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Authorship Pattern in Academic Libraries during the Period 2006 to 2020: A Scientometrics Study

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Abstract

The present study discusses the basic scientometrics analysis. The scientometrics study is based on the authorship pattern of academic libraries research from 2006 to 2020. The data was downloaded from the Web of Science database, which is maintained by Thomson Reuters. The total number of records was 3,452. Data is analysed using Microsoft Excel and HistCite software. The main purpose of the study is to find out the authorship pattern of academic libraries in a scientometric study. This study fully focused on finding out authorship pattern of single and multiple authors, relative growth rate, degree of collaboration, and exponential growth rate. The study findings reveal that a total of 3,452 publications were published in academic libraries during 2006-2020 (15 years). The highest number of publications – 628 (18.19%) – was in 2020. The highest number of paper publications was by single authors – 849 (2.46%). The extent of research contributions by the authors is explained under authorship pattern; out of 3,452, a majority number of authors was 2,603. The relative growth rate of total contributions published had gradually increased and the growth rate was calculated as 0.68 in 2007, which increased to 1.7 in 2020.

Keywords: Scientometrics, Web of Science, HistCite, Academic Libraries, Authors' Productivity, RGR

Introduction

Bibliometrics is the method which deals with the study of published literature. "The history of comparative anatomy: A numerical investigation" is designated as the first bibliometrics study. The expression statistical bibliography was first used by Hulme (1923) in his literature; later, it was used by many others. Scientometric is nothing but the study of quantitative aspects of science. According to Nalimov and Mulchenko (1996), scientometrics is the research purpose of those quantitative methods which deal with the examination of the discipline, viewed as an in-sequence process and statistical output.

Academic Libraries

A library is the centre of reliability for the performance of a university or a college. Academic library refers to a library that supports a college or university. Colleges and universities may well have more than one library. Academic library appraisal and estimate is a set of comprehensive processes to measure an academic library's offerings and values for an academic institutional accreditation, effectiveness, excellence in teaching and education, improvement, apprentice learning outcomes, and so on, in a service-oriented and student-centred academic learning environment. To help new librarians recognise library appraisal and estimate academic learning environments, this chapter explores the basic metrics, plans, purposes, and tools applicable for academic library consideration and evaluation.

Today's academic librarians are concerned with multiple demanding activities.

- Discuss with persons to analyse, identify, and satisfy their information needs.
- Create campus-wide information literacy programmes and distribute classroom instruction to support information literacy skills.
- Choose, systematise, and smooth the development of access to information in a selection of formats.
- Plan, implement, and administer computer-based systems, electronic databases design, and manage websites.
- Collaborate with classroom faculty, computer specialists, and instructional developers.

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Functions of Academic Libraries

- To ensure the necessary quiet environment for reading, studying, and researching.
- To provide all the students with the essential research and reference materials, like bibliographies, biographies, glossaries, abstracts, dictionaries, encyclopaedias, manuals, atlases, gazetteers, monographs, and so on.
- To help new students orientate how to source and find the necessary materials quickly and correctly.
- To maintain all the handbooks, including textbooks and fiction, which are specific to the educational institution, especially those written by its founders and professors, and relating to its history and educational programmes.

Review of Literature

Scientometrics is an effective method to quantitatively analyse the productivity and progress of all forms of written statement. The study by Kumar, Singh, Ranjan and Rai (2020) aims to examine the scientific research productivity of Library Philosophy and Practice (e-journal) during 1998-2019. Necessary data was collected from the Scopus database. The year-wise distribution of articles, relative growth rate, doubling time, collaboration coefficient, country- and affiliation-wise distribution, citation patterns, and so on, were analysed. Findings discovered that the highest number of articles were published in 2019 and lowest in 1998. In 2013, there was no single article. Maurya et al. (2019) measured the coverage of LIS academia in Google Scholar and Microsoft Academic using scientometric indicators. The study is based on simple search queries in Google Scholar and Microsoft Academic for each LIS faculty whose information is available on the university website. The study found more coverage for Google Scholar than Microsoft Academic in all scientometric indicators used for comparison between the two databases. The study provides an insight for the individual researcher and LIS departments, to focus on indexing their research in Google Scholar and Microsoft Academic. Renjith and Vijayan (2018) concentrated on the inferential statistical analysis of H-index and SCImago Journal Rank (SJR) of ten library and information science (LIS) journals in the Asiatic region, which appeared in SCImago Journal and Country Rank databases for the period 2006-2015. They also analysed the citations, self-citations, and citations without self-citations of six countries publishing these ten LIS journals in the Asiatic region. Husain, S., and Nazim, M. (2015) observed that academic libraries in India have frequently been concerned with applying traditional ICT-based solutions for the organisation of various library functions and services, particularly for organising and retrieving information. Use of modern ICT-based tools of information creation and sharing, such as Web discovery tools, blogs, wikis, real simple syndication (RSS) feeds, social networking, and collective bookmarking, seem uncommon in academic libraries. Jabeen et al. (2015), in their article, highlight the research efficiency and scholarly statement of library and information science professionals during 2003-2012 by using Web of Science databases from 40 library and information science core journals. Data was interpreted by using two open-source software – Vantage point (powerful text-mining tool for discovering significant result from raw data) and CiteSpace II to visualise the library and information science growth and trends. The purpose of the scientometric study carried out by Sife and Lwog (2014) was to conduct an analysis of the research productivity and scholarly impact of academic librarians in Tanzania for a period of 30 years, from 1984 to 2013.

Research Methodology and Limitation of the Study

The data for the study were retrieved from the Web of Science database. With the scientific and indexing services maintained by Thomas Reuters, the academic libraries research output were analysed. It can be seen that there are nearly 3,452 bibliographic records and contributions in the academic libraries records during the period 2006-2020. For the study, bibliographic details such as year-wise publications, authorship patterns, single-author vs. multiple-author, relative growth rate contribution and doubling time, degree of collaboration, document type distributions, country-wise distribution of publication, exponential growth rates, time series analysis of single author articles, and arithmetic mean value were analysed and the information is provided in the form of tables and figures. The collected knowledge was analysed with the assistance of HistCite tool.

Objectives

The main objectives is the frame with exclusive of the Present Study as mentioned below:

- To study the year-wise distribution of a publication.
- To determine the authorship pattern.
- To examine single author and multiple authors.
- To determine the degree of collaboration.
- To identify the document type distributions.
- To identify the country-wise distribution of publication.
- To identify the language-wise distribution of a publication.
- To identify the exponential growth rates.
- To find out the time series analysis of single-author articles.
- To identify the arithmetic mean value.

Data Analysis and Interpretation

Year-Wise Research Output

Table 1: Year-Wise Publication Stats

Sr. No.	*Publication Year*	*Records*	*Percentage*
1	2006	70	2.03%
2	2007	72	2.09%
3	2008	68	1.97%
4	2009	63	1.83%
5	2010	76	2.20%
6	2011	98	2.84%
7	2012	102	2.96%
8	2013	98	2.84%
9	2014	107	3.10%
10	2015	120	3.48%
11	2016	416	12.05%
12	2017	463	13.41%
13	2018	522	15.12%
14	2019	549	15.90%
15	2020	628	18.19%
	Total	3452	100.00%

Table 1 depicts the year-wise distribution of publications on academic libraries research from 2006 to 2020 in the Web of Science database. The study observed that out of a total of 3,452 publications 628 (18.19%), the highest number of publications published, was in 2020. The lowest number of publications – 72 (2.03%) – was in 2006.

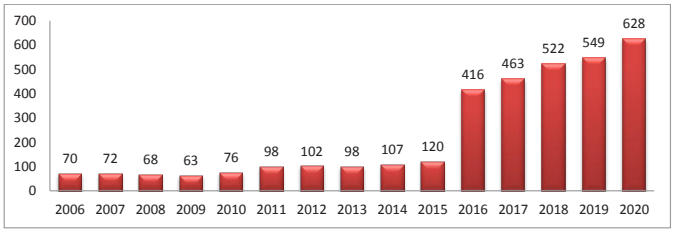

Fig. 1: Year-Wise Distribution of Publication

Authorship Pattern

Authorship Pattern (Single vs. Multiple)

Table 2: Single Author vs. Multiple Authors

Sr. No.	*Authors*	*Publication*	*Percentage*
1	Single-Author	849	24.6%
2	Multiple-Author	2603	75.4%
Total		3452	100.0%

Table 2 shows the single-author vs. multiple-author academic libraries research from 2006 to 2020. For analysis, researchers have classified the study phase, viz., the first phase was the single-author and the next phase multiple-author. It is clear from the table that single-author publications were 849 (24.6%) and multiple-author were 2,603 (75.4%). In addition, a majority of the articles were published under the single-author pattern during the period 2006-2020.

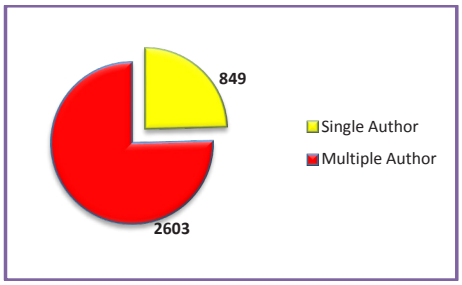

Fig. 2: Single Author vs. Multiple Authors

Authorship Pattern (Year-Wise)

Table 3: Authorship Pattern (Year-Wise)

Year	1	2	3	4	5	Above 5 Authors	Total
2006	19	20	10	7	6	8	70
2007	15	21	13	8	7	8	72
2008	15	18	14	3	6	12	68
2009	17	14	12	5	7	8	63
2010	18	20	10	9	7	12	76
2011	16	20	22	14	10	16	98
2012	15	22	20	22	8	15	102
2013	16	25	16	24	8	9	98
2014	15	18	16	15	10	33	107
2015	10	25	20	19	13	33	120
2016	130	107	79	30	30	40	416
2017	150	111	91	53	27	31	463
2018	157	127	91	52	40	55	522
2019	134	117	101	63	42	92	549
2020	122	169	99	78	55	105	628
Total	849	834	614	402	276	477	3452

Table 3 lists the authorship pattern analysed to determine the type of research and their percentage; it examines the authorship pattern of academic libraries research from 2006 to 2020, where the total number of records is 3,452. The highest number of records was in 2020, produced by 628 authors. The lowest records output was in 2009, produced by 63 authors. Among this authorship pattern, the single-author total value is high (849) and five-author total value is the lowest (276).

Degree of Collaboration

Degree of collaboration is calculated using Subramanian's formula: $C = NM / (N_M + N_S)$

Where,

C = Degree of collaboration

N_M = Number of multi-authored works

N_S = Number of single-authored works

Table 4: Degree of Collaboration

Year	Single Author (N_S)	Multiple Author (N_M)	Total ($N_S + N_M$)	Degree of Collaboration (C) $[N_M / (N_S + N_M) = C]$
2006	19	51	70	0.73
2007	15	57	72	0.79
2008	15	53	68	0.78
2009	17	46	63	0.73
2010	18	58	76	0.76
2011	16	82	98	0.84
2012	15	87	102	0.85
2013	16	82	98	0.84
2014	15	92	107	0.86
2015	10	110	120	0.92
2016	130	286	416	0.69
2017	150	313	463	0.68
2018	157	365	522	0.69
2019	134	415	549	0.76
2020	122	506	628	0.81
Total	849	2603	3452	11.73

Table 4 shows the degree of author collaboration in the studies. It is found that the degree of author collaboration in the annals of library and information ranged from 0.73 to 0.81 during the period under study. C = degree of relationship is 3452 (11.73%); N_M = number of multi-authored works is 2603; and N_S = number of single-authored works is 849.

Relative Growth Rate (RGR) and Doubling Time ($D_{t)}$

The growth of publications was analysed using two parameters: relative growth rate and doubling time (Mahapatra, 1985). Relative growth rate is a measure to study the increase in the number of publications in a certain period of time. Doubling time is the time required for publications to become double the existing amount. It is directly related to RGR and is defined as the time required for the articles to become two-fold of the existing amount (Panda, 2020).

Table 5: Relative Growth Rate of Total Contribution and Doubling Time

Year	*No. of Contributions*	*Cumulative No. of Contributions*	*W1*	*W2*	*R(a) w2 – w1*	*Mean R (a)*	*Doubling Time*	*M DT (a)*
2006	70	70		4.24		0.958		0.568
2007	72	142	4.27	4.95	0.68		1.02	
2008	68	210	4.21	5.34	1.13		0.61	
2009	63	273	4.14	5.6	1.46		0.75	
2010	76	349	4.33	5.85	1.52		0.46	
2011	98	447	4.58	6.1	1.52	1.786	0.46	0.394
2012	102	549	4.62	6.3	1.68		0.41	
2013	98	647	4.58	6.47	1.89		0.37	
2014	107	754	4.67	6.62	1.95		0.36	
2015	120	874	4.78	6.77	1.89		0.37	
2016	416	1290	6.03	7.16	1.13	1.47	0.61	
2017	463	1753	6.13	7.54	1.41		0.49	
2018	522	2275	6.25	7.72	1.47		0.47	
2019	549	2824	6.3	7.94	1.64		0.42	
2020	628	3452	6.44	8.14	1.7		0.41	0.48
Total	3452					4.214		1.422

Table 5 indicates the relative growth rates of articles' output and also the doubling time of the publication. It can be observed that the relative growth rate of all sources of research output has decreased from 0.68 in 2007 to 1.7 in 2020. The mean relative growth rates is calculated for the period 2006-2020. The study period has witnessed a mean relative growth rate of 4.214. The doubling time for publication has increased from 1.02 in 2007 to 0.41 in 2020. The mean doubling time for publications for the period 2006-2020 was 1.422.

Published Document Types

Table 6: Document Type Distributions

Sr. No.	*Document Type*	*Records*	*Percentage*
1	Articles	2,408	69.76%
2	Review Articles	729	21.12%
3	Book Reviews	133	3.85%
4	Proceedings Papers	57	1.65%
5	Editorial Materials	55	1.59%
6	Early Access	18	0.52%
7	Meeting Abstracts	14	0.41%
8	Book Chapters	13	0.37%
9	Reprints	7	0.20%
10	Corrections	5	0.15%
11	Biographical Items	4	0.12%
12	News Items	4	0.12%
13	Software Reviews	2	0.05%
14	Data Papers	1	0.03%
15	Letters	1	0.03%
16	Retractions	1	0.03%
	Total	3,452	100.00%

Table 6 reveals the type of document-wise distribution of publications. It is an accepted fact that most of the scholarly communication of scientific research is published as articles – 2,408 (69.76%).

Geographical Distribution (Country-Wise)

Table 7: Country-Wise Distribution

Sr. No.	Countries	Records	Percentage
1	USA	1,491	43.19%
2	China	357	10.34%
3	England	287	8.31%
4	Australia	203	5.88%
5	Canada	198	5.74%
6	Spain	141	4.09%
7	Brazil	82	2.38%
8	South Africa	76	2.20%
9	Germany	73	2.12%
10	India	65	1.88%
11	France	61	1.77%
12	Pakistan	61	1.77%
13	Netherlands	56	1.62%
14	South Korea	56	1.62%
15	Japan	52	1.51%
16	Italy	51	1.48%
17	Taiwan	49	1.42%
18	Malaysia	42	1.22%
19	Scotland	38	1.10%
20	Sweden	38	1.10%
21	Ireland	36	1.04%
22	Iran	35	1.01%
23	Nigeria	35	1.01%
24	Switzerland	34	0.99%
25	Saudi Arabia	32	0.93%

Table 7 shows the country-wise distribution of keywords research articles published. A majority of articles were published in the USA – 1,491 (43.19%); the lowest number of articles were published in Belgium – 32 (0.93%).

Language-Wise Distribution

Table 8: Language-Wise Distribution

Sr. No.	Language	Records	Percentage
1	English	3,330	96.47%
2	Spanish	49	1.42%
3	Portuguese	19	0.55%
4	French	13	0.38%
5	Italian	10	0.29%
6	Russian	8	0.23%
7	Japanese	7	0.20%
8	German	6	0.17%
9	Estonian	5	0.15%
10	Turkish	2	0.06%
11	Afrikaans	1	0.03%
12	Chinese	1	0.03%
13	Czech	1	0.03%
	Total	3,452	100.00%

Table 8 shows the language-wise distribution of academic libraries research during 2006-2020. It is noticed that scholarly communication is through the English language in almost all the countries; the native language of the keywords of academic libraries of about 3,452 (96.47%) of the research output is in English, followed by 49 (1.42%) in Spanish, 19 (0.55%) in Portuguese, 13 (0.38%) in French, ten (0.29%) in Italian, eight (0.23%) in Russian, seven (0.20%) in Japanese, six (0.17%) in German, five (0.15%) in Estonian, two (0.06%) in Turkish, and one (0.03%) each in Afrikaans, Chinese, and Czech. The study concludes that the majority of research works on academic libraries is published in English – 3,452 (96.47%).

Exponential Growth Rate

Table 9: Exponential Growth Rates

Sr. No.	*Publication Year*	*Records*	*Exponential Growth Rate*
1	2006	70	NIL
2	2007	72	1.03
3	2008	68	0.94
4	2009	63	0.93
5	2010	76	1.21
6	2011	98	1.29
7	2012	102	1.04
8	2013	98	1.29
9	2014	107	1.09
10	2015	120	1.12
11	2016	416	3.47
12	2017	463	1.11
13	2018	522	1.13
14	2019	549	1.05
15	2020	628	1.14
	Total	3452	17.84

Table 9 shows the exponential growth rates of publication of academic libraries research during 2006-2020. The highest growth rate, 3.47, was found in 2016, with 416 publications. It is also found that the total exponential growth rate was 17.84.

Time Series Analysis of Single Authored Articles

Table 10: Time Series Analysis of Single Authored Articles

Year	*No. of Publications*	*X*		X_y
2006	70	−7	49	−490
2007	72	−6	36	−432
2008	68	−5	25	−340
2009	63	−4	16	−252
2010	76	−3	9	−228
2011	98	−2	4	−196
2012	102	−1	1	−102
2013	98	0	0	0
2014	107	1	1	107
2015	120	2	4	480
2016	416	3	9	1248
2017	463	4	16	1852
2018	522	5	25	2610
2019	549	6	36	3294
2020	628	7	49	4396
Total	3452		280	11947

The straight line equation is applied to arrive at estimates for future growth under the time series analysis. Straight Line Yc = a + bX

Since$\sum x = 0$

$$A = \frac{\sum y}{n} = \frac{3452}{15} = 230.13$$

$$B = \frac{\sum y}{\sum x} = \frac{11947}{280} = 42.66$$

Estimated literature in 2020 is when X = 2020 − 2010 = 10

$= 230.16 + 42.66 \times 10 = 656.76$

Estimated literature in 2025 is when X = 2025 − 2010 = 15

$= 230.16 + 42.66 \times 15 = 870.06$

On the application of the formula of time series analysis, and subsequently, from the results obtained separately for the years 2020 and 2025, it is found that the future trend of growth may be an increasing trend during the years to come.

Table 11: Arithmetic Mean

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total	A.M
Total No. of Publications	70	72	68	63	76	98	102	98	107	120	416	463	522	549	628	3452	230.13

Table 11 shows the arithmetic mean value year wise. The average of the arithmetic mean value was 230.13. The arithmetic mean set of value is the ratio of their sum of the total number of values in the set. Thus, if there are a total of n numbers in the dataset, whose arithmetic mean values is represented by', the mean can be found using the following formula.

$$A = \frac{1}{n} \sum_{i=1}^{n} a_i$$

A = arithmetic mean

n = number of values

a_i = data set values

Findings

- The publications on a scientometric study of academic libraries during the period 2006-2020 (15 years) included a total of 3,452.
- The highest number of publications – 628 (18.19%) – was in 2020.
- The extent of research contributions by the authors is explained under authorship pattern; out of 3,452 a majority number of authors was 2,603.
- It is noticed that scholarly communication is through the English language in almost all the countries; about 3,330 (96.47%) of the research output was in English.
- A majority of articles – 1491 (43.19%) – were published in the USA, followed by the lowest – 32 (0.93%) – published in Saudi Arabia.
- It is also found that the exponential growth rate was 17.84. The average growth rate has a positive value, showing an increasing trend in the academic libraries keyword.
- The average of the arithmetic mean value was 230.13.

Conclusion

Scholarly literature is intended for use in support of conducting in-depth research, often containing specialised vocabulary and extensive references to sources. In this study, we report on the current stage of our research effort on academic libraries' authorship pattern. The data was collected from WOS and organised in a correct manner; the total number of records was 3,452. Data is analysed using Microsoft Excel sheet and HistCite software. We find out authorship pattern of single and multiple authors, year-wise distribution of publications, country-wise publication, document-wise publication, and relative growth rate, degree of collaboration, and exponential growth rate. That's all about our study this one will be used in future.

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