International Journal of Modern Education Research
2016; 3(5): 37-40
http://www.aascit.org/journal/ijmer
ISSN: 2375-3781

AASCIT American Association for Science and Technology

Keywords
Scientometric,
Bibliometric Indicators,
Citation Impact,
Research Output,
Polytechnics

Received: August 9, 2016
Accepted: August 17, 2016
Published: September 3, 2016

A Scientometric Analysis of Research Performance of Ghanaian Polytechnics

Isaac Toku Lomatey[1], Godfred Kwame Abledu[2], Patrick Baayel[3], Maxwell Akussah[3], Humphrey Kankam Botchway[4]

[1]Department of Purchasing and Supply, Koforidua Polytechnic, Koforidua, Ghana
[2]Department of Applied Mathematics, Koforidua Polytechnic, Koforidua, Ghana
[3]Polytechnic Library, Koforidua Polytechnic, Koforidua, Ghana
[4]Department of Liberal Studies, Koforidua Polytechnic, Koforidua, Ghana

Email address

anyemitoku@hotmail.com (I. T. Lomatey), godfredabledu@gmail.com (G. K. Abledu), patrick.baayel@gmail.com (P. Baayel), maxybilly@yahoo.com (M. Akussah), humbot@yahoo.com (H. K. Botchway)

Citation

Isaac Toku Lomatey, Godfred Kwame Abledu, Patrick Baayel, Maxwell Akussah, Humphrey Kankam Botchway. A Scientometric Analysis of Research Performance of Ghanaian Polytechnics. *International Journal of Modern Education Research.* Vol. 3, No. 5, 2016, pp. 37-40.

Abstract

Scientometric analysis has been used commonly for measurement and evaluation of the research performance of researchers, departments, academic institutions and countries. Results of such analysis can be used for ranking, awarding, budgeting and defining research priorities. This study seeks to assess and compare the research performance of Ghanaian Polytechnics using scientometric analysis. Research publications of each of the ten Polytechnics in Ghana during the last five years (i.e., 2011-2015) were retrieved and analyzed using Harzing's Publish or Perish software. Five bibliometric indicators (i.e., total number of papers - TP, total number of citations - TC, average citations received per article - ACPP, h-index and g-index) were assessed and used to rank each Polytechnic in terms of research productivity and citation impact. The results showed that the five-year TP (i.e., 564), TC (i.e., 1170), ACPP (i.e., 2.21), h-index (i.e., 9) and g-index (i.e., 16) of the highest ranked Polytechnic as well as the yearly values of these bibliometric indicators of each Polytechnic were relatively low, suggesting a relatively low research productivity and citation impact of Ghanaian Polytechnics. There is a need to support researchers in Ghanaian Polytechnics to increase research output and impact by conducting and publishing high quality research.

1. Introduction

Scientometric analysis is the "quantitative study of science, communication in science, and science policy" [1]. Scientometric analysis has been used commonly for measurement and evaluation of the research performance of researchers, departments, academic institutions and countries [2]–[4] [5]–[8]. Results of such analysis can be used for ranking, awarding, budgeting, and defining research priorities [3].

Traditionally, scientometric analysis focuses on two parameters, namely research productivity and citation impact [9] using a variety of bibliometric indicators. The indicators of research productivity include number of published articles in a given time, number of published articles per author and Lotka's index (see [1], [2] for review) whereas the indicators of citation impact include total number of citations, average number of citations per paper, number of citations per author, number of citations per

author per year, h-index and g-index (See [2], [9] for review).

Although scientometric analysis has been carried out on a number of academic institutions worldwide, up to date, no scientometric study has been conducted on any academic institution in Ghana. This report, therefore, seeks to assess and compare the research performance of Ghanaian Polytechnics (within the last five years) in relation to total number of published articles, total number of citations, average citations received per article, h-index and g-index.

2. Methods

Harzing's Publish or Perish software (Tarma Research Software Ltd, *www.harzing.com*) was used to search for and retrieve the research publications of each of the ten Polytechnics in Ghana for the last five years (i.e., 2011-2015). Keywords used for the search were names of the respective Polytechnics. Search results were filtered to include only journal articles and exclude other forms of publications (e.g., books, conference proceedings, theses). All retrieved articles were verified for their authors' affiliations, and analyzed using Harzing's Publish or Perish software. The following bibliometric indicators were computed from the data.

i. Total number of papers (TP): total number of articles published within a specified period.
ii. Total number of citations (TC): total citation to all articles.
iii. Average number of citations per paper (ACPP): total citation to all articles, divided by the total number of articles.
iv. h-index: the highest number (h) of citations, such that h articles have h citations.
v. g-index: the largest number such that g articles received (together) at least g^2 citations.

The bibliometric indicators were used to rank the Polytechnics in terms of research output (measured by TP) and citation impact (measured by TC, ACPP, h-index and g-index).

3. Results

The results of the bibliometric analysis are presented in Tables 1-3. In all, 2373 research articles were retrieved for all the Polytechnics for the period 2011-2015 (Table 1). The rankings of the Polytechnic in terms of TP were: Kumasi Polytechnic (564; 23.8%) > Accra Polytechnic (300; 12.6%) > Koforidua Polytechnic (282; 11.9%) > Takoradi Polytechnic (232; 9.8%) > Sunyani Polytechnic (210; 8.8%) > Cape Coast Polytechnic (207; 8.7%) > Tamale Polytechnic (171; 7.2%) > Ho Polytechnic (166; 7.0%) > Wa Polytechnic (141; 5.9%) > Bolgatanga Polytechnic (100; 4.2%) (Table 1).

Table 1. *Total number of papers (TP) of Ghanaian Polytechnic for the period 2011-2015 (n=2373).*

Polytechnic	Ho	Bolgatanga	Tamale	Sunyani	Cape Coast	Takoradi	Accra	Kumasi	Wa	Koforidua
N	166	100	171	210	207	232	300	564	141	282
%	7.0	4.2	7.2	8.8	8.7	9.8	12.6	23.8	5.9	11.9

Generally, TP of all the Polytechnics increased from 2011 to 2014, but decreased in 2015 except Takoradi Polytechnic, where it continued to increase (Table 2).

Table 2. *Total number of papers (TP) of Ghanaian Polytechnic from 2011 to 2015.*

Polytechnic	2011	2012	2013	2014	2015
Ho	6	24	35	30	71
Bolgatanga	5	6	17	41	31
Tamale	5	7	13	79	67
Sunyani	6	31	56	63	54
Cape Coast	6	26	41	54	80
Takoradi	9	36	34	66	87
Accra	11	37	91	107	54
Kumasi	35	89	146	155	139
Wa	11	7	36	52	35
Koforidua	9	34	73	87	79

Table 2 shows the indicators of citation impact (i.e., TC, ACPP, h-index and g-index) of the Polytechnics for the period 2011-2015. TC, ACPP, h-index and g-index varied from 107 to 1170, 0.6 to 2.21, 3 to 9 and 5 to 16 respectively (Table 1). The highest ranked Polytechnic in terms of TP and TC was Kumasi Polytechnic, while the lowest ranked Polytechnics were Bolgatanga Polytechnic and Tamale Polytechnic respectively. In terms of ACPP, the highest ranked Polytechnic was Koforidua Polytechnic while the least ranked Polytechnic was Tamale Polytechnic. The observed yearly fluctuations in TP, TC, ACPP, h-index and g-index of the Polytechnics showed no predictable trend for the five-year period. Putting all the indicators together, the rankings of the Polytechnics showed that Kumasi Polytechnic > Koforidua Polytechnic > Takoradi Polytechnic > Accra Polytechnic > Wa Polytechnic > Sunyani Polytechnic > Cape Coast Polytechnic > Ho Polytechnic > Bolgatanga Polytechnic > Tamale Polytechnic.

Table 3. *Total number of citations (TC), average citations received per paper (ACPP), h-index and g-index of Ghanaian Polytechnic for the period 2011-2015.*

Polytechnic	Total	2011	2012	2013	2014	2015
Total number of citations (TC)						
Ho	204	18	49	73	9	55
Bolgatanga	171	32	16	44	33	46
Tamale	102	30	3	30	19	20
Sunyani	209	32	46	95	21	15
Cape Coast	217	27	50	55	62	23
Takoradi	335	44	124	51	81	35
Accra	403	35	131	120	100	17
Kumasi	1170	290	291	373	166	50
Wa	235	90	37	43	28	37
Koforidua	626	180	130	142	106	68

Polytechnic	Total	2011	2012	2013	2014	2015
Average citations received per paper (ACPP)						
Ho	1.23	3	2.04	2.09	0.3	0.77
Bolgatanga	1.71	6.4	2.67	2.59	0.8	1.48
Tamale	0.6	6	0.43	2.31	0.24	0.3
Sunyani	1.00	5.33	1.48	1.7	0.33	0.28
Cape Coast	1.05	4.5	1.92	1.34	1.15	0.29
Takoradi	1.44	4.89	3.44	1.5	1.23	0.4
Accra	1.34	3.18	3.54	1.32	0.93	0.31
Kumasi	2.07	8.29	3.27	2.55	1.07	0.36
Wa	1.67	8.19	5.29	1.19	0.54	1.06
Koforidua	2.21	20	3.82	1.95	1.22	0.86
h-index						
Ho	5	3	4	5	1	4
Bolgatanga	5	2	2	5	3	3
Tamale	3	3	1	3	2	3
Sunyani	5	3	4	5	2	2
Cape Coast	4	3	4	4	4	2
Takoradi	7	3	7	3	4	4
Accra	5	3	5	5	5	3
Kumasi	9	9	9	9	5	3
Wa	5	5	3	3	2	4
Koforidua	6	5	4	6	6	4
g-index						
Ho	7	4	6	7	2	6
Bolgatanga	6	5	4	6	4	6
Tamale	5	5	1	5	2	3
Sunyani	8	5	6	8	2	2
Cape Coast	6	5	6	6	6	3
Takoradi	10	6	10	6	8	5
Accra	11	5	11	6	8	3
Kumasi	16	16	13	14	9	3
Wa	9	9	6	5	2	5
Koforidua	10	9	10	8	7	6

4. Discussion

The current study assessed and compared the research performance (i.e., research productivity and citation impact) of Ghanaian Polytechnics using bibliometric analysis of research data spanning the last five years (i.e., 2011-2015). Research productivity was measured by total number of papers (TP) whereas citation impact was measured by total number of citations (TC), average citations received per article (ACPP), h-index and g-index. TP, TC, ACPP, h-index and g-index of all the Polytechnics showed yearly fluctuations with no predictable trend. The rankings of the Polytechnics in relation to productivity are: Kumasi Polytechnic > Accra Polytechnic > Koforidua Polytechnic > Takoradi Polytechnic > Sunyani Polytechnic > Cape Coast Polytechnic > Tamale Polytechnic > Ho Polytechnic > Wa Polytechnic > Bolgatanga Polytechnic. Regarding citation impact, the rankings of the Polytechnics are Kumasi Polytechnic > Koforidua Polytechnic > Takoradi Polytechnic > Accra Polytechnic > Wa Polytechnic > Sunyani Polytechnic > Cape Coast Polytechnic > Ho Polytechnic > Bolgatanga Polytechnic > Tamale Polytechnic.

The observed differences in the bibliometric indicators of the different Polytechnics may be as a result of differences in number of staff, rank/caliber of researchers, types and number of academic programmes, and amount of research funding in each Polytechnic. Unfortunately, data on these variables were not available for analysis. The comparison might be normalized based on these variables.

The five-year TP (i.e., 564), TC (i.e., 1170), ACPP (i.e., 2.21), h-index (i.e., 9) and g-index (i.e., 16) of the highest ranked Polytechnic (Table 1) as well as the yearly values of these bibliometric indicators (Table 2) of each Polytechnic were relatively low, suggesting a relatively low research prooductivityty and citation impact of Ghanaian Polytechnics. This finding is consistent with a study in Nigeria which revealed poor research output of the country's Polytechnics [10]. Polytechnics would achieve prestige and visibility by producing high quality research, which in turn would lead to greater opportunity for attracting high caliber students and faculty. There is a need to support researchers in Ghanaian Polytechnics to increase research output and impact by conducting and publishing high quality research.

A number of data gathering tools are used for scientometric analysis, including ISI Web of Knowledge, Scopus, and Google Scholar [3]. The latter has the widest coverage of research output across many disciplines [9], hence was used in the current analysis. However, given that data quality in Google Scholar is very poor with duplications and many of its citations coming from a variety of non-research sources [9], it is possible that the actual metrics of research productivity and citation impact of the Polytechnics could be much lower than observed (or if ISI Web of Knowledge or Scopus were used for the analysis). Other scientometric parameters such as authorship patterns, collaborations, types of journal, Lotka index, etc were not assessed in this study, hence might warrant inclusion in future research.

The exclusion of these other scientometric parameters notwithstanding, the main strength of this study lies in the fact that it is the first to report a scientometric analysis of the research performance of Ghanaian Polytechnics. The results thus provide a preliminary data for further research.

5. Conclusion

The current study has shown that research productivity/output (measured by total number of published papers) and citation impact (measured by total number of citations, total citations received per paper, hi-index and g-index) of Ghanaian Polytechnics are relatively low. However, given the limitations of the data gathering technique used in this study, it is possible that the actual values of research performance metrics of the Polytechnics could be lower than observed. The rankings of the Polytechnics based on research productivity are Kumasi Polytechnic > Accra Polytechnic > Koforidua Polytechnic > Takoradi Polytechnic > Sunyani Polytechnic > Cape Coast Polytechnic > Tamale Polytechnic > Ho Polytechnic > Wa Polytechnic > Bolgatanga Polytechnic. For citation impact, Kumasi Polytechnic > Koforidua Polytechnic > Takoradi Polytechnic > Accra Polytechnic > Wa Polytechnic > Sunyani Polytechnic > Cape Coast Polytechnic > Ho Polytechnic > Bolgatanga Polytechnic > Tamale Polytechnic

respectively. However, the comparison could be normalized based on number of staff, rank/caliber of researchers, academic programmes and research funding in each Polytechnic.

References

[1] L. Leydesdorff and S. Milojević, "Scientometrics," *Int. Encycl. Soc. Behav. Sci. (Second Ed.*, pp. 322–327, 2015.

[2] S. Aswathy and A. Gopikuttan, "Productivity pattern of universities in Kerala: A scientometric analysis," *Ann. Libr. Inf. Stud.*, vol. 60, no. 3, pp. 176–185, 2013.

[3] M. A. Abolghassemi Fakhree and A. Jouyban, "Scientometric analysis of the major Iranian medical universities," *Scientometrics*, vol. 87, no. 1, pp. 205–220, 2011.

[4] Alireza Noruzi and A. Mohammadhiwa, "Scientometric analysis of Iraqi-Kurdistan universities' scientific productivity," *Electron. Libr.*, vol. 32, no. 6, pp. 770–785, 2014.

[5] H. Toivanen and B. Ponomariov, "African regional innovation systems: Bibliometric analysis of research collaboration patterns 2005-2009," *Scientometrics*, vol. 88, no. 2, pp. 471–493, 2011.

[6] R. J. W. Tijssen, "Africa's contribution to the worldwide research literature: New analytical perspectives, trends, and performance indicators," *Scientometrics*, vol. 71, no. 2, pp. 303–327, 2007.

[7] B. Gupta and A. Bala, "A scientometric analysis of Indian research output in medicine during 1999-2008," *J. Nat. Sci. Biol. Med.*, vol. 2, no. 1, p. 87, 2011.

[8] J. M. Van Zyl, "The state of research output in South Africa with respect to economy size and population," *South African Stat. J.*, vol. 46, no. 2, pp. 395–412, 2012.

[9] J. Mingers and L. Leydesdorff, "A Review of Theory and Practice in Scientometrics A Review of Theory and Practice in Scientometrics 1," *Eur. J. Oper. Res.*, pp. 1–45, 2015.

[10] S. Chiemeke, O. B. Longe, F. A. Longe, and I. O. Shaib, "Research Outputs from Nigerian Tertiary Institutions : An Empirical Appraisal," *Libr. Philos. Pract.*, no. 2000, pp. 1–11, 2000.