
Mapping of Virtual Library Research (2017-2021): A Scientometric Study

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Abstract

The present study explores the Scientometric Analysis of Virtual Library Research (2017-2021): A Study. This study covered 2272 records worldwide from 2017 to 2021. The study was undertaken to examine the year wise distribution of contributions, authorship pattern, and degree of collaboration, relative growth rate and doubling time, Document wise distribution of records. A Number of publications published in the year of 2021 with 656 (28.87%) records. USA ranked first in the virtual library Research with 480 (21.13%) records followed by China (368), and South India (273), with second and third position. A number of records published through the article 1700..

Keywords

Awareness; Public libraries; Open E-Resources;
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Introduction

Scientometrics is a wide-ranging field with vague boundaries. It is generic term for a system of knowledge, which endeavors to study the Scientific and Technological system, using a variety of approaches with in the areas of Science and Technology Studies (STS). Scientometrics is a "Science of Science". Virtual Library is another kind of Digital Library which provides portal to information that is available electronically elsewhere. This is referring red so to emphasize that the Library does not itself hold content. Librarians have used this term for a decade or more to denote a Library that provides access to distributed information in electronic format through pointers provided locally.

A Virtual Library has been defined by Gapen (1993) as, "the concept of remote access to the contents and services of libraries and other information resources, combining an on-site collection of current and heavily used materials in both print and electronic form, with an electronic network which provides access to, and delivery from, external worldwide library and commercial information and knowledge sources". The speedy and wide access to current information contents makes virtual libraries a global symbol of the information access paradigm. The Virtual Library has changed the traditional focus of librarians on the selection, cataloguing and management of information resources such as books and periodicals. The virtual library is putting emphasis on access without the need to allow for the time required by these technical processes. Virtual Libraries have induced libraries, scholars, publishers and document delivery vendors to develop new partnerships that are working for the good of scholarly communication in both developed and developing countries.

Features of a Virtual Library

- It provides speedy and wide access to updated information in a global manner.
- It has changed the tradition a library system of cataloguing only book materials.
- Cataloguing of NBM (Non Book Materials) includes not only databases but also websites.
- Greater emphasis is on access and not on collection.
- Time Savings

- It results in a creation of digital divide because only developed countries with strong funds for automation and fulfilling infrastructural requirements for Virtual Library can afford to support Virtual Library services.

Review of the Literature

Araujo & Oliveira (2017) investigate the scientific research on the technological theme and thus understand the basis of its support. The source of the research was the Referential Database of Information Science Periodical Articles (BRAPCI) using the terms 'computer', 'automation', 'information systems', 'technology', "electronic", 'e-digital' and 'virtual' gathered to analyze the technological base area of 353 articles. Results indicated that the articles were published between 1972 and 2008, outlining the year of 2001 with the largest quantity (29) and a decreasing setting in the last decade. Seven thematic domain groups that constitute the technological basis of the field were identified: the most representative of them is led by 'information systems', followed by 'digital and virtual library'; policy issues involving 'internet and network'; 'computer teaching librarianship'; 'automatic indexing', 'knowledge management, and electronic publishing'. SatishKumar(2018) analysed the research productivity of Scientists of Aryabhata Research Institute of Observational Sciences (ARIES), Nainital. The data was collected and analysed from the Web of Science (WoS) database for the period of 15 years from 2001-2015. 574. A total of 16,891 publications published by Indian scientists during 1993–2002. ARIES’s scientists are highly collaborating with USA. Out of 10 collaborating countries 07 are from developed countries and 03 countries are from Asia; and those are too leading researcher’s countries among Asian countries. Tata Institute of Fundamental Research (TIFR) was the top most collaborating Institutions with 15.85%. The Average impact factor of its top 10 journal publications (69.51 %) is 3.289 with H-Index 25. ARIES has also published two research articles in the highly prestigious Journal ‘NATURE’ in 2008. A similar study by Garg et al. (2006) analysed Scientometric profile of Indian agricultural research as seen through Science Citation Index Expanded. Thus, these two agencies contributed about two-third of the total output.

Research Methodology

The study is based on scientometric analysis and the data for this study was collected from the “Web of

Science” a multidisciplinary platform developed by Institute for Scientific Information (ISI), now maintained by Clarivate Analytics Group. The present study is limited to the research output of ‘Virtual Library’ for the past five years 2017- 2021. A total of 2272 publications were recorded during the study period which includes Articles, Proc. papers, editorial materials, meeting abstracts, reviews etc. The data was collected and analysed as per the objectives of the study. Each publication recorded with complete bibliographical details such as Title, Year, type of document, geographical distributions, etc. have been downloaded from the WoS database. The data was tabulated in MS Excel for its simple frequency calculation, Bibexcel for analyzing and VOS viewer for visualization map

Objectives of the Study

1. Analyse the annual distribution of Articles;
2. Find out the contribution of authors Collaboration of Publications;
3. Calculate the Relative Growth Rate (AGR) and Doubling Time of publications;
4. Identify the top countries of publications;
5. Study the degree of collaboration ;and
6. Perform the time series analysis for the study period 2017-2021

Analysis and Interpretation

Table1: Publication Years on Virtual Library

Publication Years	Record Count	% of 2,272	Citing Articles	Times Cited	H-Index
2021	656	28.87%	1647	1790	16
2020	531	23.37%	5418	6592	33
2019	423	18.62%	4237	4542	30
2018	340	14.97%	4740	4958	33
2017	322	14.17%	4803	4972	33

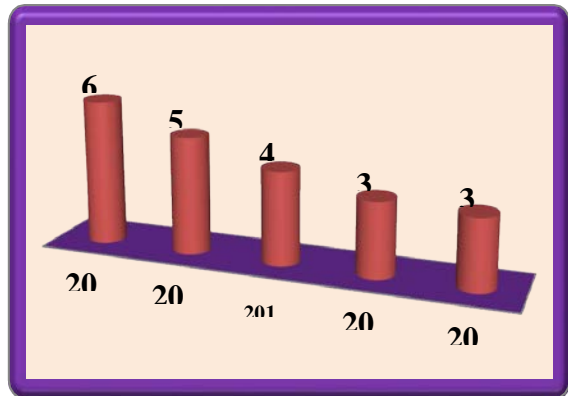


Figure-1 Publication Years

Table 1 and figure 1 indicates that the year-wise distribution of publication of Virtual Library; it is observed that the research output in the field of Virtual Library showing the ranges of growth year wise. The total number of publication 2272 was published, the highest number of publications in the year 2021 which was 656 articles with H Index of 16. The minimum number of publications which was recorded in the year 2017 numbered in 322 articles with the H Index of 33. From 2017 the publication seemed to rise gradually from 322 to 656.

Table 2: Document-wise Distribution

Document Types	Record Count	% of 2,272
Articles	1,700	74.82%
Review Articles	529	23.28%
Early Access	60	2.64%
Proceedings Papers	28	1.23%
Editorial Materials	25	1.10%
Meeting Abstracts	9	0.40%
Book Chapters	3	0.13%
Book Reviews	3	0.13%
News Items	3	0.13%
Data Papers	2	0.09%
Letters	2	0.09%
Corrections	1	0.04%

Table 2 reveals the type of document used for publication during the period 2017-2021. It could be seen that most of the publications were in Articles with 1700 (74.82%), followed by Review articles 529(23.28%), remaining Early Access, Proceeding Paper, Editorial Material, Meeting Abstract, Book chapters, Book Reviews, News Items, Data Papers,

Letters and Correction shaving below three percentage

Table 3: Country-wise Distribution

Countries	Record Count	% of 2,272
USA	480	21.13%
PEOPLES R CHINA	368	16.20%
INDIA	273	12.02%
BRAZIL	262	11.53%
ENGLAND	165	7.26%
GERMANY	138	6.07%
ITALY	135	5.94%
SPAIN	102	4.49%
FRANCE	90	3.96%
CANADA	84	3.70%

Top 3 countries are listed above in the table 3 shows the Distribution of India's International Collaborative Papers in Virtual Library research and the highest number of publication is made by the USA with 480 articles, followed by China with 368 records and having second place; Canada least with 84 publications for each respectively. And India had got the third position with 273 records

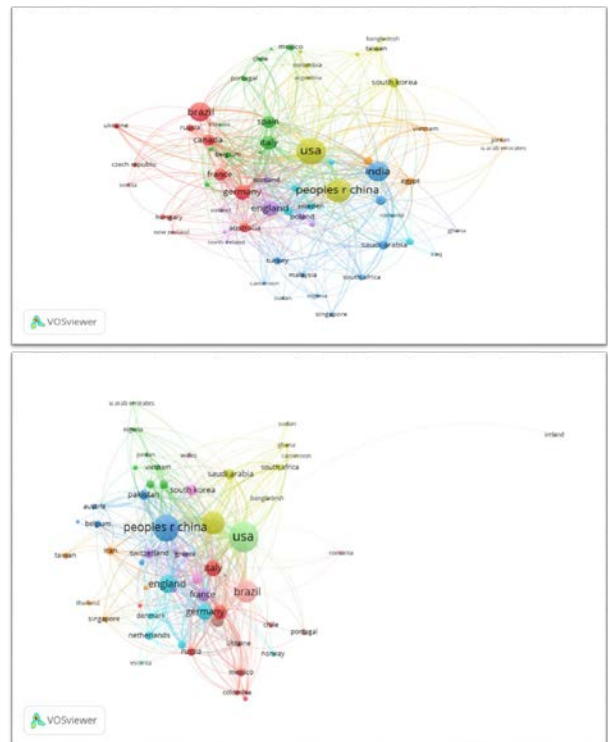


Figure 2. Visualization map on Citation with Countries

Table 4 :Year-wise Authorship Pattern

Year	1*	2*	3*	4*	5*	5+*	Total
2017	23	40	45	48	43	123	322
2018	13	44	53	53	38	139	340
2019	22	52	47	61	59	182	423
2020	27	47	65	68	71	253	531
2021	20	65	87	100	99	285	656
Total	105	248	297	330	310	982	2272
1* Single Author		2*Two Authors		3* Three Authors			
4* Four Authors		5* Five Authors		5+*Above Five Authors			

Table 4 shows year wise of the authorship pattern of Virtual Library research articles published during the period studied 2017 to 2021. The total publication numbered 2272 articles was published. The above five author was the highest number of contributed 982 articles, followed by four authors 330 articles, five authors 310 articles, three authors 297 articles, two authors 248 articles and one author 105 articles.

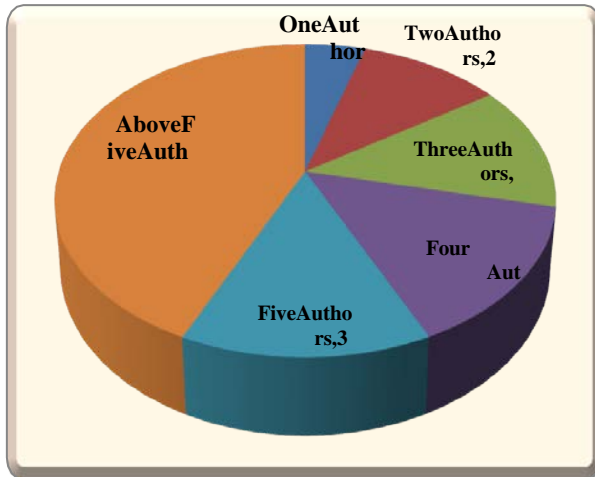


Figure 3. Authorship Pattern

Table 5: Single Vs Multi-Authors

Authorship Pattern	Records	Percentage
Single Author	105	04.63
Multi Authors	2167	95.37
Total	2272	100

It is observed from the table 5 that the authorship pattern in terms of Single Authors and Multi-Authors during the period of study (2017 to 2021). Out of 2272 research outputs, Multi –authors published the majority of 2167(95.37%) papers and single authors published the rest of 105(04.63%) journals..

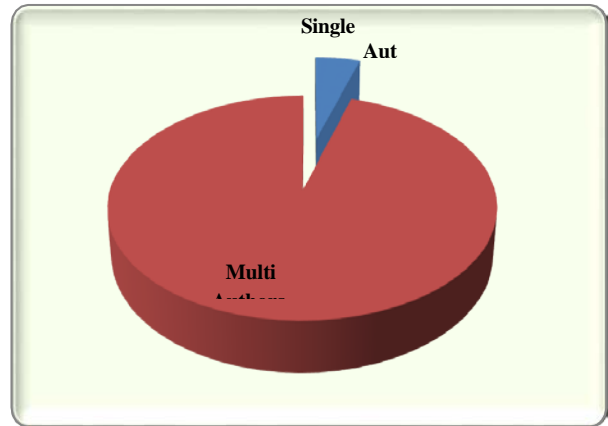


Figure 5. Single Vs Multi Authors

Table- 6: Collaborative Index

Year	1*	2*	3*	4*	5*	5+*	Total	CI*
2017	23	40	45	48	43	123	322	4.29
2018	13	44	53	53	38	139	340	4.40
2019	22	52	47	61	59	182	423	4.48
2020	27	47	65	68	71	253	531	4.63
2021	20	65	87	100	99	285	656	4.59
Total	105	248	297	330	310	982	2272	4.51
1* Single Author		2*Two Authors		3* Three Authors		4* Four Authors		
5* Five Authors		5+*Above Five Authors		CI*Collaborative Index				

Table 6 shows the authorship pattern and Collaborative Index (CI), in Virtual Library over the study period of 05 years, (2017-2021). The collaborative index 4.29 in 2017 has increased to 4.63 in 2020. The average CI is 4.51 during the study period. The distribution of year wise collaboration index has been presented in the table 3. It is seen from table 3 that the value for collaboration index has been calculated with minimum to 4.29 in 2017 and maximum to 4.63 in 2020 with an average of 4.51 According to Ajiferuke, the range of collaboration rate (0.50- 0.67) is better collaboration among the authors.

Table - 7: Collaborative Co-efficient

Year	1*	2*	3*	4*	5*	5+*	Total	CC
2017	23	40	45	48	43	123	322	0.69
2018	13	44	53	53	38	139	340	0.71
2019	22	52	47	61	59	182	423	0.71
2020	27	47	65	68	71	253	531	0.72
2021	20	65	87	100	99	285	656	0.73
Total	105	248	297	330	310	982	2272	0.71
1* Single Author		2* Two Authors		3* Three Authors		4* Four Authors		
5* Five Authors		5+* Above Five Authors		CC* Collaborative Co-efficient				

Table 7 shows the Collaborative Co-efficient has increased from 0.69 in 2017 to 0.73 in 2021 indicating that research among Scientists is fairly collaborative with an average CC of 0.71. There is a constant increase in CC from 2017 to 2021. The overall Collaborative Coefficient is 0.71 (0.71%). This shows their high degree of Collaboration observed in Virtual Library discipline.

Table 8: Relative Growth Rate (RGR) and Doubling Time (DT)

Year	Records	Cumulative	W1	W2	W2-W1	Mean R (a)	DT	Mean DTR (a)
2017	322	-	5.77	-	-		-	
2018	340	662	5.82	6.49	0.67		1.03	
2019	423	1085	6.04	6.98	0.94		0.73	
2020	531	1616	6.27	7.38	1.11		0.62	
2021	656	2272	6.48	7.72	1.24	0.99	0.55	0.73
	2272							

Table 8 shows that research results in the period from 2017 to 2021. A total of 2272 scientific articles published throughout India for 05 years. The highest percentage of papers was published in 2021. The above table shows that relative growth rates for Virtual Library research are increased from 0.649 in the year 2018, to 1.24 RGR in 2021. Mean RGR is 0.99. And the doubling time for publications of Virtual Library decreased in 1.03 in 2018 to 0.55 in 2021. Mean DT is 0.73 during their search period.

Table - 9: Degree of Collaboration (DC)

Year	Single Author (NS)	Multi Authors (NM)	Total (NS+NM)
2017	23	299	322
2018	13	327	340
2019	22	401	423
2020	27	504	531
2021	20	636	656
	105	2167	2272

Table 9 amounts to calculate the degree of collaboration in Virtual Library research by using the formula given by (K. Subramanyam, 1982)

which was, $C = \frac{NM}{NS + NM}$ Where,
 C - The degree of collaboration
 NM - no. of multi-authored papers
 NS - no. of single-authored papers

The degree of collaboration varied from 0.92 to 0.96 for the duration of the study. The average mean value was 0.95 suggesting the increase of collaborative research in Virtual Library.

Table 10: Time Series Analysis

Year	Records(Y)	X	X ²	XY
2017	322	-2	4	-644
2018	340	-1	1	-340
2019	423	0	0	0
2020	531	1	1	531
2021	656	2	4	1312
	2272		10	859

The calculated value of Time Series Analysis output of Virtual Library for the year 2031 is 1313.4 and research output for the year 2036 is 1742.9. With the application of the formula, the Time series analysis calculated from the results for the year 2031 and 2036, it is found that the Future trend of growth of

research output in Virtual Library research may take increasing for upcoming years. The expectation from the calculations proved there is positive Growth in the research output of the Virtual Library research.

Straight line equation:

$$Yc = a + bX \text{ Since } \Sigma X = 0$$

$$a = \Sigma Y / N = 2272 / 5 = 454.4$$

$$b = \Sigma XY / \Sigma X^2 = 859 / 10 = 85.9$$

Estimated literature in 2031 is when $X = 2031 - 2021 = 10$

$$= 454.4 + (85.9 \times 10) = 1313.4$$

Estimated literature in 2036 is when $X = 2036 - 2021 = 15$

$$= 454.4 + (85.9 \times 15) = 1742.9$$

Findings and Conclusion

- The highest number of publications 656 articles with an average of 28.87 percentages in the year 2021. In this research gradually increased from 2017(322) to 2021(656).
- The distribution of publications by document type was found mostly in the form of articles with 1700(74.82%) publications during the study period.
- The top 10 distribution of articles by the country during 2017-2021 ranked USA at the top among all the countries with 480 (21.13%) publications.
- The authorship pattern indicated that the maximum number of papers was published by the collaborative work of above five authors 982 and the least number of papers published by a single author with 105 records.
- During 2017 to 2021 there was a tremendous and gradual increase in the publishing of ORL papers where multiple authors i.e., 2167 (95.37%) had contributed more than the single authors i.e., 105 (4.63%).
- The Collaborative Index was 4.29 in 2017 and increased to 4.63 in the year 2020. The overall CI indicates the increasing trend in collaborative publications.
- The Collaborative Co-efficient collaboration was 0.69 in 2017 and increased to 0.73 in the year 2021. The overall CC indicates the increasing trend in collaborative publications.
- There could be observed an increasing and decreasing trend in the relative growth rate and doubling time data. The mean relative growth rate for the period 2017-2021 was 0.99. The mean

doubling time was 0.73 for the period of 2017-2021.

- The normal Degree of Collaboration from 0.92 to 0.96. The average degree of collaboration rate is 0.95.

The value of time series analysis of deforestation for the year 2031 in 1313.4 articles and the year 2036 in 1742.9 articles.

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