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GROWTH OF LIS RESEARCH ARTICLES IN AFRICA SEEN THROUGH SCOPUS: A BIBLIOMETRIC ANALYSIS

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ABSTRACT

The present study aims to analyze the growth of Library and Information Science (LIS) research articles in Africa. It covers a total of 160 article indexed by Scopus database during the period of 1987-2017. In this study the author has tried to analyze the annual growth of LIS research publications in Africa and identify the authorship pattern, authors' productivity and degree of collaboration. Lotka's inverse square law has been applied to identify the productivity of authors and Bradford's law has been applied to identify the scattering of core journals.

KEYWORDS: Bibliometric, Scopus, Authorship Pattern, Author's Productivity, Lotka's Law And Bradford's Law.

INTRODUCTION

Bibliometrics, the statistical analysis of publications has been practiced since the 1920s (Gingras, 2014). However, bibliometric activity grew significantly with the emergence of new citation mapping tools starting with the ISI's citation indices in the 1960s (De Bellis, 2009; Thelwall, 2008). It is a set of methods to analyze the impact and distribution of scientific publications. Pritchard (1969) stated that bibliometrics deals with application of mathematics and statistical methods to books and other media of communication. Fairthrone (1969) defined the same as quantitative treatment of properties of recorded discourse and behavior appearing to it. It offers a quantitative method and considered as support to qualitative methods for the impact of journals, articles, researcher's activity, etc. used in Library and Information science (LIS). In the information explosion era, it helps the researchers to quantify the process of written communication. Researchers use mathematical and statistical tools to analyze and measure scattering of literature output of a particular subject, measuring the literature output through language wise, geographical wise, document type wise, institution wise etc. It is an interdisciplinary and multi-disciplinary science. The methods are used in studies of properties and behavior of recorded knowledge, for analysis of the structures of scientific and research areas, and for evaluation of research activity and administration of scientific information. (Patra and others, 2006). A good number of studies have been done by different authors on different subject fields. This study attempted to assess the year wise growth of LIS publications, authorship pattern, author's productivity, etc. particularly in between the period of 1987-2017 from Scopus database of Africa.

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LITERATURE REVIEW

Reviewing literature is an essential part of the research process as it provides supporting information and evidence on similar studies already done on the subject and avoids duplication of effort. The study tried to review some of the articles used by Scopus database for the bibliometric studies. Francisco, and others (2018) in their study on 50 years of the "European journal of marketing: a bibliometric analysis" used the Scopus database to analyze the most productive authors, institutions and countries, as well as the most cited papers and the citing articles from the total number of publications and citations between 1967 and 2017. They found that British authors and institutions are the most productive in the journal, although Australians' are growing significantly the number of papers published. Christopher Walton and others (2013) investigated the citation-patterns of monograph books in taxonomic botany (mainly at publications and publishers, and the age of current literature); and recommended for collections management and reference services in libraries that hold botany materials. 454 citations were collected at random from 47 botanical monographs published in 2009; a Bradford distribution of cited journals was produced with age-distributions of citations. A small Bradfordian core of highly-cited journals and important publishers of monograph books were identified and found that older materials are more important than in other sciences.

Satpathy and others (2013) investigated the scholarly communications in open access journals of library & information science and analyzed top ten open access journals (373 papers) of 2011, which were indexed in Scopus, have been selected. They employed necessary bibliometric measures to analyze different publication parameters. It is found that the contribution of articles in these top ten open access journals in 2011 is good, i.e. 37.3 percent. Studied the authors contribution and degree of collaboration, numbers of citations used, etc. Further studies can include more open access journals of this field for a period of more than one year. Maharana (2014) did a bibliometric study for the Sambalpur university research growth using Scopus; found that the university's publications range 38 to 83 papers with 11.29% per annum. 1152 authors contributed 301 papers, in which 598 authors were affiliated to Sambalpur University. Sujira and Jeonghyun (2017) investigated the longitudinal trends of research in the area of institutional repositories (IR) using bibliometric and text-mining methods. The LISA and the Web of Science citation databases were used as data sources. A total of 603 articles published in 109 peer-reviewed journals from 2005 to 2015 were collected and analyzed. The articles were analyzed in terms of publication trends, authorship patterns and keywords and phrases appearing in the article titles and abstracts. They found that there has been a notable growth trend in research outputs, along with more participation and collaboration among institutes and countries with new research themes and foci, including research data, data management, linked open data, students and student research and an international audience, are observed in the later period.

Salini and others (2014) studied a bibliometric analysis of organic chemistry research activity during the last decade (2004 to 2013) with special emphasis on the Indian contribution. The Indian output is compared with that of world's leading countries using exergy, an indicator which combines quantity and quality of publications. A three-dimensional approach combining quantity, quality and consistency is used for analyzing the performance of various institutions and authors. It is found that the contribution from India is equal to the world average and its growth pattern is positive and

similar to the worldwide research growth. India ranks at the 9th position based on the Exergy(X), the performance indicator while USA, Germany and China occupy first, second and third positions.

OBJECTIVES OF THE STUDY

The present study deals with the following objectives;

- To know the year wise growth of LIS research articles in Africa;
- To know the authorship pattern of the articles published;
- To identify the authors' productivity and degree of authors' collaboration;
- To know the subject orientation of articles and their geographical distributions;
- To identify the most productive LIS Journals and the sources of publication.

METHODOLOGY

The data for the study period 1987 to 2017 are retrieved from the Scopus database (on 19th Dec 2017) using "Library and Information Science" or “Information Science” and "Africa" as the keyword for limiting the search has been used. Further limiting the search results, other defined search criteria like Document type- Article, Subject area- Social Science, Source type- Journal, country- Africa and Year- 1987-2017 were used to find out the relevant data. A total of 160 articles were retrieved for the period of 1987-2017. All the bibliographic data of the retrieved 160 articles were recorded in a MS excel spreadsheet and the analyses of recorded data were done by simple statistical percentage and average.

DATA ANALYSIS & INTERPRETATION

YEAR WISE GROWTH OF LIS RESEARCH ARTICLES IN AFRICA

Scopus database has indexed a total of 160 research articles in the field of Library and Information Science in Africa during the period of 1987-2017. During this period of 31 years, it is found that a highest numbers of 15 (9.4%) articles have been indexed in the year 2015 and followed by 10 (6.3%) articles each in the years 2017 & 2010. Similarly the lowest numbers of articles with 1 (0.6%) were indexed in each of the year 1987, 1988 & 1989, which is given below as Table-1:

Table 1.Year wise growth of LIS research Publications

S. No.	Year	No. of Pubns(%)	Year	No.of Pubns(%)	Year	No. of Pubns(%)
1	2017	10 (6.25)	2007	7 (4.38)	1997	2 (1.25)
2	2016	9 (5.63)	2006	6 (3.75)	1996	6 (3.75)
3	2015	15 (9.38)	2005	4 (2.5)	1995	3 (1.88)
4	2014	6 (3.75)	2004	6 (3.75)	1994	3 (1.88)
5	2013	5 (3.13)	2003	2 (1.25)	1993	2 (1.25)
6	2012	9 (5.63)	2002	7 (4.38)	1991	2 (1.25)
7	2011	7 (4.38)	2001	7 (4.38)	1990	4 (2.5)
8	2010	10 (6.25)	2000	2 (1.25)	1989	1 (0.63)
9	2009	6 (3.75)	1999	7 (4.38)	1988	1 (0.63)
10	2008	8 (5)	1998	2 (1.25)	1987	1 (0.63)
*1992 No publications (zero)					Total	160 (100%)

AUTHORSHIP PATTERN OF THE ARTICLES

Table-2 shows the four types of authorship pattern used by their collaboration of contribution in the articles during 1987-2017. The numbers of articles contributed by each category of authorship pattern have been distributed in the following table to make an easy understanding of the authorship pattern. Only Single authors have dominated with highest 89 (55.6%) articles followed by two authors collaboration with 43 (26.9%) articles, Three authors and more than three authors with each 14 (8.7%) articles. It is found that by three authors' collaboration only the least number of contributions in many years.

Table 2.Authorship pattern used in the articles

S. No.	Year	One	Two	Three	> 3	Total	S. No.	Year	One	Two	Three	> 3	Total
1	2017	4	6	0	0	10	16	2002	4	2	1	0	7
2	2016	4	3	1	1	9	17	2001	5	2	0	0	7
3	2015	6	3	2	4	15	18	2000	1	1	0	0	2
4	2014	1	0	2	3	6	19	1999	4	1	0	2	7
5	2013	0	4	1	0	5	20	1998	1	1	0	0	2
6	2012	3	2	3	1	9	21	1997	0	2	0	0	2
7	2011	2	2	0	3	7	22	1996	5	1	0	0	6
8	2010	8	2	0	0	10	23	1995	1	2	0	0	3
9	2009	4	0	2	0	6	24	1994	2	1	0	0	3
10	2008	6	2	0	0	8	25	1993	2	0	0	0	2
11	2007	4	3	0	0	7	26	1991	2	0	0	0	2
12	2006	4	0	2	0	6	27	1990	4	0	0	0	4
13	2005	4	0	0	0	4	28	1989	1	0	0	0	1
14	2004	4	2	0	0	6	29	1988	1	0	0	0	1
15	2003	1	1	0	0	2	30	1987	1	0	0	0	1
	Total	55	30	13	12	110		Total	34	13	1	2	50
Final Total Percentage		89 (55.6)	43 (26.9)	14 (8.7)	14 (8.7)	160 100%		1992* No publication					

AUTHORS' PRODUCTIVITY

Table-3 depicts the authors' productivity of the African LIS research articles during 1987-2017. It is depicted from the table that about 279 numbers of authors have contributed a total of 160 articles and their Average Authors per Article (AAPA) is found to be 1.74 and Productivity Per Author (PPA) is 0.57.

Table 3.Authors' Productivity

Year	Total No. of articles	Total No. of Authors	Total AAPA	Total PPA	Year	Total No. of articles	Total No. of Authors	Total AAPA	Total PPA
2017	10	16	1.6	0.6	2002	7	11	1.6	0.6
2016	9	17	1.9	0.5	2001	7	9	1.3	0.8
2015	15	36	2.4	0.4	2000	2	3	1.5	0.7
2014	6	21	3.5	0.3	1999	7	15	2.1	0.5
2013	5	11	2.2	0.5	1998	2	3	1.5	0.7

2012	9	21	2.3	0.4	1997	2	4	2.0	0.5
2011	7	18	2.6	0.4	1996	6	7	1.2	0.9
2010	10	12	1.2	0.8	1995	3	5	1.7	0.6
2009	6	10	1.7	0.6	1994	3	4	1.3	0.8
2008	8	10	1.3	0.8	1993	2	2	1.0	1.0
2007	7	10	1.4	0.7	1991	2	2	1.0	1.0
2006	6	10	1.7	0.6	1990	4	4	1.0	1.0
2005	4	4	1.0	1.0	1989	1	1	1.0	1.0
2004	6	8	1.3	0.8	1988	1	1	1.0	1.0
2003	2	3	1.5	0.7	1987	1	1	1.0	1.0
Total	110	207				50	72		
Final Total	160	279	1.74	0.57					

Note: Average Authors Per Article= Number of Authors / Number of Articles
Productivity Per Author= Number of Articles/ Number of Authors

LOTKA'S LAW OF SCIENTIFIC PRODUCTIVITY

Lotka's inverse square law of scientific productivity is a widely used law for bibliometric mapping of research outputs and authors' productivity in any discipline of knowledge. Lotka's law states that the number of authors making *n* contributions is about $1/n^2$ of those making one; and the proportion of all contributors, that make a single contribution, is about 60 percent. This means that out of all the authors in a given field, 60 percent will have just one publication, and 15 percent will have two publications, 7 percent of authors will have three publications and so on. In Table-4, Lotka's law has been applied to the following data set, and result promulgated that with one article contribution only 89 authors were both observed and expected. For two articles contribution maximum 43 authors observed and again 43 authors have been identified as expected. Again for three articles contribution highest 14 authors observed but 28 as expected and for more than 3 authors contribution 14 authors observed and 21 authors have been expected. So, in the following data set it is found that the numbers of authors observed are somehow different with the numbers of authors expected.

Lotk'a formula for scientific productivity of authors is as follows:

Xn**Y= C** and **Y= C/X**n, Where, X= number of publications, Y= relative frequency of authors with 'X' publications and C= Constants depending on the specified field.

Putting the value of X= 1 and Y= 89, the calculation obtained was;

1n.89= C,

=> C=89

Again putting the value of X= 2 and Y= 43 and C= 89 the calculation obtained were:

2n.43= 89

=> 2n= 89/43=2.07

=> n log 2= log 2.07

=> n (0.301)= 0.316

=> n =0.316/0.301

=> n =1.04

Table 4.Lotka's Law of Scientific productivity

No. of articles (x)	No. of authors observed (y)	No. of authors expected (n=1.04)
1	89	89
2	43	43
3	14	28
>3	14	21

DEGREE OF AUTHORS' COLLABORATION

Degree of authors' collaboration examines the prominent area of inquiry indicating the trend in patterns of single and joint authors' publication. Table-5, explains the applications of Subramanian's equation to calculate degree of authors' collaboration in different years. It is observed in the table that, the degree of authors' collaboration has ranged from 0 to 1.0 during the period of study and the mean value is found to be 0.376.

Subramanian's equation $C = \frac{\mathrm{Nm}}{\mathrm{Nm}+\mathrm{Ns}}$, where *C= degree of collaboration,*

Nm= number of multi-authored work, Ns= number of single-authored works.

Table 5.Degree of authors' collaboration

Year	Single Author Ns^1	Multiple Authors Nm^1	Ns+ Nm	Degree of Collaboration	Year	Single Author Ns^2	Multiple Authors Nm^2	Ns+ Nm	Degree of Collaboration
2017	4	6	10	0.60	2002	4	3	7	0.43
2016	4	5	9	0.56	2001	5	2	7	0.29
2015	6	9	15	0.60	2000	1	1	2	0.50
2014	1	5	6	0.83	1999	4	3	7	0.43
2013	0	5	5	1.00	1998	1	1	2	0.50
2012	3	6	9	0.67	1997	0	2	2	1.00
2011	2	5	7	0.71	1996	5	1	6	0.17
2010	8	2	10	0.20	1995	1	2	3	0.67
2009	4	2	6	0.33	1994	2	1	3	0.33
2008	6	2	8	0.25	1993	2	0	2	0.00
2007	4	3	7	0.43	1991	2	0	2	0.00
2006	4	2	6	0.33	1990	4	0	4	0.00
2005	4	0	4	0.00	1989	1	0	1	0.00
2004	4	2	6	0.33	1988	1	0	1	0.00
2003	1	1	2	0.50	1987	1	0	1	0.00
	55	55	110	7.348		34	16	50	4.310
Total	89 (Ns^1+Ns^2)	71 (Nm^1+ Nm^2)	160	11.658	11.658/31 =0.376				0.43(mean)

SUBJECT ORIENTATION OF LIS RESEARCH ARTICLES

Table-6 depicts the major subjects orientation of LIS research, which shows that amongst the whole 160 articles, total 160 (100%) articles have Social Sciences orientation, 38 (23.75%) articles have computer Science orientation, 12 (7.5%) articles have Medicine orientation, 9 (5.63%) articles have Health profession, 7 (4.38%) articles have Engineering orientation, 3 (1.8%) articles have Arts and Humanities orientation, 2 (1.25%) articles each have orientation towards Business and Economics and 1(0.63%) articles have Immunology and Microbiology orientation. The lowest number of subject orientation has come up from Immunology and Microbiology and the maximum from computer science orientation.

Table 6.Subject orientation of articles

Subject orientation of articles	Total article (N=160)	Percentage (%)
Social Sciences	160	100%
Computer Science	38	23.75
Medicine	12	7.50
Health Professions	9	5.63
Engineering	7	4.38
Arts and Humanities	3	1.88
Business, Management and Accounting	2	1.25
Economics, Econometrics and Finance	2	1.25
Immunology and Microbiology	1	0.63

GEOGRAPHICAL DISTRIBUTION OF LIS ARTICLES

Geographical distribution of LIS research articles (Table 7) with collaboration to foreign countries shows that amongst the 160 articles, whole total 160 articles were contributed by authors of Africa. The authors of South Africa contributed 63(39.38%), United States have contributed 21 (13.13%) articles, 18 (11.25%) from Nigeria, 15 (9.38%) from Botswana, etc. Lowest numbers of collaborative contributions have come up from Brazil, Colombia, Mali, France, Iran, Malta, Mozambique, New Zealand, Sri Lanka, Rwanda, South Korea and Tunisia with only 1 (0.63%) articles each.

Table 7.Geographical distribution of LIS research articles

Rank	Name of the Country	Total contributions	Percentage (%)
1	Africa	160	100
2	South Africa	63	39.38
3	United States	21	13.13
4	Nigeria	18	11.25
5	Botswana	15	9.38
6	Uganda	8	5.00
7	Ghana	7	4.38
7	United Kingdom	7	4.38
8	Canada	5	3.13
8	Kenya	5	3.13
9	Tanzania	4	2.50
9	Zambia	4	2.50

10	Ethiopia	3	1.88
10	India	3	1.88
10	Japan	3	1.88
10	Zimbabwe	3	1.88
11	Australia	2	1.25
11	Bangladesh	2	1.25
11	Belgium	2	1.25
11	Malaysia	2	1.25
11	Pakistan	2	1.25
11	Senegal	2	1.25
11	Turkey	2	1.25
12	Brazil and 11 countries Each 1 contribution	12	0.63

SOURCES OF PUBLICATIONS

While checking from Scopus database for the year 1987-2017, the total numbers of articles (160) have been published in different types of sources like Journals (153), Books (4), Conference proceedings (2) and in Book series (1). The same is given below as Fig.1 below:

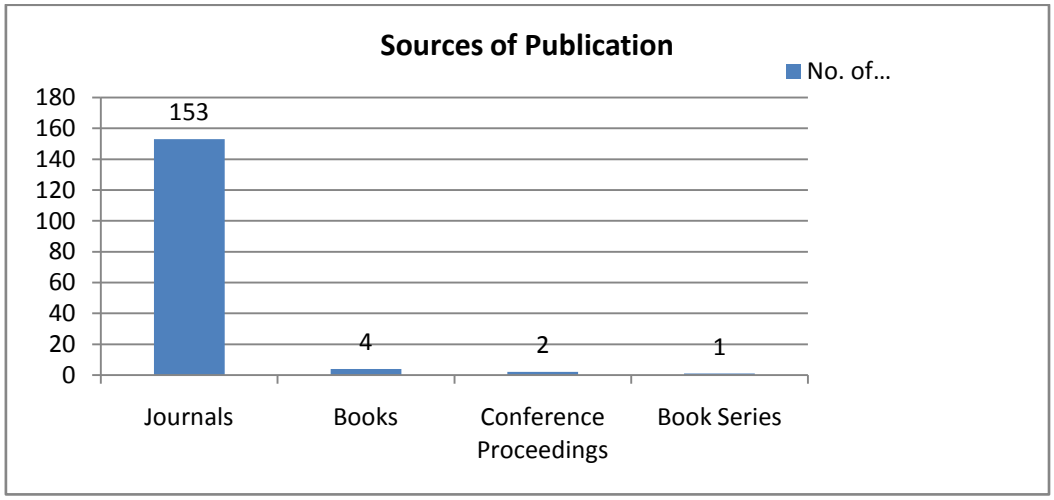

Figure 1.Sources of Publications

MOST PRODUCTIVE LIS JOURNALS DURING 1987-2017

Bradford's Law is used in determining the increasing productivity of number of core journals in any given field. The law states the increasing productivity of journals from one zone to the next in the mathematical expression *1:n:n²*. According to Bradford's law contributing journals can be divided into three equal zones, each containing the same number of productivity. Table-8 depicts that first two journals produced 53 articles, next 9 journals produced 56 articles and remaining 37 journals produced 51 articles which mostly meets the Bradford's law of scattering of journals. Again it is found that International Information Library Review has contributed highest 36 (22.5%) articles and secured the number 1 rank. It is followed by Education for Information with 17 (10.63%) articles with rank 2 rank and Library Review and Health Information Libraries Journal with 18 (11.25%) articles have ranked 3 (each with 9 articles).

Table 8.Most productive LIS Journals during 1987-2017

				Cumulative	
Rank	**Contributing Journals**	**No. of articles**	**Percentage**	**No. of articles**	**Percentage**
1	International Infn Library Review	36	22.50	36	22.50
2	Education For Information	17	10.63	53	33.13
3	2 no. of journals with 9 articles	18	11.25	71	44.38
4	Library Management	7	4.38	78	48.75
5	3 no. of journals with 6 articles	18	11.25	96	60.00
6	Canadian Jl of Information & Lib Science	5	3.13	101	63.13
7	2 no. of journals with 4 articles	8	5.00	109	68.13
8	3 no. of journals with 3 articles	9	5.63	118	73.75
9	8 no. of journals with 2 articles	16	10.00	134	83.75
10	26 no. of journals with one article	26	16.25	160	100
		160	100.00		

CONCLUSION AND FINDINGS

The present study has been summarized with the following research findings:

- The publication of LIS research articles in Africa ranges from 1-15, the highest is 15 (9.4%) in 2015, and there was no publication in the year 1992.
- It is found that highest 89 (55.6%) articles have been contributed by single authors only. Two authors collaboration is 43 (26.9%) only.
- The Average Authors per Articles (AAPA) was found to be 1.74 and Productivity per Authors (PPA) as 0.57.
- The major source of publication is through Journals (153), then Books (4), 3rd being Conference proceedings (2) and finally Book series (1).
- The study witnessed a moderate International collaborative research in the field of LIS. 65 (40.6%) articles have been contributed by the authors of foreign countries out of 160, which is a moderate contribution.
- International Information Library Review has been identified as most favored LIS journal having 36 (22.5%) articles publication out of 160 LIS research articles.
- With the application of Lotka's law to the present data set, it is revealed that the numbers of authors observed are somehow different with the numbers of authors expected.

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