databases or excluded by the institutions, journals, publishers, or managers of the indexing service.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability

Data can be assessed in the supplementary materials.

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