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Uncovering Trends and Impact: A Bibliometric Analysis of Open Access Social Science Journals in Scopus (2012-2022)

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This study conducted a comprehensive analysis of research trends and collaboration dynamics of Open Access Social Science Journals indexed in Scopus from 2012 to 2022. It examined 627 documents from 167 sources, with an annual growth rate of 18.52%. Collaborative research was prevalent, with 1440 contributors, including 89 solo authors. International collaboration was found in 25.84% of documents. Bradford's Law categorized journals into three zones, with just four journals in Zone-I contributing 36.52% of all documents, indicating the influence of specialized journals. Authorship varied, with Thelwall M. being the most prolific author. Lokta's Law revealed a skew in authorship, with most authors contributing only one article, Lotka's inverse square law does not confirm to the present data set. Keyword analysis highlighted themes like "bibliometrics", "Human", and "Citation Analysis," reflecting interest in research dissemination. Treemap analysis visually represented keyword distribution. Collaboration network analysis identified 9 clusters of countries with strong collaborative ties, with the USA, Germany, and China leading. These countries played pivotal roles in international research collaborations. In conclusion, this research offers valuable insights into academic research, emphasizing keyword importance, concentration in specialized journals, varying author productivity, and the central role of specific countries in global knowledge exchange. These findings are relevant for researchers, policymakers, and institutions navigating the evolving academic research landscape.

Keywords: Open Access Journals, Bibliometric Analysis, Scopus Database, Bradford's Law, Lokta's Law, Kolmogorov–Smirnov (K-S) test

1. Introduction

The advent of open access publishing has transformed the dissemination of scholarly information, enabling unrestricted access to research outputs. In parallel, bibliometrics and citation analysis have emerged as powerful tools to assess the impact, trends, and influence of scholarly publications. bibliometrics can be think of as a new tool for editors and editorial boards to identify trends and caveats regarding topic coverage, authorship dynamics, citation impact, collaboration networks, evolution of themes of interest, and visibility and recognition of their journals[1]. Scopus, a prominent citation database, encompasses a vast array of research across disciplines, including social sciences. This paper focuses on the bibliometric analysis of open access social science journals listed in Scopus. Scopus is a comprehensive abstract and citation database containing a vast collection of peer-reviewed literature from various disciplines.

Bibliometrics has been used as a major tool to study progress and development of different academic disciplines / fields in the world, including library and information science (LIS)[2]. Bibliometrics is a quantitative approach to analyzing and evaluating scholarly publications using various indicators like citations, h-index, impact factor, etc. Citation analysis involves studying the pattern of citations among publications to understand their influence and popularity within a given field. Open access journals provide free and unrestricted access to research articles. They have gained prominence in academia for their potential to increase the dissemination and accessibility of scholarly knowledge.

Bradford's law was originally proposed by British librarian Samuel C. Bradford (1934), according to Tsay & Li[3], The most prominent model for the distribution of bibliographic items is the Bradford distribution, which addresses the way that subject literature is distributed among certain journals. Bradford's law of scattering describes a quantitative relationship between journals and the papers they publish[4].

Lotka's Law, also known as Lotka's Law of Scientific Productivity, is a bibliometric principle that

describes the distribution of author productivity in scholarly fields, particularly in scientific and academic research. This law is named after Alfred J. Lotka, an American mathematician and statistician who formulated it in the early 20th century. The law provided a fundamental theoretical base for bibliometric studies involving authorship[5]. The key idea behind Lotka's Law is that a small percentage of authors (or researchers) in a given field will be highly productive, while the majority of authors will be less productive. It is a statistical law that helps us understand the pattern of authorship in academic and scientific publications.

The Kolmogorov-Smirnov (K-S) test is a statistical method that is utilized for the evaluation of the adequacy of a sample distribution to a designated theoretical distribution. The K-S test is classified as a non-parametric test, thereby signifying that it does not make any assumptions regarding the specific distribution of the data. Its purpose is to ascertain whether a sample is derived from a population that exhibits a particular distribution, such as normal, exponential, or uniform. Additionally, it aids in the determination of whether two samples are derived from the same distribution.

The study anticipates providing insights into the publication trends, collaboration dynamics, and citation impact of articles within the field of Library and Information Science. By focusing on open access social science journals, the research aims to shed light on the dissemination and influence of research within an accessible and open scholarly ecosystem. The findings of this study will be valuable for researchers, practitioners, and policymakers seeking to comprehend the scholarly landscape of Library and Information Science and the impact of open access publishing within the broader context of social science research.

2. Review of Literature

Bibliometrics and citation analysis are widely used methodologies to assess the scholarly impact and visibility of research publications. In this literature review, we will explore the existing research related to bibliometrics and citation analysis, specifically focused on open access journals listed in Scopus.

2.1 (Sharma & K.S., 2018)[6] This article examines the ten most cited papers in Indian Library and Information Science (LIS) research using the Web of Science database. Its objectives include understanding these influential papers, suggesting future research directions, and exploring citation manipulation. The article emphasizes the use of citation counts to measure research impact and considers percentiles for normalization. It notes the trend of focusing on exceptional papers in bibliometric studies and methods to identify them. The Web of Science database's comprehensive citation tracking is highlighted. Among the top ten cited LIS publications in India, Sengupta's review, "Bibliometrics, Informetrics, Scientometrics and Librametrics – An Overview", has the highest citation count. Mukerjee, B. is a notable author with three works in the top ten. The study proposes further analysis of Indian LIS researchers' proficiency, comparing cited papers using databases like Scopus, and exploring social media's impact on paper visibility through altmetrics. It also suggests evaluating India's SWAYAM MOOC system for potential improvements.

2.2. (Mohanty, 2018)[7] This research examined the growth of research publications in India's Library and Information Science (LIS) field from 2010 to 2014 using Scopus data. It investigated various aspects, including annual publication growth, preferred journals, key research areas, and productive institutions. The study aimed to identify prolific authors, top journals, and preferred research topics. It also assessed authorship trends, collaboration levels, and institutional research output rankings. Journal articles were the most common research output, followed by reviews, conference papers, and book chapters. The study provided insights into India's contributions to LIS research using Scopus. Two Indian journals, "Annals of Library Information Studies" and "DESIDOC Journal of Library Information Technology", were indexed in Scopus during this period, with the former having the highest number of entries. Collaboration among Indian LIS professionals was robust. The Emerald group emerged as the primary publisher of international LIS journals in Scopus. However, individual author research output was limited. The absence of Indian LIS journals in Scopus suggests a need for further investigation, with efforts required to boost visibility and quality of Indian LIS research. Enhanced research collaboration and a detailed examination of author productivity patterns are recommended, along with evaluating the

accessibility and availability of Indian LIS research across platforms. Future research could explore the global impact of Indian LIS research.

2.3. (Farooq, 2023)[8] The study employed bibliometric analysis to explore the relationship between knowledge management and performance across a span of 33 years (1988-2021). Out of 1,583 publications identified in this domain, 40 were excluded during the screening process. The research showcased how the understanding of knowledge management's impact on performance has evolved over time, influencing firms' competitive advantage. The analysis delved into theoretical frameworks like resource based view, knowledge based view, and social exchange theory, highlighting knowledge management's role in gaining competitive edge. It also noted the fragmented nature of past research due to measurement issues, advocating for more comprehensive bibliometric analysis. While the study had limitations like excluding certain databases and relying on specific keywords, it revealed a rising interest in knowledge management and performance from 2000 onwards. Prominent themes, authors, and documents were identified, and collaborations between countries were mapped. Recommendations included expanding data sources, employing additional keywords, and incorporating conference proceedings and editorials for a more thorough analysis.

2.4. (Prieto-Guti´errez & Segado-Boj, 2019)[9] The article discusses the significant growth in the field of Library and Information Science (LIS) over the past decade, with a notable increase in Scopus coverage. It highlights the importance of bibliometric analysis in understanding trends within LIS, whether at the national, individual, or institutional level. The article specifically conducts a detailed bibliometric analysis of research published in the Annals of Library and Information Studies (ALIS) from 2011 to 2017, comparing it to trends in other global LIS journals. The analysis explores authorship patterns, research themes, and performance metrics like citations. It underscores ALIS's alignment with leading LIS journals worldwide, particularly in areas related to metrics, bibliometrics, and social networking. However, the study reveals that collaboration among Asia based journals, including ALIS, lags behind top ranked LIS journals, indicating limited international engagement. The distribution of LIS research remains concentrated in Europe and North America, but Asia is gaining prominence. ALIS primarily caters to local interests, featuring predominantly domestic authors. The study suggests a roadmap for expanding research in the LIS field, emphasizing the need for increased collaboration and internationalization. The insights from this study are valuable for evaluating ALIS's research capabilities in the future, and the methodology can be broadly applied to analyze other journals and scientific domains to identify trends and future developments

3. Objectives

- To Analyze Research Trends
- To Apply Bradford's Law of Scattering
- To Assess Collaborative Behavior of authors
- To Understand Authorship Patterns using Lotka Law
- To confirm Lotka's law using Kolmogorov – Smirnov (K-S) test.
- To identify frequently used keywords
- To Investigate Keyword distribution
- To Assess Collaborative Behavior of Countries

4. Methodology

The research methodology involves a systematic approach using the Scopus database as the primary data source. The selection criteria are meticulously defined, including limitations to subject area (Library and Information Science), document type (Article), publication year (2012-2022), language (English), and keywords related to "Bibliometric and Citation Analysis." The study focuses exclusively on documents published in open access social science journals, ensuring the investigation aligns with the accessible and open nature of scholarly research. This rigorous filtering process resulted in a refined dataset of 627 articles out of 978252 articles. The data set is exported into CSV file for further investigation. The final data set analyzed using biblioshiny app of the bibliometrix package in the R software[10].

5. Analysis

5.1. To Analyze Research Trends

The analysis reveals key findings about research between 2012 and 2022 within specific criteria. Figure-1, shows 627 documents from 167 sources, with an annual growth rate of 18.52%. The study identified 1440 contributors, 89 of whom were solo authors. International collaboration is evident in

25.84% of documents. On average, each document involves 2.98 authors, suggesting interdisciplinary cooperation. There are 1624 distinct author keywords, highlighting diverse research themes. A substantial 25428 references indicate thorough engagement with existing knowledge. Each document receives around 27.85 citations, reflecting its impact, even after an average of 4.66 years. The significant volume of documents, global collaboration, and high citations demonstrate strong contributor interest. Open access journals play a role in the broader recognition of research. This analysis underscores the vibrant, collaborative, and impactful nature of research in this domain.

5.2. To Apply Bradford's Law of Scattering

In figure-2, Bradford's Law describes how scientific journals are distributed by subject. If journals are grouped with equal article counts per subject, the number of journals in each group increases geometrically. This law categorizes journals into zones based on their focus and output. There are three zones: Zone I has a few specialized journals (here, 04), Zone II has slightly broader journals (16), and Zone III includes general ones (147). Bradford's Law emphasizes that Zone I, the core of specialized journals, is most productive in publishing articles. In the research area, Zone I is 04 journals contribute around 36.52% of all documents. This highlights how a small set of specialized journals holds a significant portion of subject-specific literature. The distribution of documents and journals according to Bradford's predicted zones are as follows:

Zone I: 04 journals, 229 articles
Zone II: 16 journals, 195 articles
Zone III: 147 journals, 203 articles

The concentration of articles in Zone I confirms Bradford's observation that a handful of journals often dominate research output in a specific subject.

Figure 01

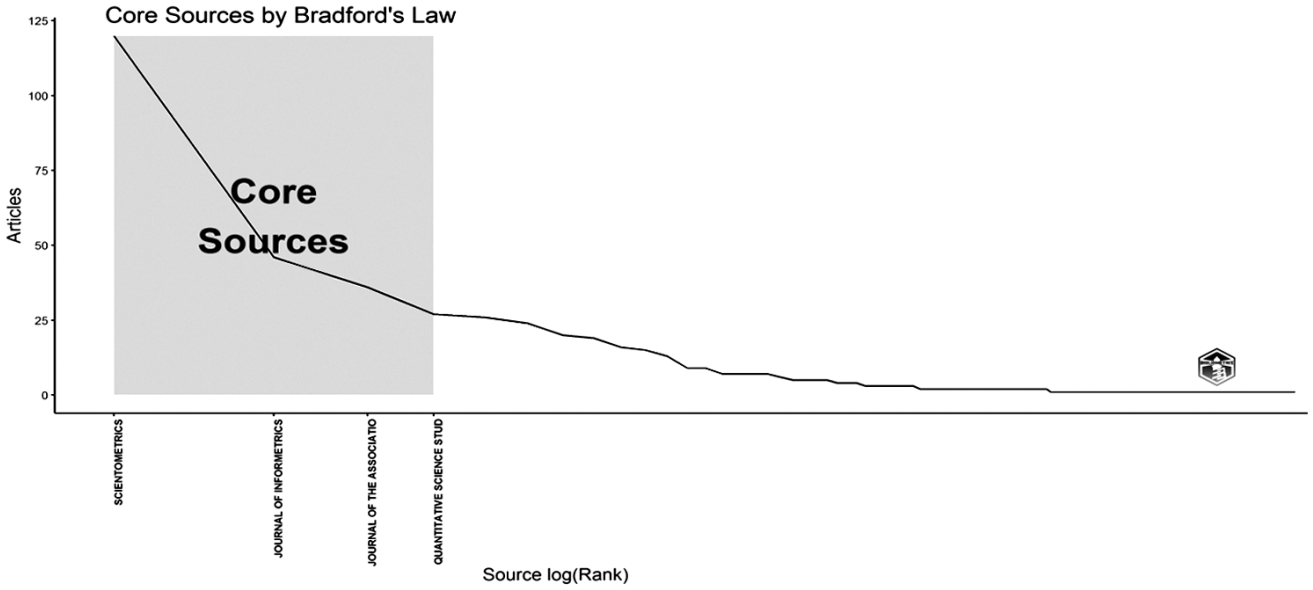

Figure 02

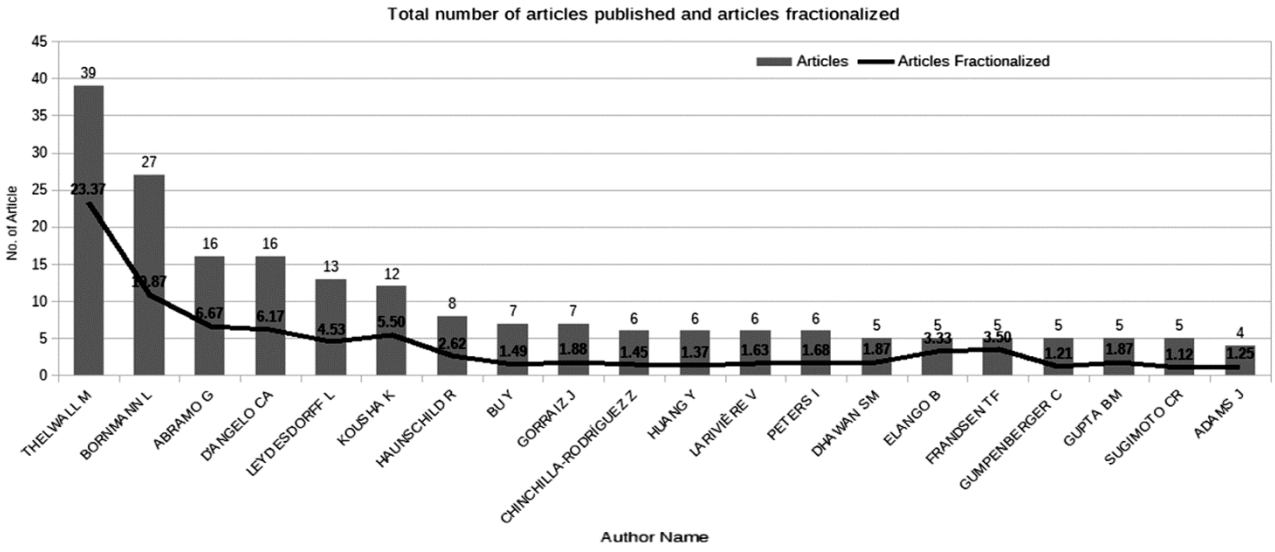

Figure 03

This pattern helps researchers by directing them to specialized journals in Zone I, which form the core of subject-related knowledge.

5.3. To Assess Collaborative Behavior of authors

Author contribution evaluation in figure-03 shows that in bibliometric analysis entails assessing an author's involvement using article count and "articles fractionalized." This concept quantifies varying levels of input authors provide to collaborative scholarly works. Fractional authorship acknowledges that in multiauthor publications, contributions aren't uniform; some authors might influence specific aspects. The wall M. led with 39 documents and fractionally contributed to 23.37 more. Bornmann L. contributed to 27 articles, Abramo and D'angelo to 16 each. Other authors like Leydesdorff, Koushak, and more had diverse contributions. Fractional au- thorship is crucial, recognizing varied roles in collaborative research, ensuring equitable acknowledgment, vital especially in fields emphasizing collective effort.

5.4. To Understand Authorship Patterns

Lokta's Law, a concept in bibliometrics, examines how authors' publication frequency is distributed within a specific field. Table-01 and Figure-04 findings reveal a significant skew in authorship in academic publishing. Approximately 85.6% of authors contribute just one article, indicating that most authors publish infrequently. About 9.8% of authors have two articles, and 2.4% have three. In essence, Lokta's Law suggests that as authors publish more articles, they become rarer in the field. Prolific authors are a minority, producing a significant portion of research output, while the majority contributes only a single or a few articles. Understanding Lokta's Law helps assess the research landscape, highlighting the imbalance in author productivity, where a small group of prolific authors makes up a substantial part of the published literature, while most authors are occasional or infrequent contributors.

Table 1 — Author Productivity through Lotka's Law

Documents written	No. of Authors	Proportion of Authors
1	1232	0.856
2	141	0.098
3	34	0.024
4	14	0.01
5	6	0.004
6	4	0.003
7	2	0.001
8	1	0.001
12	1	0.001
13	1	0.001
16	2	0.001
27	1	0.001
39	1	0.001

5.5. To confirm Lotka's law using Kolmogorov – Smirnov (K-S) test[11]

Lotka's law is about the frequency distribution of authors' productivity in the given subject. In the present study, an attempt is made to study the applicability of Lotka's law in the Open Access Social Science Journals listed in Scopus during 2012 to 2022. The first step in applying Lotka's law is to

find out the value of 'n', 'c', and critical value (c.v.) from the data.

In the present study linear least square (LLS) method defined by 'Pao' has been used to calculate the value of 'n'. It is calculated by the following formula.

$$n = \frac{N\sum XY - \sum X \sum Y}{N\sum X^2 - (\sum X)^2}$$

Where,

N= number of data set used in the study

X= logarithm value of x, i.e. documents written

Y= logarithm value of y, i.e. no. of authors

The constant 'c' can be calculated by using the following Riemann formula:

$$c = \frac{1}{\sum_{x=1}^{P-1} \frac{1}{x^n} + \frac{1}{(n-1)P^{n-1}} + \frac{1}{2P^n} + \frac{n}{24(P-1)^{n+1}}}$$

Where,

P = 20

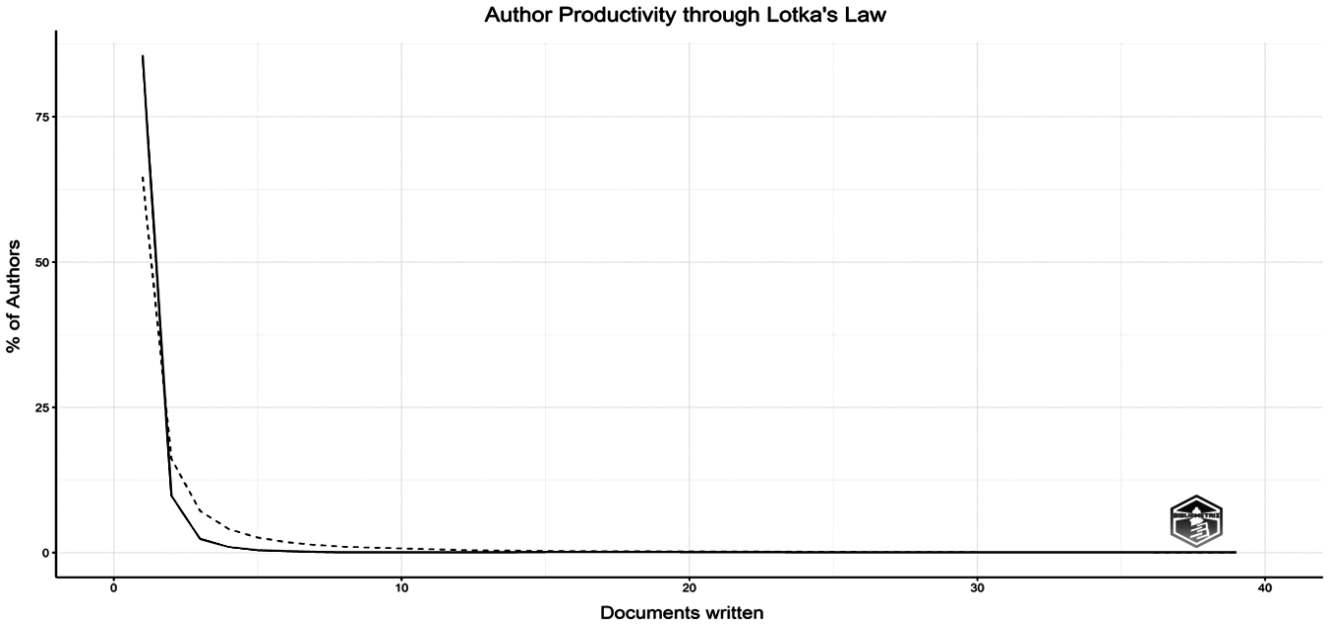

Figure 04

Table 2

S. No.	Document Written (*x*)	No. of Authors (*y*)	*X* = log (*x*)	*Y* = log (*y*)	*XY*	X^2	$1/X^n$
1	1	1232	0.0000	3.0906	0.0000	0.0000	1.0000
2	2	141	0.3010	2.1492	0.6470	0.0906	0.2557
3	3	34	0.4771	1.5315	0.7307	0.2276	0.1153
4	4	14	0.6021	1.1461	0.6900	0.3625	0.0655
5	5	6	0.6990	0.7782	0.5439	0.4886	0.0422
6	6	4	0.7782	06021	0.4685	0.6055	0.0295
7	7	2	0.8451	0.3010	0.2544	0.7142	0.0218
8	8	1	0.9031	0.0000	0.0000	0.8156	0.0168
9	12	1	1.0792	0.0000	0.0000	1.1646	0.0133
10	13	1	1.1129	0.0000	0.0000	1.2409	0.0108
11	16	2	1.2041	0.3010	0.3625	1.4499	0.0090
12	27	1	1.4314	0.0000	0.0000	2.0488	0.0076
13	39	1	1.5911	0.0000	0.0000	2.5315	0.0065
		1440	**11.0252**	**9.8997**	**11.7403**	**11.7403**	0.0056
							0.0049
							0.0000
							0.0038
							0.0034
							0.0031
							1.6149

Table 3

S. No.	Document Written	No. of Authors	Observed Author		Expected Author		Deviation
	x	y_x	Relative $yx/\sum yx$	Cumulative (FO)	Relative $\mathbf{yx} = C/x^n$	Cumulative (Fe)	($Fo - Fe$)
1	1	1232	0.8556	0.8556	0.6778	0.6778	**0.1777**
2	2	141	0.0979	0.9535	0.1735	0.8513	0.1022
3	3	34	0.0236	0.9771	0.0782	0.9295	0.0476
4	4	14	0.0097	0.9868	0.0444	0.9739	0.0129
5	5	6	0.0042	0.9910	0.0286	1.0025	-0.0115
6	6	4	0.0028	0.9938	0.0200	1.0255	-0.0288
7	7	2	0.0014	0.9951	0.0148	1.0373	-0.0422
8	8	1	0.0007	0.9958	0.0114	1.0487	-0.0528
9	12	1	0.0007	0.9965	0.0090	1.0577	-0.0611
10	13	1	0.007	0.9972	0.00073	1.0650	-0.0678
11	16	2	0.0014	0.9986	0.0061	1.0711	-0.0725
12	27	1	0.0007	0.9993	0.0051	1.0762	-0.0769
13	39	1	0.0007	1.0000	0.0044	1.0806	-0.0806
		1440					

N = value calculated from previous formula above

From the above Calculations the Findings are: 'n'= 1.9661 'c' = 0.6778

Kolmogorov – Smirnov (K-S) test to determine maximum deviation i.e. D_{max}

$D_{max} = [F(x) - S(x)]$

Where,

$F(x)$ = Observed Cumulative frequency

$S(x)$ = Expected Cumulative frequency

D_{max} = 0.1777

Critical value at 0.01 level of significance can be calculated using the formula:

Critical Value (CV)= $\frac{1.63}{\sum \sqrt{\quad}}$ = CV = 0.043

Where $\sum \sqrt{\quad}$ = 1440

The K-S goodness-of-fit test is used to test the fitness of Lotka's law. As per the tables represents above that this test applies to data and tested on the observed frequency of authors in comparison with the expected frequency of the author's productivity. In the present study where n=1.9661, and c=0.6778. As per Lotka's inverse square law, the D_{Max} value is 0.1777 which is more than critical value at 0.01 level of significance i.e. 0.043, So it is observed that the data does not fit the specified distribution and Lotka's inverse square law does not confirm the present data set.

5.6. To identify frequently used keywords

Keywords are vital in academic research as they serve as entry points for search engines and aid in discovering and analyzing specific research topics. In this study, the focus was on identifying frequently used keywords within a specific research area, aiming to boost research visibility and unveil prevalent themes. Figure-05, uncovered that "bibliometrics" was the most commonly used keyword, appearing 175 times, highlighting its central role in the field. It signifies the importance of quantitative analysis of publications and citation patterns. Other high frequency keywords like "Human" (76 times) and "Citation Analysis" (72 times) underscore the prominence of human related aspects and citation patterns. Keywords like "Publishing" (43 times), "article" (39 times), and "publication" (38 times) indicate a strong interest in research dissemination processes and scholarly articles. Furthermore, the study revealed keywords like "United States" (25 times), "information science" and "web of science" (22 times each), "Information Analysis" (21 times), "computer applications" (20 times), and "periodical as topic" (17 times), representing a diverse range of topics and interests within the research area. Overall, the study highlights the central role of "bibliometrics" in the field and demonstrates how keyword analysis can help researchers refine their search strategies and gain insights into prevailing research themes. It emphasizes the crucial role of keywords as gateways to accessing and comprehending scholarly content in academic research.

5.7. To Investigate Keyword distribution

The tree-map analysis of visually represents keyword distribution within a dataset, offering insights into keyword prevalence. In figure-06

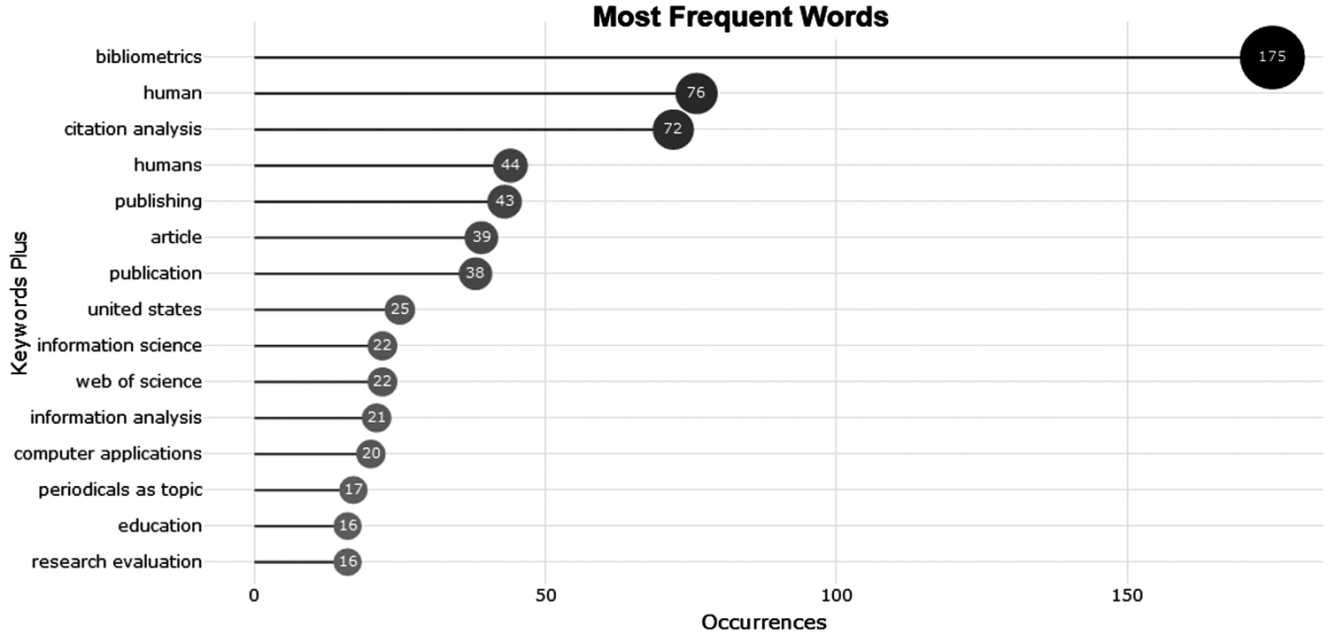

Figure 05

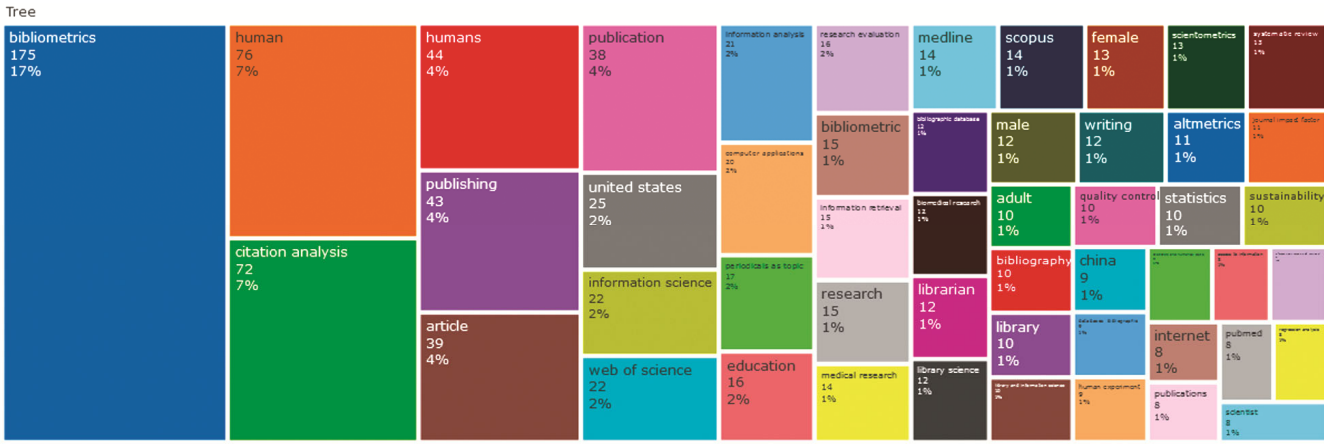

Figure 06

analyse, the focus is on keyword frequency, revealing key aspects of the keyword landscape. “Bibliometrics” is the standout keyword, making up 17% of total keywords, indicating its prominence and extensive use in the research area. This highlights a strong emphasis on quantitative analysis of publications and citation patterns. Next, “human” and “citation analysis” each constitute 7% of keywords, underscoring their significance in the field, though slightly less than “bibliometrics”. Additionally, keywords like “humans,” “publishing,” “article,” and “publications” each make up 4% of total keywords, reflecting their common usage and relevance. In summary, the tree-map analysis offers a clear overview of keyword distribution. “Bibliometrics” is a major focus, with “human” and “citation analysis” also important. The diverse keyword set covers various research themes within the field, providing a snapshot of the key topics driving research in this domain. Researchers can use this information to quickly grasp the dominant concepts in the dataset.

5.8. To Assess Collaborative Behavior of Countries

The collaboration network among countries offers valuable insights into their collaborative interactions across various domains. In figure-07, The network analysis identifies 9 clusters, reflecting groups of countries with strong collaborative ties or shared research interests. These clusters indicate that countries often collaborate more closely with others

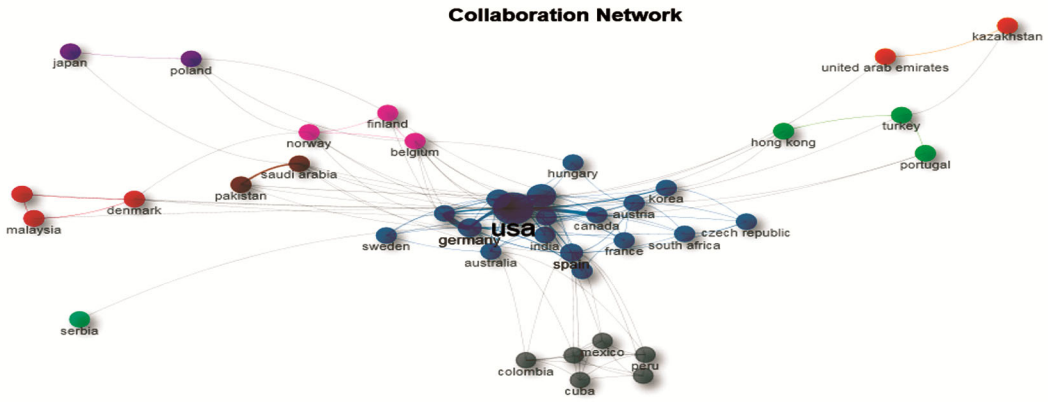

Figure 07

within the same group. Certain countries, such as the USA, Germany, China, Spain, United Kingdom, Netherlands, Italy, Austria, Canada, and Australia, exhibit the highest closeness centrality. This suggests they are strategically positioned in the network, connected via the shortest paths to other countries. These nations act as central hubs, facilitating efficient collaborations with a wide range of other nations. The country collaboration map visually represents how different countries cooperate with one another. Analyzing this map helps reveal patterns of international cooperation and highlights significant partnerships between countries. Overall, this analysis provides a deeper understanding of the dynamics and structure of international collaboration. It aids researchers and policymakers in identifying key players in global cooperation and recognizing countries closely linked through collaborative endeavors. These insights inform decisions related to research funding, international partnerships, and diplomatic efforts aimed at fostering collaboration across various domains.

6. Findings

6.1. The analysis covers research conducted between 2012 and 2022 within specific criteria. It encompasses 627 documents from 167 sources, with an annual growth rate of 18.52%. The study identifies 1440 contributors, of which 89 are solo authors. International collaboration is evident in 25.84% of documents, with an average of 2.98 authors per document. There are 1624 distinct author keywords and 25,428 references cited. Each document receives an average of 27.85 citations, even after an average of 4.66 years.

6.2. Bradford's Law categorizes journals into three zones based on their focus and output. Zone I, with 04 journals, contributes around 36.52% of all documents. This emphasizes how a small set of specialized journals holds a significant portion of subject-specific literature.

6.3. Author contribution assessment highlights Thelwall M. as the most prolific author with 39 documents and 23.37 fractional contributions. Other authors like Bornmann L., Abramo, and D'angelo have substantial contributions. This underscores the varying degrees of author involvement in collaborative scholarly works.

6.4. Lokta's Law reveals a significant skew in authorship, where approximately 85.6% of authors contribute only one article. This suggests that most authors publish infrequently, with a minority of prolific authors producing a significant share of research output.

6.5. Lotka's inverse square law does not confirm to the present data in open access journals in the field of social science with 0.01 level of significance.

6.6. Keyword analysis identifies "bibliometrics" as the most commonly used keyword, followed by "Human" and "Citation Analysis." Other frequent keywords include "Publishing," "article," and "publication," emphasizing the interest in research dissemination processes and scholarly articles. Diverse topics are also covered by keywords such as "United States", "information science" and "web of science".

6.7. The tree-map analysis visually represents keyword distribution, highlighting "bibliometrics" as a major focus, followed by "human" and "citation analysis." The analysis offers a clear overview of keyword prevalence within the dataset.

6.8. The collaboration network analysis identifies 9 clusters of countries with strong collaborative ties. Countries like the USA, Germany, and China

exhibit the highest closeness centrality, indicating their strategic positions in the network. They act as central hubs for efficient collaborations. The country collaboration map visually represents international cooperation patterns.

7. Conclusion

This research paper provides a comprehensive analysis of research trends and collaboration dynamics within the specified criteria. It underscores the importance of specific keywords, the concentration of research in specialized journals, and the varying levels of author productivity. Additionally, the study highlights the central role of certain countries in international research collaborations, facilitating efficient knowledge exchange across borders. These findings offer valuable insights for researchers, policymakers, and institutions looking to understand and engage with the evolving landscape of academic research.

8. Future Studies

While the present study provides valuable insights into the bibliometric and citation trends of Library and Information Science articles in open access social science journals, several avenues for future research and exploration emerge. The following areas enhance our understanding of the field and its scholarly landscape

8.1 Network Analysis: Employing network analysis techniques to map author collaborations, institutional networks, and co-citation patterns could unveil hidden structures and relationships within the field, facilitating a deeper understanding of its knowledge ecosystem.

8.2 Predictive Modeling: Developing predictive models based on bibliometric and citation data could offer insights into potential future trends, helping researchers anticipate shifts in the field and focus their efforts accordingly.

Incorporating these future research directions could further enrich our understanding of Library and Information Science's scholarly landscape, its interaction with open access publishing, and its broader impact within the social science domain.

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