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Quantitative and Qualitative Methods applied in LIS research published in Annals of Library and Information Studies (ALIS): An Analysis

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Abstract: The study examined 296 research articles published in the Annals of Library and Information Studies (ALIS) during 2011 to 2020 to identify trends in Library and Information Science (LIS) research, focusing on the research methods used. The research finds Bibliometrics and Scientometrics emerged as the dominant areas of study. Bibliometrics and Surveys of various types were the most used research methods with Web of Knowledge and Scopus being the preferred data sources to ensure reliability for their findings. Questionnaires and Likert scales were frequently used for data collection, with purposive and random sampling as the primary selection methods. Statistical data analysis often involved frequency counts and simple percentage analysis, followed by descriptive and inferential statistics. MS Excel and SPSS were the preferred software/tools for data analysis. Citation analysis revealed that journals were the most cited sources, particularly Scientometrics and Annals of Library and Information Studies. The findings provide a comprehensive overview of the methodologies and trends within LIS research.

Keywords: Research Methods; Quantitative analysis; Qualitative analysis; Content analysis.

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Introduction:

Research Methods in Library and Information Science cover various techniques to understand information practices, user behaviour, library services, library operations and other relevant topics within this field. In LIS, researchers study and evaluate information systems and services, which helps understand how information is accessed, managed and utilized. The primary research method used both qualitative and quantitative approaches. Qualitative research method includes understanding the user needs, information-seeking behaviour and evaluation of the quality of library services. Quantitative research methods are used to measure, quantify, and analyse patterns in data related to information use, services or management, usage studies, technology adoption and impact, information retrieval studies, and bibliometric and citation analysis. Research methods in LIS are significant, allowing researchers to investigate diverse questions related to user experience, technology advancement, services effectiveness and the changing role of libraries and information professionals in the digital age. Application of right combinations of both qualitative and quantitative methods is paramount in LIS research so as to understand the effectiveness of libraries, their services and the user communities. The present study aims to explore research methods in LIS through Qualitative and Quantitative examination of research articles published in the *Annals of Library and Information Studies* (ALIS) Journal. Library and Information Science has evolved into a highly interdisciplinary, dynamic, and technology-driven scientific discipline that employs a diverse range of research methods and approaches. A systematic examination of the current status of LIS research and the identification of methodological patterns can provide insights for researchers, supporting more systematic choices in the selection and application of research methods.

Literature Review

Chu (2015) noted limited adoption of mixed methods and qualitative approaches. The study emphasized the need for increased focus on education and support for these less used methods within the LIS field. Zhang et al. (2016) explored the use of statistical approaches in six leading journals. Identifying emerging statistical techniques and their potential applications in LIS researcher can contribute to methodological advancement. Ullah & Ameen (2022) examined the application of statistical methods in LIS research in which it was revealed that articles in high-impact journals were more likely to use inferential statistics. These journals also emphasize on appropriate statistical techniques for ensuring the reliability of research findings. Togia & Malliari (2017) analysis indicated an increasing trend towards diverse research methods, including quantitative, qualitative and mixed methods, despite the continued dominance of quantitative approaches. The findings shows that empirical research constitutes majority of publications with a focus on topics such as information retrieval, information behavior and library services. Similarly, Fidel (2008) investigated the limited application of mixed-methods research in the LIS field. An analysis of 465 research articles revealed that only 5% explicitly employed mixed method research, indicating a need for increased awareness and understanding of the methodological approach among LIS researchers. Hider & Pymm (2008) in their empirical study on research methods in high-profile LIS journals used content analysis framework to categorize the different research strategies, data collection techniques, and analysis types. Still surveys are the dominant research techniques in LIS, although application of experimental methods has shown substantial growth in recently.

Methodology

Ten volumes of the journal *Annals of Library and Information Studies* (ALIS) published between 2011 and 2020 were collected from the journal website for a comprehensive study and analysis. The sample comprises 40 issues and 296

articles. Publications such as short communications and guest editorials were systematically excluded from the analysis. All articles were individually reviewed to extract methodological information. The data collection process focused on identifying key research trends, methods employed, and specific data collection techniques utilized by the authors, etc. The research focuses on both qualitative and quantitative aspects of the articles. Linear AI tools were used for qualitative research validation, cross-verifying the methodological categorization of research methods identified within the articles. Finally, MS Excel was utilised for data collection and analysis, enabling the researchers to perform descriptive statistics.

Research Objectives

The study primarily aims to make an analysis of the LIS research articles from ALIS to find out the following

- *Research trends*
- *Research methods employed*
- *Types of data sources*
- *Data collection techniques*
- *Sampling techniques*
- *Statistical analysis methods predominantly used*
- *Software and tools frequently used for data analysis*
- *Application of Bradford's Law in scattering pattern of citations*

Discussion and Analysis

Trends of Library and Information Science Research

The analysis of research article published during the 2011 to 2020 in the field of Library and Information Science (LIS) revealed several key trends that have shaped the research landscape. Predominant areas of focus are Bibliometric Analysis (which included publication analysis on ‘Rabindranath Tagore’, ‘S. R Ranganathan, Rice research, Global Nuclear Fuel and Organic Chemistry Research etc.), Scientomic Analysis (which included Mobile Computing, Solar

cell research, Global allergy research, Artificial Neural Network and Books Authored by Nobel Laureate Amartya Sen, etc.) followed by Electronic Resources Management (which included Access, Use and Usage etc.). The use and impact of ICT in Libraries reflect the increasing library services and resources. Knowledge organizations and Information retrieval have remained the essential topics, highlighting on effective acquisition and management. Research on academic libraries, institutional repositories and library consortia demonstrates a focus on improving library services and collaboration. The rise of Web 2.0 and social media has prompted research exploring the role of new technologies and platforms in information dissemination and user engagement. These research trends depict a holistic view of the current state of LIS research.

Table- 1 Trends of Library and Information Science Research

SL.No	**Trends of Research**	**No. of articles**	**%**	**Cumulative No. of articles**	**Cumulative percentage of articles**
1	Bibliometric Analysis	59	19.93	59	19.93
2	Scientometric Analysis	26	8.78	85	28.72
3	Electronic Resources	17	5.74	102	34.46
4	Use and Impact of ICT in Libraries	15	5.07	117	39.53
5	Knowledge Organization	15	5.07	132	44.59
6	Academic Library	13	4.39	145	48.99
7	Scholarly communication	12	4.05	157	53.04
8	Information Literacy	8	2.70	165	55.74
9	Information retrieval	8	2.70	173	58.45
10	Information seeking behavior	7	2.36	180	60.81
11	Information Resources	7	2.36	187	63.18
12	Library Consortia	6	2.03	193	65.20
13	Web 2.0	6	2.03	199	67.23

SL.No	Trends of Research	No. of articles	%	Cumulative No. of articles	Cumulative percentage of articles
14	Social Media	6	2.03	205	69.26
15	Webometric Analysis	5	1.69	210	70.95
16	Open Access	5	1.69	215	72.64
17	Metrics Study	4	1.35	219	73.99
18	Library Automation	4	1.35	223	75.34
19	Discovery Service	3	1.01	226	76.35
20	Ontology	3	1.01	229	77.36
21	Sentiment Analysis	3	1.01	232	78.38
22	Institutional Repository	3	1.01	235	79.39
23	Other	61	20.61	296	100.00

Dominant Research methods

Bibliometrics was the most dominant method used (89, 30.07%), followed by Survey (63, 21.28%) and Theoretical Approach (28, 9.46%). Other frequently used methods are Evaluation Study, Case Study, Content analysis, Literature Review, Conceptual Analysis, Comparative Analysis, Experimental method, Analytical Approach and Webometric Analysis.

The Bibliometrics method is used in various areas to help understand the structure and dynamics of research output. Authors carried out different approaches such as Publication Trends, Document Types, Geographical Distribution of Research, Authorship Patterns and Citation Impact, Core Journals of different disciplines, Application of Bradford's Law and Lotka's Law, etc. . Bibliometric indicators such as Citation Per Paper (CPP), Proportion of Papers Not Cited (PNC), Relative Citation Index (RCI), Activity Index (AI), h-index,p-index and Impact factor, etc.

Survey method is used in the study of users' behavior, their Information resources usage, Information seeking behaviour, Librarians' attitudes towards

monetary and non-monetary incentives, Job Stress and Job Satisfaction among academic Librarians, Cloud computing applications in university libraries, Service Quality Assessment in Academic Libraries, Library and information service research etc.

Table 2 Dominant Research methods in LIS

SL.No	Name of the dominant research Methods	Frequency	Percentage
1	Bibliometrics	89	30.07
2	Survey	63	21.28
3	Theoretical Approach	28	9.46
4	Mixed Method	25	8.45
5	Evaluation Study	19	6.42
6	Case Study	15	5.07
7	Content analysis	10	3.38
8	Literature Review	10	3.38
9	Conceptual Analysis	7	2.36
10	Comparative Analysis	6	2.03
11	Experimental method	6	2.03
12	Analytical Approach	5	1.69
13	Webometric Analysis	5	1.69
14	Other Methods	8	2.70
Total		**296**	**100.00**

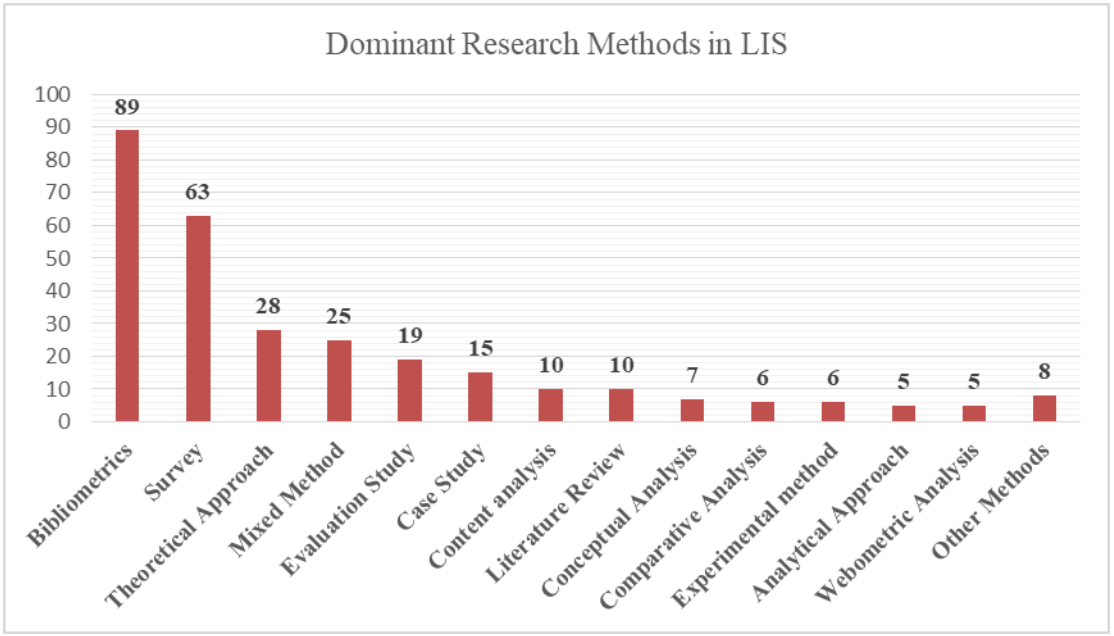

Figure-1 Dominant Research Methods

Data sources in LIS research

The LIS researchers employ diverse comprehensive data sources to ensure the reliability of their findings. A majority of LIS research used bibliographic databases, such as Web of Knowledge/Web of Science and Scopus which provide access to vast academic literature, offering reliable and high-quality bibliographic data for comprehensive literature reviews, citation analysis, Bibliometric and Scientometric analysis. To gather primary data, LIS researchers often utilize surveys, interviews, or questionnaires involving library professionals, students, undergraduate students, and research scholars, which help collect qualitative and quantitative insights.

Journal Citation Reports are employed for citation analysis and impact factor calculations, helping assess the influence and credibility of research. CAB Abstracts serves as a leading abstract information service, providing access to literature in agriculture and applied life sciences, which can be valuable for interdisciplinary LIS research. The Directory of Open Access Journals (DOAJ)

provides indexed access to high-quality, peer-reviewed, open-access journals, supporting research with easily accessible scholarly content. Other sources such as websites, theses, journal articles, and the Indian Science Abstracts contribute to expand the research base, providing diverse perspectives and in-depth coverage of the field. Collectively, these sources form a robust foundation for ensuring reliable and impactful research outcomes in ALIS research.

Figure-2 Data sources are employed by LIS researchers for data collection and analysis

Data collection techniques used in the articles

The data collection techniques primarily reflects the research methods employed by the authors. the questionnaire emerges as the most frequently used tool, indicating a preference for gathering quantitative data directly from participants. The Likert scale is used to measure attitudes or opinions, while nominal and ordinal scales are employed for classifying and ranking data. Checklist-based

technique for website content analysis and citation analysis are also predominant in bibliometric studies. Other notable data collection techniques include Ratio scales for precise measurements, Interviews for qualitative insights, Dichotomous scales for binary choices. Frequency scales capture repetitive behaviours or occurrences, while observational methods provide firsthand insights into subjects' actions. Additionally, SERVQUAL, a tool for assessing service quality, is occasionally used to gauge perceptions and expectations in the context of library and information science. These diverse techniques highlight the range of quantitative and qualitative approaches used by researchers in LIS research.

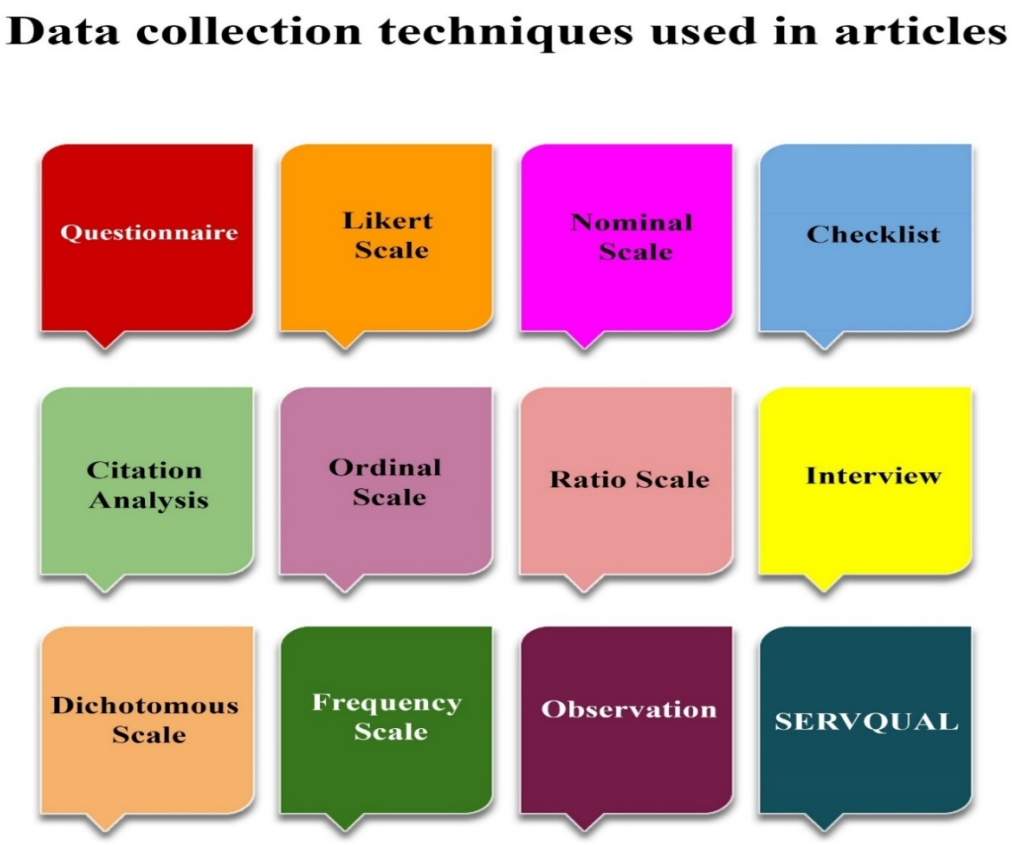

Figure-3 Data collection techniques used in the articles

Sampling Techniques used in LIS research

This study showcased a range of sampling methods utilized based on the research subjects. Purposive Sampling was the predominant, where researchers selected individuals according to specific criteria relevant to the research objective. Random Sampling was often used, ensuring that all members of the population had an equal chance of being included in the sample. Stratified Random Sampling was also employed, involving the division of the population into groups and then drawing independent random samples from each group. Other methods are Convenience sampling, Census Sampling, Voluntary Response Sampling, Systematic Random Sampling, Systematic Sampling and Population Sampling. These sampling methods helped structure research across multiple studies in the ALIS journal.

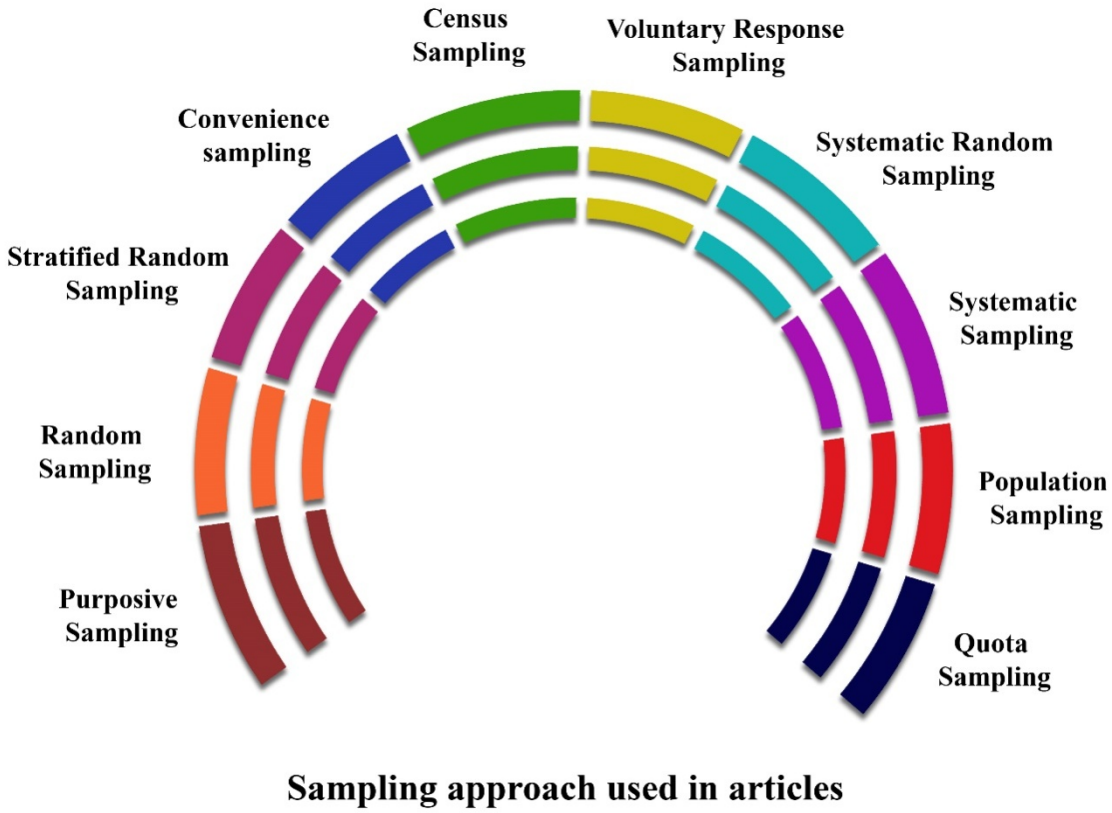

Figure-4 Sampling approach used in research articles in LIS

Statistical analysis methods used in the articles

Statistical data analysis from 296 articles revealed that a significant portion (n=194, 66%) of these articles employed statistical methods to report their findings. Frequency counts and Percentage (56.70%) was the most common approach in many studies used for summarisation of data. A combination of Descriptive and Inferential Statistics (11.34%) methods shows that researchers often used descriptive statistics to summarize data and inferential statistics to conclude the data. Some studies specifically used inferential statistics Inferential Statistics (10.31%) such as t-tests or chi-square tests to generalize sample data

to a larger population. Descriptive Statistics (Mean, Median, Mode: 7.73%) method was used to report central tendencies in the data. This distribution strongly reflects descriptive statistics and using inferential statistics for deeper analysis.

Table-3 Statistical Method used in LIS research articles

SL.No	**Statistical analysis methods used in the articles**	**Frequency**	**Percentage**
1	Frequency and Percentage	110	56.70
2	Both Descriptive and Inferential Statistics	22	11.34
3	Inferential Statistics	20	10.31
4	Descriptive Statistics	15	7.73
5	Frequency	14	7.22
6	Frequency, Percentage and Average	13	6.70
Total		**194**	**100.00**

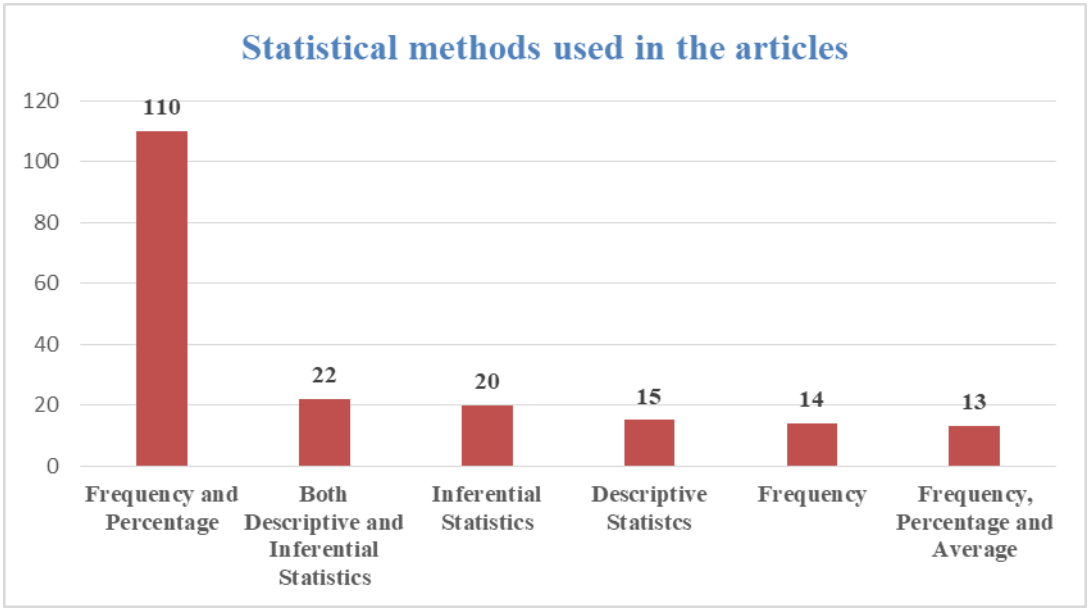

Figure-5 Statistical analysis methods used in the articles

Software and tools used for data analysis in LIS research

The selection of software and tools depend on the specific needs of research for collection, organization, analysis, and visualization of data. Several software/tools are popular among LIS researchers for data collection and analysis. MS-Excel is often favoured for its simple features of data entry, organize, and statistical analysis. It supports functions pivot tables, data visualization, descriptive statistics and more. SPSS is another widely used statistical software package is powerful and versatile. It is applicable to a wide range of statistical analyses, including descriptive statistics, inferential statistics, correlation analysis, regression analysis, and hypothesis testing.BibExcel: It can be used to import, export and analyze bibliographic data. R software is an open source statistical programming language highly flexible and can be used for various data analysis tasks. It has a large community of users and a wide range of packages. Several packages are available in the R software ecosystem for conducting bibliometric analysis using R Studio. The most widely used

packages for bibliometric analysis include Bibliometrix, BibliometrixData, biblioshiny. Popular software/tools such as VOSViewer, Fox Pro, UCINET, HistCite, Pajek and SurveyMonkey assist researchers in collecting, visualizing and analyzing data. Further, it has been noticed that some of the studies do not explicitly mention the software or tool used in their research paper.

Figure-6 Software and tools are used for data analysis in research articles

Bibliographical distribution of References

This study focused on major bibliographical forms such as books, book chapters, conferences, journals, other resources, and web resources. The analysis assessed the total distribution of citations and their distribution over year. The result shows that most of the reference come from journals (63.74%), followed by web resources (15.33%), books (9.80%), proceedings (4.61%), other resources (2.42%), and book chapters (2.42%). Other resources include

theses, reports, standards, etc. Therefore, journal citations have been crucial in scholarly articles published in ALIS.

Table-4 Bibliographical distribution of citations

Year	Books	Book Chapter	Proceedings	Journals	Other resources	Web resources	Total
2020	54	20	33	584	24	75	790
2019	45	14	15	264	15	80	433
2018	23	14	58	624	26	130	875
2017	45	18	25	375	20	111	594
2016	36	20	31	341	43	98	569
2015	133	14	15	349	22	116	649
2014	64	10	53	549	29	97	802
2013	108	22	33	541	32	85	821
2012	45	12	24	237	27	120	465
2011	115	21	27	481	42	133	819
Total	**668**	**165**	**314**	**4345**	**280**	**1045**	**6817**

Descriptive Statistics: Bibliographical distribution of citations

The below mentioned table summarizes various descriptive statistics for six types of resources: Bibliographical distribution of citations book, book chapter, proceedings, journal, other resources, and web resources. For each category, metrics like the mean, median, mode standard deviation and more are calculated. This analysis helps understand the general distribution and spread of the data for each resource type.

Journals: (Mean 434.5, Standard Deviation 138.46) Journals have a high mean, indicating that they are used more frequently than other resources. However, the large standard deviation suggests significant variability in their usage. Web resources: (Mean 104.5, Standard Deviation 20.62) Web resources have a high mean with moderate variability. Books (Mean 66.8, Standard Deviation 37.81)

The average value for book usage is 66.8, with a substantial deviation 37.81, suggesting variability in the data. Proceedings (Mean 31.4, Standard Deviation 14.27) There is moderate variation in the use of proceeding. Other resources (Mean 28, Standard Deviation 8.99) Moderate mean and a reasonable spread. Book chapters (Mean 16.5, standard deviation 4.20) The average usage of book chapters is lower, with less variability than books.

Table-5 Descriptive Statistics: Bibliographical distribution of citations

	Book	**Book Chapter**	**Proceedings**	**Journal**	**Other resources**	**Web resources**
Mean	66.8	16.5	31.4	434.5	28	104.5
Standard Error	11.95715	1.327068616	4.512205669	43.78539838	2.844097201	6.520480555
Median	49.5	16	29	428	26.5	104.5
Mode	45	14	33	-	-	-
Standard Deviation	37.81181	4.196559437	14.26884719	138.4615871	8.993825042	20.61956999
Sample Variance	1429.733	17.61111111	203.6	19171.61111	80.88888889	425.1666667
Kurtosis	-0.84048	-1.56485358	0.23115082	-1.605847627	-0.218920086	-1.409284444
Skewness	0.836472	-0.124031302	0.924247773	-0.07101645	0.608246993	-0.051330288
Range	110	12	43	387	28	58
Minimum	23	10	15	237	15	75
Maximum	133	22	58	624	43	133
Sum	668	165	314	4345	280	1045
Count	10	10	10	10	10	10
Largest(1)	133	22	58	624	43	133
Smallest(1)	23	10	15	237	15	75
Confidence Level(95.0%)	27.04894	3.002037775	10.20731837	99.04945257	6.433794855	14.75035179

A total of 1212 journals were cited a total of 4345 times. Table 6 shows that Scientometrics is the most cited source journal with a remarkable 317 citations, followed by Annals of Library and Information Studies (200 citations), Journal of the American Society for Information Science and Technology (111 citations), Annals of Library Science and Documentation (101 citations), DESIDOC Journal of Library & Information Technology (87 citations), Journal of Documentation (87 citations), The Electronic Library (76 citations), Journal of Information Science (56 citations), SRELS Journal of Information Management (55 citations), and College & Research Libraries (51 citations).The other front ranking journals which have been cited for more than 40 times include Library Philosophy and Practice, Current Science, IASLIC Bulletin, Malaysian Journal of Library and Information Science, Information Processing & Management, Journal of the American Society for Information Science, and The Journal of Academic Librarianship

The distribution of journals according to the Bradford's predicted zones1: n:n^2 (on an approximation) are:

Zone-1: 17 core journals (1465 citations)

Zone-2: Next 134 journals (1448 citations)

Zone-3: Next 1061 journals (1432 citations)

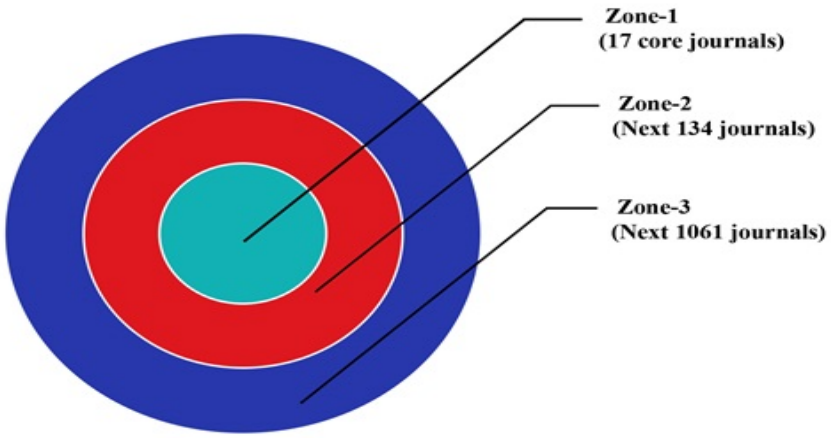

Figure-7 Bradford's distribution

Table-6 Core Journals referred in the Annals of Library and Information Studies

SL.No	Name of the Journal referred	No. of Citations	Cumulative citations	SJR h-index	Quartiles
1	Scientometrics	317	317	144	Q1
2	Annals of Library and Information Studies	200	517	17	Q3
3	Journal of the American Society for Information Science and Technology *Journals rename*	111	628	165	Q1

SL.No	Name of the Journal referred	No. of Citations	Cumulative citations	SJR h-index	Quartiles
	as: Journal of the Association for Information Science and Technology				
4	Annals of Library Science and Documentation *Journal rename as Annals of Library and Information Studies*	101	729	17	Q3
5	DESIDOC Journal of Library & Information Technology	87	816	19	Q3
6	Journal of Documentation	87	903	72	Q1
7	The Electronic Library	76	979	47	Q2
8	Journal of Information Science	56	1035	77	Q1
9	SRELS Journal of Information Management	55	1090	NA	NA
10	College &	51	1141	59	Q1

SL.No	Name of the Journal referred	No. of Citations	Cumulative citations	SJR h-index	Quartiles
	Research Libraries				
11	Library Philosophy and Practice	50	1191	27	Q3
12	Current Science	49	1240	137	Q2
13	IASLIC Bulletin	48	1288	NA	NA
14	Malaysian Journal of Library and Information Science	47	1335	29	Q2
15	Information Processing & Management	44	1379	123	Q1
16	Journal of the American Society for Information Science *Journals rename as: Journal of the Association for Information Science and Technology*	44	1423	165	Q1
17	The Journal of Academic Librarianship	42	1465	67	Q1

Summary Findings

- Bibliometric Analysis, Scientometric Analysis, and Electronic Resources Management (acquisition, access and management) are emerging research areas in LIS, as reflected in the publications of ALIS.
- Bibliometrics, Survey and Theoretical approaches are the most dominant research methods as presented in publications of the ALIS.
- Web of Knowledge/Web of Science and Scopus are the preferred data sources used by LIS researchers for data collection and analysis to ensure the reliability of their findings as published in ALIS.
- Questionnaires and Likert scales are frequently used data collection techniques in research articles published in ALIS.
- Purposive and Random Sampling are frequently used sampling techniques in LIS research published in ALIS.
- Statistical data analysis in research articles published in ALIS often involves frequency and percentage analysis, followed by descriptive and inferential statistics.
- MS Excel and SPSS were the preferred software/tools for data analysis in research articles published in the ALIS.
- The analysis reveals that journals are the primary source of references accounting for most citations (63.74%, mean 434.5, standard deviation 138.46). Journals have a high average, suggesting their frequent use compared to other resources. Web resources (15.33%), books (9.80%), proceedings (4.61%), other resources (2.42%), and book chapters (2.42%) follow.
- Citation analysis confirms the prominence of journals, particularly Scientometrics and Annals of Library and Information Studies, emphasizing the significance of journal literature in LIS research.

Conclusion:

The study concluded that significant progress has been made in LIS research, but some areas require further attention. It has been observed that a few researchers did not specify the software/tools used for data analysis. Further, there was limited use of statistical applications in many research papers, suggesting the need for greater emphasis on statistical literacy and application among LIS researchers. To address this, LIS schools need to incorporate diverse research methods and applications of descriptive and inferential statistics into their curriculum to support future research endeavors. Moreover, LIS Schools should focus on practical training in data analysis software like MS Excel, R, SPSS, and many more, which are crucial for empowering researchers with the necessary skills to conduct comprehensive analyses. Such initiatives will help improve the quality and reliability of LIS research.

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