

Top 100 cited papers in Information and Library science: A Brief Analysis

Faizul Nisha¹, Sunil Kumar², Shipra Awasthi³, Manorama Tripathi^{3,*}

¹DRDO-Defence Scientific Information & Documentation Centre, Delhi, INDIA.

²Planning and Development Division, Indira Gandhi National Open University, New Delhi, INDIA.

³Dr. B.R. Ambedkar Central Library, Jawaharlal Nehru University, New Delhi, INDIA.

ABSTRACT

High number of citations of research publications expresses its intellectual and cognitive impact. Papers with high citations are considered as a landmark in relevant research field as these express trends and emerging research areas as well as set future course of research. The objective of this study is to conduct bibliometric analysis of the top 100 most cited studies in the discipline of Information Science and Library Science. The data for the study was obtained from "Information Science and Library Science" category of Web of Science, as indexed in the last twenty-one years (2000-2021). The outcome of bibliometric analysis included progressive growth in citation over time, annual citation density, name of journal with its impact factor, which published these papers, year of publication, type of article i.e. articles, proceedings, book reviews, reviews and poetry etc; nature of access i.e. subscribed or open access, and country of origin. Number of citations of these papers as reported by Web of Science were cross checked with numbers of citations reported by Google Scholar to understand which one provided higher number of citations for the same paper. The number of citations in the top 100 cited papers ranged from 699 to 14,273. The large numbers of the top 100 cited papers were published in MIS Quarterly. There were 40 publications authored by two, while 13 other papers were authored by more than four authors. This research is valuable for scholars in the discipline of library science and information science in identifying highly cited papers in the last 21 years, frequently pursued research areas, and names of journals publishing high quality research work in library Science discipline. The study of frequently cited papers will also guide in designing of objectives and methodology of future research studies. Journals have been charging very high subscription fee. This study will also help librarian in identifying journals which are making valuable contributions in the discipline of Information and Library Science.

Keywords: Citation Analysis, Collaboration, High impact Journals, Keywords, Keyword Plus.

Correspondence

Manorama Tripathi

Dr. B.R. Ambedkar Central Library,
Jawaharlal Nehru University, New Delhi,
110067, INDIA.

Email id: manoramatripathi2@yahoo.
com

ORCID ID: 0000-0002-7206-2855

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INTRODUCTION

The researchers cite highly scholarly research works to convince audiences that their research work is built upon previously published authoritative work.^[1] The number of citations of a research paper is a measure of its merit and impact on future research studies. Bornmann and Daniel^[2] reviewed 30 studies on citing behaviour of researchers and concluded that the researchers cite to acknowledge the intellectual contributions of their peers. The analysis of citations has become standard benchmark to evaluate scientific endeavours, such analysis also helps in understanding trends in scholarly works in a particular area of study. The present paper aims to characterise the published literature in Information Science

Library Science to identify the most frequently cited papers in the last 21 years, the journals in which these papers were published and number of authors of these publications.

Review of Literature

Meyer and Spencer^[3] expressed importance of studying highly cited papers in LIS discipline as research works in LIS discipline are also cited in other disciplines like computer science, medicine, psychology. Ivanovic and Ho^[4] studied 501 highly cited articles published between 1956 and 2009 in 37 journals and found that MIS quarterly had published 26% of all the analysed highly cited articles. The researchers from USA had contributed 67% of all highly cited articles. Levitt and Thelwall^[5] analyzed 82 highly cited research papers in Information Science Library science indexed in Web of Science and concluded that there is a moderate correlation between citation ranking and period between year of publication and year of the highest number of citations.

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A review of highly cited articles in Social Sciences by Mahapatra and Sahoo,^[6] published during 2001–2010, unfolds those 371 articles emerged from 397 journals, contributed by 1,556 authors from 1,326 institutions located in 46 countries. *Social Science and Medicine* was the most productive journal; J. Urry of Lancaster University, UK, was the most efficient author; the USA, the UK and Canada are the pioneers in social science research. Google scholar has disclosed its most prominent papers of 2020 and found that papers in Artificial Intelligence (AI) area accumulated majority of citations (Crew, 2020).^[7] Research publications in Computer vision discipline gathered enormous citations immediately after its publication. Three out of the top five highly cited papers enumerated by Google Scholar were published in *Nature* Journal; these papers covered Artificial Intelligence (AI) area.

Asubiaro and Badonns^[8] have studied research articles published in journals and conference proceedings in the Library and Information science discipline from 54 African countries indexed in WOS between 2006 and 2015. The study noted that authors from North African countries have focused more on computer related aspects of LIS while researchers from other African countries have focused on social science related aspects of LIS. There were no papers on human and computer interaction and history of Library and Information science. Garg and Singh^[9] conducted bibliometric analysis of 699 papers published in Library and Information Science Research (LISR) during 1994–2020, the study highlighted that the maximum articles with high citations were published during the three-year block of 2015–2017. The typographical representation of output reflects that 51 countries produced the 699 papers. The highest contribution was made by authors from the USA. However, they had low values of CPP in comparison to papers from Norway and Finland. Among the institutions, Florida State University (USA) topped the list. However, the University of Illinois at Urbana-Champaign, USA had the highest value of CPP. During the period of study, 1,389 papers received 74,061 citations, of which only 41 (3 %) articles remained uncited.

Zhand *et al.*^[10] analysed 2140 highly cited papers in the field of Economics and Business, contributed by 4499 authors from 914 universities located in 64 countries and territories. The study concluded that there was positive correlation between authors' highly cited papers and *h*-index; between universities' highly cited papers and *h*-index and between countries' highly cited papers and *h*-index.

Analysis of highly cited papers from Taiwan pinpointed that papers published in low impact factor journals could not gain good numbers of citations. International collaboration was the primary factor accountable for the expansion of highly cited papers over the years. For international collaboration, The United States was the most preferred selection. In contrast,

for domestic collaboration, National Taiwan University was the most favoured choice of organizations. With a little exception, leading authors tended to be the corresponding authors (Chuang and Ho, 2015).^[11]

Objectives of the Study

The current study conducted quantitatively analysis of citation parameters of the highly cited 100 Library Science Information Science articles over the last 21 years i.e. from 2000 to 2020. The objectives of this study are:

1. To explore patterns of collaboration in the top 100 cited papers;
2. To identify journals frequently publishing high quality research work (highly cited research papers) in the Library Science and Information Science discipline.
3. To understand pattern of the citations of the top cited paper over the time
4. To identify prime research areas were covered by highly cited articles.

Null Hypothesis

1. There is no difference in numbers of citations in research publications published in paid subscription-based journals and journals with open access
2. There is no association in origin (country) of research work and its publication country.
3. There is no change in contributions (Numbers of research papers) of researchers from USA in the library science and information science discipline over a period of 21 years

METHODOLOGY

This study was based on secondary data; extracted from SSCI, which is an integral component of Web of Science (WoS), an online bibliographic and citation indexing service maintained and published by Clarivate Analytics. The data for the study was collected in May 2021. The WoS core collection indexes 41 different types of documents include articles, proceedings, book reviews, reviews and poetry. The Basic Search with “2000–2020” was keyed in for year published. In ‘more settings’, SSCI was selected. The query was run which returned 51,96,747 results. The results were further refined by Information Science Library science which returned 2,08,609 records. Later, the resulting list was sorted by the number of citations in descending order. Two researchers performed the paper selection and data extraction. Any disagreement on data extraction was resolved through discussion and consensus. The assessment stopped at the hundredth most cited paper. The following information was extracted for each paper: number of citations, title, authors

Table 1: Year-wise publication of top 100 cited papers.

year of publication	Total no papers	Average no of citation per paper	Subscription based access		Open Access	
			No of papers	Average no of citation per paper	No of papers	Average no of citation per paper
2000	08	1370.6	7	1467.0	1	696.0
2001	08	1771.9	6	1956.5	2	1218.0
2002	08	1210.6	8	1210.6		
2003	09	2912.2	8	3180.3	1	768.0
2004	12	1365.3	11	1402.9	1	952.0
2005	11	2405.7	10	2577.9	1	684.0
2006	13	934.6	10	993.0	3	740.0
2007	10	1972.7	8	1307.1	2	4635.0
2008	02	787.5	1	832.0	1	743.0
2009	05	1531.4	3	1447.7	2	1657.0
2010	05	1111.8	2	950.0	3	1219.7
2011	01	992.0	1	992.0		
2012	04	1500.3	3	1750.7	1	749.0
2013	01	705.0	1	705.0		
2015	01	1262.0			1	1262.0
2016	02	1039.5	2	1039.5		
Total	100	1615.9	81	1664.6	19	1408.1

(name, number, authorship position, and country), year of publication, title of the journals, study design, and thematic field. The hundred records were saved as MS-Excel file. Google Scholar was also searched for numbers of citations for 100 publications examined in this study.

The authors applied quantitative statistical techniques to enlighten descriptive and inferential analysis of the data. The descriptive analysis highlights frequency, mean, standard deviation, range of numbers of citations of highly cited papers. Similarly inferential analysis tests the null hypothesis with the help of independent samples T test and Chi-square test. These statistical tests meet the requirements of research objectives of the study. Data is adequate and selected statistical tests are robust for the data.

Analysis

The 100 publications had 7507 references in total, ranging from 2-190.

19 of the top 100 cited research papers were published in open access journals; thus, high quality research works in Information Science and Library Sciences Disciplines is still dominated by paid subscription-based journals.

Citations of Open Access Articles

81 research papers published in subscription fee-based access are with mean number of citations of 1664.6; while 19 research

Table 2: Open Access and numbers of citations.

Nature of Access	No of research papers	Average numbers of citation per paper	Std. Deviation numbers of citation per paper
Open Access	19	1408.1	1289.668
Subscribed access	81	1664.6	1951.034
Total	100	1615.9	1840.823

papers with open access had mean number of citations of 1408.05. It is observed that papers published in Journals with open access got lesser numbers of citations than papers published in paid subscription-based journals Table 1, 2.

The difference in number of citations of papers published in paid subscription-based journals and journals with open access was statistically examined with Independent Samples *t*-test.

The level of significance of the value of Levene's Test reflects that both the groups do not differ on variances in number of citations Table 3. The significance level of value of *t* test reflects that there was no difference in number of citations in research papers with open access and subscribed access. The null hypothesis is not rejected i.e. there is no difference in numbers of citations in research publications published in paid subscription-based journals and journals with open access

Table 3: Difference in Number of Citations of Open Access and Subscribed Access articles Independent Samples Test

	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	t	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
Equal variances assumed	.035	.853	-.545	98	.587	-256.6	470.913	-1191.1	677.9

Table 4: Type of Documents of top 100 cited publication in library science Information science discipline.

Type of publication	Number of Publications	Number of Citations	Average number of citations	Themes
Articles	67	110193	1644.7	<ul style="list-style-type: none"> ➤ Qualitative research-content analysis, Delphi method ➤ Types of errors, sample size, scale development ➤ Bibliometrics - G Index, vosviewer ➤ IS use, acceptance and research ➤ Technology acceptance and diffusion ➤ Business Analytics ➤ Performance evaluation and Text Classification ➤ Knowledge management ➤ Concept of emotion and its measurement ➤ E-Commerce ➤ Social Media-Blog, Twitter, folhsonomy ➤ E-government
Reviews	28	44123	1575.8	<ul style="list-style-type: none"> ➤ Information System ➤ Knowledge Management and sharing ➤ E-commerce- webmetrics, website usability and trust ➤ Information technology in supply chain integration, enhancing firms performance ➤ Information technology-use, acceptance, diffusion ➤ Different types of reviews
Articles(Proceeding papers)	3	4453	1484.3	<ul style="list-style-type: none"> ➤ Structured equation modelling ➤ E-government; adoption and acceptance of technology ➤ Mapping of biomedical text to meta thesaurus
Editorial Material	2	2820	1410.0	<ul style="list-style-type: none"> ➤ Importance of assimilating and synthesizing past published literature. ➤ Factors to use for determining sample size scope and nature of the topic and study, design and availability of shadowed data.

Type of Documents

Web of Science (WoS) citation index classifies documents into Articles, Reviews, Article (Proceeding paper), Editorial Material, Abstract, Bibliography, Book, Case Report, Correction, Clinical Trial, Art and Literature, Letters, meeting note etc. The 100 documents were published in the form of articles, proceeding papers, reviews and editorials. Out of 100 publications,67 publications were in the form of articles. The prime themes covered by these articles includes information systems, usage, adoption and diffusion of technology, e- commerce, and use of social media. On an average an article received 1644.7 citations. There were 28 reviews which received 44123 citations, 1575.8 per published review. These review publications covered topics of Information systems; knowledge management and sharing; e commerce;

use and adoption of technology and firms. There were three proceedings papers with 4453 citations; 1484.3 citations per publication. They covered topics of structural equation modelling; e- government; use and acceptance of technology and mapping of biomedical text to meta thesaurus. The editorial materials, two in number attracted 2820 citations, 1410 per editorial. The editorials focussed on the importance of published literature which becomes the foundation for future research; and the factors which must be considered while determining the sample size.

The analysis of numbers of citations when papers were classified on nature of publications reflects that research papers are the most cited document type followed by reviews and proceedings papers of Seminars/Conferences as shown in Table 4.

Cross comparison of number of citations reported by WoS and Google Scholar

The citations of the 100 articles were also collected from Google Scholar. It was found that there was a difference of over 5000 citations in 11 papers; 3000 to 5000 in 14 papers; 45 papers noted a difference of 1000 to 2000 citations. Google Scholar provides more citations as evident through Table 05. Web of Science on its web site states that it indexes journals with high scholarly values. Each journal has to clear rigorous evaluation criteria before getting indexed in the Web of Sciences. Once a journal is selected for indexing in Web of Science then all the back issues are indexed in the citation database. The analysis reflects that Google Scholars reports a higher number of citations in comparison to the number of citations reported by Web of Sciences Core.

Association in Number of Citations Reported by WoS-Core and WoS-All Database

The analysis of citations records reflects that numbers of citations in WoS-all database is always higher than as reported by WoS Core index. The ratio between Numbers of citations reported by WoS-all database to WoS-core range between 1 to 1.23 (mean of ratio is 1.02 with standard deviation .023). The descriptive statistics parameters of numbers of citations reported by WoS – all database and WoS Core reflects minor gaps in Wos-Core and WoS – all database that both the WoS-Core and WoS-all databases can be treated as reliable sources to know numbers of citations to individual papers. The value of binary association between numbers of citations as reported by WoS-Core and WoS -all databases is 1.0, thus both the indexes reported the same parameter.

Author Defined Keywords and Keyword Plus

There were 454 unique author defined keywords in 100 top cited papers in Information science library science in the last 21 years. There were 16 author keywords in two articles; one article had 13 author keywords, 71 publications had 2-11 author defined keywords; while 24 publications did not have any author keyword.

Table 5: Gaps in numbers of citations reported by Web of Science Core and Google scholar.

Gaps in numbers of citation reported by Google Scholar and WOS core database (No of citations by Google Scholar - No of citations by WOS)	No of research papers
Over 5000	11
3000 to 5000	14
2000 to 3000	24
1000 to 2000	45
1000 to 500	4
less than 500	2
Total	100

There were 14 research papers which had keyword “technology acceptance model”. It is the most frequently repeated author defined keyword. It is followed by author defined keyword “trust” appeared in seven papers. Information Technology and Technology Acceptance model appeared in four research papers. There are 10 keywords which appeared in three research papers. There were 36 keywords which appeared in two papers. There were 340 unique keywords which reflect once in research papers, Table 6.

Keyword – Plus

There were 5 research papers without Keyword – Plus. There were 386 keyword –Plus defined by WOS in rest of 95 research publications. There were 14 research papers having keyword Plus “User Acceptance”. It was the most frequently repeated keyword-plus. It was followed by Keyword Plus “Information-Technology” which appeared in 13 papers; “Technology” keyword plus appeared in 12 research papers. Adoption and Model keyword plus appeared in 11 research papers. Internet and Perceived Usefulness appeared in 10 research papers. “Performance” keyword plus appeared in 9 research papers. There were 273 unique keyword-plus which reflected in research papers only once.

Table 7 reflects average numbers of citation in research papers having specific keyword plus. In case a paper had more than one keyword plus than number of citations, in that papers were counted with each keyword plus while computing number of citations and mean number of citations for keyword plus.

Number of Research Papers with Popular Keyword Plus

The Table 8 reflects keyword Plus which appeared in five or more research papers in top 100 cited publications in the last 21 years in Information Science Library Science discipline.

Table 6: Author Keywords.

Author defined keyword	Frequency of keywords
Technology Acceptance Model	14
Trust	7
Information Technology	4
Adoption; Design Science; Information Quality; Innovation; Knowledge Management; Methodology; Perceived Usefulness; Satisfaction; Social Capital; Structural Equation Modeling; Tam	3
Acceptance; Competitive Advantage; Construct Validity; Consumer Behaviour; Design Artefact; Design Theory; E-Commerce; Ease Of Use; Electronic Commerce; Expectation-Confirmation Theory; Feedback Mechanisms; Firm Performance; Habit; Information Asymmetry; Information Processing; Information Systems Success; Nomological Network; Nomological Validity; Perceived Ease of Use; Playfulness; Resource-Based View; Self-Efficacy; Social Influence; System Quality; Technology Adoption; Technology Infrastructure; Theory Of Reasoned Action; Usage; User Satisfaction; Value; Knowledge Management; Theory Of Planned Behaviour; User Acceptance	2

Table 7: Keyword Plus.

Keyword Plus	No. of research papers	Mean numbers of citation per paper	Standard deviation in citations per paper	No of citations	
				Minimum	Maximum
User acceptance	14	1144.6	628.593	648	2903
Information-technology	13	992.6	562.436	647	2781
Technology	12	1958.	1114.361	749	4203
Adoption	11	1586.8	1032.566	658	3897
Model	11	1396.0	565.386	832	2609
Internet	10	1218.7	848.346	736	3469
Perceived usefulness	10	2287.2	3225.463	658	11271
Performance	9	1711.2	664.272	768	2781
Determinants	8	1108.5	633.957	705	2637
Information	8	1042.1	412.025	705	2003
Perceived ease	8	1159.6	497.533	648	2015
Usage	8	1827.0	1155.253	658	3897
Framework	7	976.7	221.169	705	1342
Knowledge	7	1203.6	465.246	699	1954
Management	7	1564.9	1238.022	705	4203
Systems	7	1375.7	778.117	647	1962
Acceptance	6	1869.7	1213.955	736	3897
Structural equation models	6	1427.3	848.594	705	2781
Trust	6	1150.8	530.518	749	2188
Behavior	5	1611.0	932.336	743	2637
Impact	5	1944.0	1352.004	743	3897
Online	5	870.2	113.559	749	1022
Planned behavior	5	1361.4	758.701	648	2505
Self-efficacy	5	1462.2	800.520	648	2505
Strategy	5	1491.4	421.143	1005	1954
Success	5	1690.4	1438.764	749	4203
Support	5	1644.6	1484.975	705	3498
Technology acceptance model	5	1549.8	889.919	846	2903

Volume (Number of) research publications which focused on applications of Internet and Information Technology was steady over a period of twenty-one years. Papers focusing on users acceptance, behaviour, utilization of services were more frequent in the beginning of 21st century (2000 to 2007) subsequently these areas got lesser attention and research during that period was dominated by applications of internet, ICT and technology in library.

Research papers with keyword Plus behaviour, Community, consumers, sustainable consumption, saturation, Business Intelligence, web, System, perspective, Multiple Processes and networking got high number of citations in recent years, thus research publications focused on ICT, Internet, Web, library automation, AI application in libraries got lot of attention in recent years.

Unique Journals Published top Cited Articles in Library Science Discipline

There were 20 unique journals which published top 100 most cited articles in Information science Library Science discipline in the last 21 years. Table 9 lists details of these 20 journals which published top cited articles.

Out of these 20 journals, MIS Quarterly has published maximum 34 papers, followed by Information Systems Research with 13 papers, Information and Management with 9 papers, Journal of The American Medical Informatics Association with 7 papers, and Journal of Computer-Mediated Communication with 6 papers. Three journals titled Journal of Management Information Systems, Journal of The American Society for Information Science And Technology and Qualitative Health

Table 8: Popular Keyword Plus.

Key Word Plus	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2015	2016	(blank)	Grand Total
User Acceptance	1	2	3	2	1	3	5	3	1									21
Information-Technology	2	2		2	1	3	3	1	1					1				16
Model	1		2	1	2	3		2	1				2					14
Adoption		1		1	2	3		3					1					11
Technology		1	3	1	2		2	1										10
Internet			2		1		2		1	1	1		1					9
Performance	1	1	1	3		1		1		1								9
Systems	1	1		3			1						2	1				9
Strategy	1	1	1	2	2		2											9
Determinants	1	1	2		2	1	1											8
Information	1			1		1	1		1	2	1							8
Perceived Usefulness	1		1	2	1	1	1	1										8
Usage	1			3	1	2		1										8
Framework	1		1	1	1		1							1		1		7
Management	2				2	1	2											7
Knowledge	1				1		1	2								1		6
Behaviour		1			1	1							1			1		5
Impact				2	1				1	1								5
Perceived Ease			2			1	1		1									5
Planned Behaviour	2					1		2										5
Success			2		1		1	1										5
Trust					1		2				1		1					5
Structural Equation Models		1		1	1		1			1								5

Research published 4 articles each. The average number of citations ranged from 699.0 to 2250.0.

Eight journals were published from UK, which published 21 papers among the 100 top cited publications with 1183 mean number of citations per paper, it was followed by USA having 7 journals which published 63 papers with 1880.3 mean number of citations, Table 10.

Contributions of Authors

A total of 256 authors contributed the 100 top most cited articles. The number of authors in 99 research papers ranged from one to seven. There was one article which had 10 authors Publications with two authors were the most frequent ($n=40$) in top 100 cited articles followed by paper authored by three authors. The cumulative contribution of papers with 2 or 3 authors was 71% of top 100 cited papers.

Table 11 reflects that papers with highest average number of citations are authored by four. Research papers with 5 or more authors have low number of citations similarly average numbers of citations of publications with three authors was lesser than citations of papers authored by two. It reflects that

more authors in research papers does not mean that the papers will have more quality or citations.

Very high standard deviation of number of citations when papers are classified by numbers of authors in Table 11 reflects that there are very few papers in each row (No of authors) with exceptionally very high numbers of citations; thus, average numbers of citations when papers are classified by numbers of authors is not a reliable parameter in understanding impact of numbers of authors on numbers of citations.

Country Wise Contribution

The first authors were from 14 countries in 100 top cited papers in Library Science and Information Science discipline. The first authors in 64 research papers were from USA followed by Canada with six research papers, Netherlands and Taiwan with five papers each; thus, top four countries contributed 80 out of 100 top cited research papers, Table 12.

The highest average number of citations was for research publications from Taiwan; however very high value of standard deviation of number of citations for papers originating from Taiwan reflects that one to two papers from Taiwan had

Table 9: Details of Journals published top cited article.

Title of Journal	No of papers	First issue was published in	No of issues in a calendar year	Total Numbers of citations in top cited 100 papers	Average number of citations per paper	Impact factor	Affiliated Country
MIS Quarterly	34	1977	4	64411	1894.4	5.430	USA
Information Systems Research	13	1990	4	16692	1284.0	5.207	USA
Information and Management	9	1963	8	10013	1112.6	7.555	Netherlands
Journal of The American Medical Informatics Association	7	1994	12	5551	793.0	4.497	United Kingdom
Journal of Computer-Mediated Communication	6	1994	4	12778	2129.7	5.59	USA
Journal of Management Information Systems	4	1984	4	8501	2125.3	3.949	United Kingdom
Journal of the American Society for Information Science and Technology	4	1950	12	5486	1371.5	2.687	USA
Qualitative Health Research	4	1991	12	16900	4225.0	3.277	USA
Journal Of Information Science	3	1979	6	2368	789.3	3.282	United Kingdom
Scientometrics	3	1978	12	4398	1466.0	3.238	Hungary
Government Information Quarterly	2	1984	4	1951	975.5	7.279	United Kingdom
Information Processing and Management	2	1963	4	2412	1206.0	6.222	United Kingdom
Journal of Strategic Information Systems	2	1991	4	1722	861.0	11.0222	Netherlands
Health Information And Libraries Journal	1	2001	4	2250	2250.0	2.154	United Kingdom
Information Society	1	1981	5	699	699.0	3.67	Germany
Information Systems Journal	1	1975	8	836	836.0	2.309	United Kingdom
International Journal of Geographical Information Science	1	1997	12	932	932.0	4.186	USA
International Journal of Information Management	1	1970	4	1262	1262.0	14.098	USA
Journal of The Association For Information Science And Technology	1	1950	12	975	975.0	3.366	United Kingdom
Social Science Information Sur Les Sciences Sociales	1	1962	4	1452	1452.0	0.714	France
Total	100			161589	1615.9		

Table 10: Countries with publishers of top cited journals.

Nation published journal	No of Journals	No of papers	Total Numbers of citations	Average number of citations per paper
UK	8	21	24844	1183.0
USA	7	63	118461	1880.3
Netherlands	2	11	11735	1066.8
French	1	1	1452	1452.0
Germany	1	1	699	699.0
Hungary	1	3	4398	1466.0
Total	20	100		

Table 11: Numbers of authors.

Number of authors	Number of publications	Average numbers of citations	Std. Deviation of average numbers of citations
1-author	16	1274.8	588.48
2-author	40	1749.4	2253.03
3-author	31	1331.2	717.94
4-author	07	3131.6	3674.44
5-author	02	742.0	19.80
6-author	02	762.5	94.05
7-author	01	769.0	
10-author	01	756.0	
Total	100	1581.0	

exceptionally very high number of citations result in very high value of mean numbers of citation per paper.

Countries of Origin of and Countries of Publication

50 out of 64 research papers contributed by researchers from USA were also published in USA; one out of six papers originated in Canada was published in USA. Similarly, two

out of five papers originated from Netherland were published in USA; and one out of five papers originated from Taiwan was published in USA. Hence, papers which originated from countries other than USA are lesser likely be published in USA as compare to papers originated from USA.

Table 12: Country wise contribution.

Country	No of research papers	No of Citations	Average numbers of citation per paper	Standard Deviation in numbers of citations
USA	64	105481	1648.1	1590.3
Canada	6	9145	1524.2	402.6
Netherlands	5	6625	1325.0	740.0
Taiwan	5	18255	3651.0	5939.8
South Korea	3	4613	1537.7	424.3
Australia	3	3027	1009.0	251.0
Spain	3	2215	738.3	4.2
UK	2	3021	1510.5	739.5
Switzerland	2	2151	1075.5	532.5
Singapore	2	2105	1052.5	635.5
Belgium	2	1808	904.0	243.2
Denmark	1	1104	1104.0	
Chile	1	1064	1064.0	
Finland	1	975	975.0	
Total		161589		

*in case of multi author papers with different nationalities, papers are counted once in country of first author

Table 13: Countries of first authors and countries of publication.

Country of the First Author	Country published papers			Total
	UK	Netherlands	USA	
USA	11	3	50	64
Canada	3	2	1	6
Netherlands	1	2	2	5
Taiwan	0	4	1	5
South Korea	1	1	1	3
Spain	1	1	1	3
Australia	0	0	3	3
Belgium	1	1	0	2
UK	0	0	2	2
Singapore	0	0	2	2
Switzerland	1	0	1	2
Chile	0	0	1	1
Finland	0	0	1	1
Denmark	0	0	1	1
	19	14	67	100

The contributions of authors from other than USA was very low in the range of one to three papers, therefore the Table 14 categorized papers by origin into two groups i.e. a) papers originated from USA and b) papers originated from rest of countries.

78.1 % of research papers originated from USA were published in journals published from USA; only 47.2 % of

Table 14: Origin of research papers in USA and other countries.

Country of origin	Country of publishing				Total
	USA		Other than USA		
	No	%	No	%	
USA	50	78.1	14	21.9	64
Other than USA	17	47.2	19	52.8	36
Total	67	67.0	33	33.0	100

Table 15: Association in country of origin and country of publication.

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	9.952 ^a	1	.002		
Continuity Correction ^b	8.603	1	.003		
Likelihood Ratio	9.799	1	.002		
Fisher's Exact Test				.002	.002
N of Valid Cases	100				

papers contributed by authors from other than USA were published in USA.

The association in country of origin of research and country of publishing was statistically examined with Chi square test, as shown in Table 15.

The level of significance of Chi-square test reflects that there was significant association in origin of research work and its publication. Research Papers which are originated from USA are more likely to be published in journals published from USA.

Table 16 reflects that there was no major difference in prime research areas in Information Sciences and Library Science discipline across different nations in the last 21 years. The prime research areas across the globe in Library Science and Information science discipline were Computer Science; Information Science and Library Science; Business and Economics”; 49 out of top 100 research papers covered these research areas.

There were 13 research papers covering research areas of “Computer Science; Information Science and Library Science” were contributed by USA, Canada, Taiwan, Netherlands, Spain, UK, Belgium and Finland, thus researchers across the globe worked in this research areas.

There were 13 research papers in “Information Science and Library Science; Business and Economics” research areas and all these papers were originated from USA.

Origin of Research and Year of Publication

In the initial years most of the top cited papers were authored by researchers from USA. 24 in top 100 cited paper in the last

Table 16: Country wise focus on research areas.

Origin of research	Research Areas									Total
	Communication; Information Science and Library Science	Computer Science; Geography; Physical Geography; Information Science and Library Science	Computer Science; Health Care Sciences and Services; Information Science and Library Science; Medical Informatics	Computer Science; Information Science and Library Science	Computer Science; Information Science and Library Science; Business and Economics	Information Science and Library Science	Information Science and Library Science; Business and Economics	Information Science and Library Science; Social Sciences - Other Topics	Information Science and Library Science; Social Sciences - Other Topics; Biomedical Social Sciences	
USA	5	0	6	5	30	3	13	0	2	64
Canada	0	1	0	1	3	1	0	0	0	6
Taiwan	0	0	0	1	3	0	0	0	1	5
Netherlands	0	0	1	1	3	0	0	0	0	5
Australia	0	0	0	0	3	0	0	0	0	3
South Korea	0	0	0	0	3	0	0	0	0	3
Spain	0	0	0	1	1	1	0	0	0	3
UK	0	0	0	1	1		0	0	0	2
Singapore	0	0	0	0	2	0	0	0	0	2
Belgium	0	0	0	2	0	0	0	0	0	2
Switzerland	1	0	0	0	0	0	0	1	0	2
Chili	1	0	0	0	0	0	0	0	0	1
Finland	0	0	0	1	0	0	0	0	0	1
Denmark	0	0	0	0	0	0	0	0	1	1
	7	1	7	13	49	5	13	1	4	100

21 years were published between 2000 to 2002. 21 of these research papers were authored by researchers from USA. In subsequent years universities and research institutions located outside USA also made significant contribution in producing high quality research papers for example in 2004, 6 out of 12 top cited research papers were authored by researcher other than USA similarly in 2005 only 6 out of top 11 papers were authored by researcher other than USA, Table 17.

The association in years of publication and contributions by researchers from USA was examined by Chi-square test, Table 18, 19.

The significance level of Chi-square test value reflects that there was no significant change in contributions (Numbers of research papers) of researchers from USA in the library science and information science discipline over a period of 21 years.

Year of Publication and Country of Publication

Publications are classified by country of publication and year of publication in the Table 17.

The Table 18 reflects that 67 out of 100 top cited research papers in Library Science Information Science in the last 21 years were published in USA, similarly 62.9 of publications between 2006-10 were published in USA. The Table 18 reflects that there was no change in volume of publications published in USA over the period of 21 years.

Main Research Areas

The major research areas covered in top cited research papers were Computer Science; Information Science and Library Science; Business and Economics; Information Science and Library Science; Business and Economics and Computer Science; Information Science and Library Science with 49%,13%,13% of papers respectively; however, the top three focused research areas could not attain highest number of citations per paper.

The highest mean numbers of citations per papers is in the research area "Information Science and Library Science; Social Sciences- Other Topics with Biomedical Social Sciences" however high standard deviation reflects that one of four

Table 17: Origin of research and year of publication.

Origin of research	Publication Year																Total
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2015	2016	
USA	8	7	6	6	6	6	8	8	1	2	3	1	2	0	0	0	64
Canada	0	0	1	1	2	0	1	0	0	0	0	0	0	0	1	0	6
Taiwan	0	0	0	0	2	2	0	0	1	0	0	0	0	0	0	0	5
Netherlands	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	5
Australia	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	0	3
South Korea	0	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	3
Spain	0	0	0	0	0	0	1	0	1	0	0	0	1	0	0	0	3
UK	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	2
Singapore	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	2
Belgium	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	2
Switzerland	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	2
Chili	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
Finland	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Denmark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
	8	8	8	9	12	11	13	10	2	5	5	1	4	1	1	2	100

Table 18: Association in years of publication and contributions by researchers from USA.

	Value	d _f	Asymp. Sig. (2-sided)
Pearson Chi-Square	.763 ^a	2	.683
Likelihood Ratio	.792	2	.673
Linear-by-Linear Association	.025	1	.874
N of Valid Cases	100		

a. 1 cell (16.7%) has expected count less than 5. The minimum expected count is 2.97.

Table 19: Year of publication and country of publication.

Year of publication	USA		out side of USA		Total
	No	%	No	%	
2000-05	38	67.9	18	32.1	56
2006-10	22	62.9	13	37.1	35
2011-2016	7	77.8	2	22.2	9
Total	67	67.0	33	33.0	100

papers have exceptionally very high numbers of citation making high value of mean numbers. It is followed by research paper in the area “Communication; Information Science and Library Science” with 1925.3 mean number of citation per paper, Table 20.

Research Areas Focused by the Top Journals

The Table 21 reflects that journals with high impact factor focus on publishing papers in specific research areas of library science discipline for example all the 34 top cited papers published in MIS quarterly are from ‘Computer Science; Information Science and Library Science; Business and Economics’

Table 20: Major Research Areas.

Research Areas	No of research papers	Mean number of citations	Std. Deviation
Computer Science; Information Science and Library Science; Business and Economics	49	1727.49	1637.052
Computer Science; Information Science and Library Science	13	1203.00	539.271
Information Science and Library Science; Business and Economics	13	1284.00	698.114
Communication; Information Science and Library Science	7	1925.29	1973.025
Computer Science; Health Care Sciences and Services; Information Science and Library Science; Medical Informatics	7	793.00	94.710
Information Science and Library Science	5	1259.80	582.424
Information Science and Library Science; Social Sciences - Other Topics; Biomedical Social Sciences	4	4225.00	6700.859
Computer Science; Geography; Physical Geography; Information Science and Library Science	1	932.00	
Information Science and Library Science; Social Sciences - Other Topics	1	1452.00	
Total	100	1615.89	1840.823

research area; all 13 papers published in Information Systems Research journal are from “Information Science and Library Science; Business and Economics” likewise other journals also prioritised publishing papers in specific research areas under Information Science and Library Science.

Table 21: Research Areas of Top Journals.

Title of Journal	Research areas									
	Computer Science; Information Science and Library Science; Business and Economics	Computer Science; Information Science and Library Science	Information Science and Library Science; Business and Economics	Communication; Information Science and Library Science	Computer Science; Health Care Sciences and Services; Information Science and Library Science; Medical Informatics	Information Science and Library Science	Information Science and Library Science; Social Sciences - Other Topics; Biomedical Social Sciences	Computer Science; Geography; Physical Geography; Information Science and Library Science	Information Science and Library Science; Social Sciences - Other Topics	total
Mis quarterly	34	0	0	0	0	0	0	0	0	34
Information systems research	0	0	13	0	0	0	0	0	0	13
Information and management	9	0	0	0	0	0	0	0	0	9
Journal of the american medical informatics association	0	0	0	0	7	0	0	0	0	7
Journal of computer-mediated communication	0	0	0	6	0	0	0	0	0	6
Journal of management information systems	4	0	0	0	0	0	0	0	0	4
Journal of the american society for information science and technology	0	4	0	0	0	0	0	0	0	4
Qualitative health research	0	0	0	0	0	0	4	0	0	4
Journal of information science	0	3	0	0	0	0	0	0	0	3
Scientometrics	0	3	0	0	0	0	0	0	0	3
Government information quarterly	0	0	0	0	0	2	0	0	0	2
Information processing and management	0	2	0	0	0	0	0	0	0	2
Journal of strategic information systems	2	0	0	0	0	0	0	0	0	2
Health information and libraries journal	0	0	0	0	0	1	0	0	0	1
Information society	0	0	0	1	0	0	0	0	0	1
Information systems journal	0	0	0	0	0	1	0	0	0	1
International journal of geographical information science	0	0	0	0	0	0	0	1	0	1
International journal of information management	0	0	0	0	0	1	0	0	0	1
Journal of the association for information science and technology	0	1	0	0	0	0	0	0	0	1
Social science information sur les sciences sociales	0	0	0	0	0	0	0	0	1	1
	49	13	13	7	7	5	4	1	1	100

CONCLUSION

The present study has explored the citation pattern of 100 most cited papers in Information Science Library Science over the last twenty-one years i.e. from 2000–2020. An asymmetric distribution of research output has been observed for countries. For instance, 04 most productive countries produced 80 per cent articles and only 20 per cent output was from 10 other countries. USA was the leading contributor in the field

of library and Information Science; however, the value of citation per paper for the USA was lower than Taiwan. MIS Quarterly published from USA published out maximum of 34 papers. This suggests that papers published in this journal have wider publicity and impact on future research.

Latest trends in research unveils that highly cited papers are on themes of quantitative research–content analysis/ Delphi Method/Types of errors, sample size, scale development/

Bibliometrics/G-Index/VoSViewer/Technology acceptance and diffusion/Knowledge Management/E-Commerce/Social Media-Blog, Twitter, Folksonomy/E-government occupied the top position. The other research areas get popularity in recent time are Information System/Knowledge Management and Sharing/E-Commerce-web metrics, website usability and trust/Information Technology in supply chain integration/IT use, acceptance, diffusion. The major research areas covered in top 100 cited papers over a period of 21 years are Computer Science/Information Science and Library Science, Business and Economics.

Collaborative research gained momentum and 2-authored research contributed maximum number of papers (40) but the highest numbers of average number of citations per paper was for paper contributed by 4-author papers.

About 80 % of top 100 cited research papers were published in paid subscription-based journal; very few are published in journals with open access hence libraries need to retain subscription of paid journals so that students can have access to high quality research in Information Science and Library Science discipline.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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