



Mapping the Scientific Literature of e-Services in Libraries: A Bibliometric Study

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Abstract

Purpose: The purpose of this study is to analyze the research trends and patterns in e-services in libraries by examining the literature published over three decades.

Design/Methodology/Approach: Web of Science (WoS) was used to obtain the scientific publications on e-services of libraries. The data was extracted on 31-December-2021. The search query applied to get the desired results is $((TS = (DIGITAL\ LIBRAR^*))\ AND\ TS = (ELECTRONIC\ SERVIC^*))\ OR\ TI = (DIGITAL\ LIBRARY\ SERVIC^*))\ AND\ TI = (E-SERVIC^*)$ and Articles After refinements and removal of duplicates the total of 2300 articles were retrieved within a specific time. R software was used for data visualization and analysis.

Findings: The study revealed that the highest number of articles were published in 2015 and the highest mean total citation count per article belongs to 2011. It is revealed that the Academic of Librarianship had published the highest number of records. The most occurred keywords are "Information" and "Model". It is also revealed that the word "Information" has the highest growth rate. It was determined that the USA has the highest productivity and citations followed by the UK and China. Cook C, and Thompson B are the most Prolific authors revealed in the study. It was also revealed that the University of Illinois, Chicago was the most prolific institution.

Practical Implications: The findings can help libraries in developing e-services by highlighting current research trends and identifying leading institutions and authors in the field. This can help in formulating policies and strategies that meet the evolving needs of the digital age.

Originality/Value: The study is confined to articles indexed in the Web of Science database, which may not reflect the scope of research on e-services in libraries. This study provides valuable insights into the research landscape of library e-services.

Keywords: E-services, Bibliometric analysis, Research trends, Digital Library

Introduction

Bibliometrics deals with the quantitative analysis of written communication. "Philosophical Transactions of Royal Society" in 1665 marked the beginning of journal publication but journals became popular in 1900s when journals got attention from the students and scholar community. Thus, it paved the path for the bibliometric analysis of written communication. The term "Bibliometrics" was first coined by Pritchard in 1969 (Nicholas & Ritchie, 1978). Pritchard (1969) defined it as, "the application of mathematical and statistical methods to Bibliographic information of books and other media of communication". There are three types of bibliometric indicators: quantity indicators, which measure the productivity of a particular researcher, quality indicators, which measure the quality or performance of a researcher's

output and structural indicators, which measure connections between publications, authors, and areas of research. From its very beginning, Bibliometrics has been associated with the identification of the main journals, ranking of journals, sorting of good magazines, the contribution of institutes, authorship patterns, literature in a particular field, and much more. Bibliometrics has helped scholars and policymakers to identify the active areas and important ones (Shamsi et al., 2022).

The rapid development of libraries and the growth of literature generated several studies about the efficiency and effectiveness of information services. These studies led to the identification of appropriate quantitative measuring techniques and their applications known as Bibliometrics (Nidhi, 2016). Bibliometrics is a new subject of recent origin. It is the branch of the library and Information science that analyze the behavior and properties of the recorded knowledge quantitatively (Song et al., 2023). The libraries and information managers all over the world began to use Bibliometric techniques in their day-to-day administration (García-Villar & García-Santos, 2021). Bibliometric techniques help researchers in the era of information explosion to quantify the process of written communication. Various mathematical and statistical tools are used by researchers to analyze and measure the scattering of literature output of a particular subject through language-wise, document type-wise, institute-wise, geographical-wise, etc. (Patil et al., 2023). It is also used to identify the pattern of publication, authorship, citations used for a subject, etc. over some time and thereby offer insight into the dynamics of an area under study (Song et al., 2023).

Bibliometric data helps us to explore trends, both within a country and worldwide as well as track collaboration patterns among individual researchers, institutions, and countries (Afuye et al., 2022). In the research world, the bibliometric study is not new. The Bibliometric word has been derived from two words 'Biblio' and "Metric". The word "Biblio" means "Books, Documents" and "Metric" means "a Scale or Measure" (Sethukumari, 2016). In other words, we can say that Bibliometrics is the application of statistical studies in library and information science (Afuye et al., 2022). Bibliometrics is gaining popularity among researchers of all disciplines. According to Belter (2018), bibliometrics deals with four major themes: productivity, collaboration, research topics, and citation impact. He terms it as, "a science of science". Bibliometric analysis provides valuable information and extends systematic comparison among institutions, and countries. (Kraus et al., 2022; Mukherjee et al., 2022; Paul-Lim et al., 2021).

Review of Literature

Services in libraries include the typical traditional library and information services and other global information services through computers and telecommunications etc. Lateef et al. (2024) showed the various services

provided by the libraries in e-format which include: Online Reference services, current awareness services, Subscription services, Audio and video communication services, electronic document delivery Services, Interoperability services, online cataloguing services like OPAC, chat-services, indexing and abstracting services etc. Fagbohun et al. (2020) demonstrated that libraries establish an omnipresent remote access facility covering service regions and integrating online reading services, online databases, multimedia databases and large-scale electronic reference books etc., thus meeting the readers' needs for browsing digital information in the library or anywhere. Digital services are widely available in many regions of the world, and communication with the government is increasingly automated. Lindgren et al. (2019) and Rose et al. (2015) suggest that while this is generally promoted as a cost-saving approach, it also helps citizens by improving the speed and availability of services.

Current trends in academic communication are evidenced by manifestations of language dominants. It has been shown that English-speaking societies use the global distribution of the English language to promote their competitive advantages in science. Huang and Xue (2020) and Tchuifon et al. (2017) conducted bibliometric which studies revealed that most of the articles were published in English language. Chiu and Ho (2005) further revealed that Japanese and German are the prominent languages used after English for publications.

The number of researchers and scientific papers rapidly grows, annually. The metrics to analyze the quality and quantity of these publications have consolidated in the academic world. Different countries produce a lot of literature annually. A number of bibliometric studies have been conducted like Chiu and Ho (2005) showing that the most articles were published by UK followed by USA. Chiu and Ho (2005), Dabi et al. (2016), Gonçalves et al. (2021), Haunschild et al. (2016), Liu et al. (2018), Sachdeva et al. (2021), Van et al. (2018), Vioque et al. (2010), and Zhang et al. (2019) in their study revealed that most of the literature was published by USA followed by United Kingdom. Bibliometric methods estimate how much influence or impact a document type has on future research. It usually does this by counting the number of times a document type is cited after it is published. Boamah and Ho (2017), Chiu and Ho (2005), Fu et al. (2014), Uzunboyulu and Ozcinar (2009), Vioque et al. (2010), and Wang et al. (2010) revealed that articles are most preferred and used document type followed by review papers.

Objectives

- a) To explore the productivity and impact of scientific literature on e-services in libraries globally.
- b) To identify and elucidate the impact of most relevant authors, articles, journals, institutions and countries.

- c) To highlight the most impactful keywords used.

Methodology

To exhaustively cover the scientific output of e-services of libraries. Web of Science (WoS) was used to obtain an underlying corpus of abundant scientific publications. The data was extracted on 31 December 2023.

The search query applied to get the desired results is

((TS=(DIGITAL LIBRAR*)) AND TS=(ELECTRONIC SERVIC*)) OR TI=(DIGITAL LIBRARY SERVIC*)) AND TI=(E-SERVIC*) and Articles.

After refinements and duplicate removal, a total of 2300 articles were retrieved within the specified time frame from 1989 to 2021.

The R-Bibliometric package was utilised for the methodological execution and analysis of bibliometric studies. This software is selected for its capabilities in providing comprehensive evaluation and insightful visualisation of bibliometric data across diverse academic disciplines.

Data Analysis and Interpretation

Table 1 demonstrates the main information about the study. The table shows that the current study comprises 2300 Documents/articles spanning 30 years from 1989 to 2021. The records are retrieved from 501 sources, having an average citation of 0.86 per document per year, 14 Average Years from Publication and 8.87 Average citations per document. In this study, it is further revealed that the records have 51702 references with 5513 author appearances and 4787 Authors comprising of 877 Single-authored documents. These records are retrieved using 1659 Keywords plus (ID) and 3145 Author’s Keywords. The study portrayed a total of 810 Authors of single-authored documents and 3977 Authors of multi-authored documents. From the table, it is evident that there are 0.48 Documents per Author, 2.08 Authors per Document and 2.4 Co-Authors per Document with a Collaboration Index of 2.79

Table 1. Main Information about Data

Description	Results
Timespan	1989-2021
Sources	501
Documents	2300
Average years from publication	14
Average citations per documents	8.87
Average citations per year per doc	0.86
References	51702
Article	2300
Keywords Plus (ID)	1659
Author’s Keywords (DE)	3145

Authors	4787
Author Appearances	5513
Authors of single-authored documents	810
Authors of multi-authored documents	3977
Single-authored documents	877
Documents per Author	0.48
Authors per Document	2.08
Co-Authors per Documents	2.4
Collaboration Index	2.79

Average Total Citation Productivity of Articles

Table 2 deals with Average Total Citation Productivity of Articles. These articles are categorized year wise. From Table 2, it is evident that the highest number of articles is published in 2015 (102), followed by 2017 (99), 2009 and 2020 (88) and the least number of articles is published in 1989 (27), followed by 1990 (33). Further, the year 2011 has the highest mean total citation count per Article (24.47), followed by 2004 (16.01) and 2001 (15.35). The least mean total citations per article is in 2021 (1.27), followed by 1990 (2.03). Furthermore, the highest mean total citations per year are in 2011 and 2020 (2.44), followed by 2016 (2.37) and 2018 (1.93). The least mean total citations per year is in 1990 (0.06), followed by 1989 (0.07) and 1998 (0.08).

Table 2: Average Total Citation Productivity of Articles

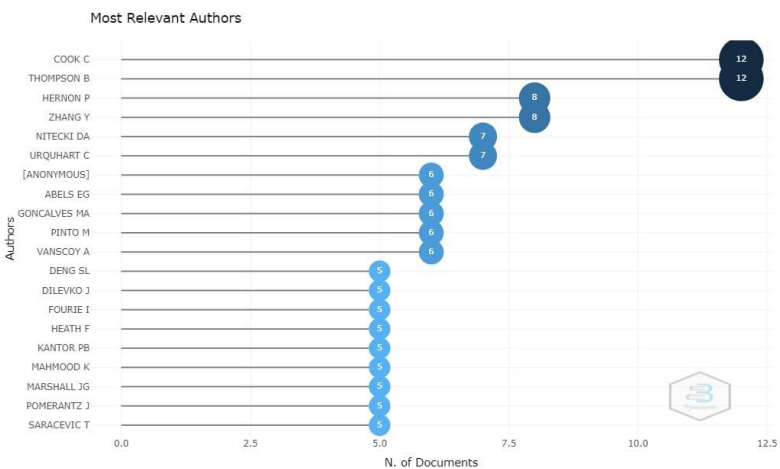
Year	N	MTA	MTY	CY	Year	N	MTA	MTY	CY
1989	27	2.4	0.07	32	2006	79	11.7	0.78	15
1990	33	2.03	0.06	31	2007	73	10.56	0.75	14
1991	64	3.82	0.12	30	2008	83	14.84	1.14	13
1992	43	3.88	0.13	29	2009	88	13.35	1.11	12
1993	47	2.46	0.08	28	2010	81	9.25	0.84	11
1994	61	5.31	0.19	27	2011	69	24.47	2.44	10
1995	63	6	0.23	26	2012	81	8.75	0.97	9
1996	55	9.03	0.36	25	2013	82	11.96	1.49	8
1997	63	7.9	0.32	24	2014	74	9.67	1.38	7
1998	57	6.54	0.28	23	2015	102	7	1.16	6
1999	39	10.25	0.46	22	2016	78	11.87	2.37	5
2000	61	12.09	0.57	21	2017	99	6.8	1.7	4
2001	68	15.35	0.76	20	2018	74	5.79	1.93	3
2002	63	9.68	0.5	19	2019	83	3.54	1.77	2
2003	66	12.19	0.67	18	2020	88	2.44	2.44	1
2004	78	16.01	0.94	17	2021	86	1.27		0
2005	63	8.22	0.51	16					

MTA = Mean Total Citation per Article; MTY = Mean Total Citation per Year; CY = Citable Year

Most Prolific Authors

Researchers worldwide are publishing articles across various fields with different publishing houses. The present findings represent the most prolific authors from selected data in the Web of Science, with Cook C and Thompson B having the highest number of documents (12), followed by Hernon P and Zhang Y (8). Saracevic T, Pomerantz J, Marshall J.G and Mahmood K have the least number of documents (5) respectively (Fig. 2). A similar trend of exploring the relevant authors was found in the study of Ahmad et al. (2018).

Fig. 2: Most Prolific Authors



Top 10 Productive Countries

It is evident that the U.S.A. (1398) has the highest productivity of articles, followed by the U.K. (405) and China (356). The results are in line with the studies, like, Goncalves et al. (2021), Haunschild et al. (2016), Sachdeva et al. (2021), Shonhe and Liah (2020), and Zhang et al. (2019). Their studies also showed that the USA has the highest production of articles. Possible reasons include the USA leading in LIS schools (Ahmad et al., 2019).

Table 3. Top 10 Countries with the Highest Number of Publications

Region	Frequency	Region	Frequency
USA	1398	Spain	126
UK	405	Germany	117
China	356	South Korea	72
Canada	217	Japan	69
Australia	136	South Africa	61

Most Frequent Keywords

Fig. 4. shows the map of frequent keywords. The most keywords are an essential factor in searching the literature. The current study represents occurrences of words from which *Information* and *Model* have the highest occurrences, i.e. (67) both, followed by *Library* (61) and *Quality* (60). In contrast, *Systems*, *Education* and *Needs* have minimal occurrences with (21), (22), and (23) respectively (Table 4).

Fig. 4: Keyword Map

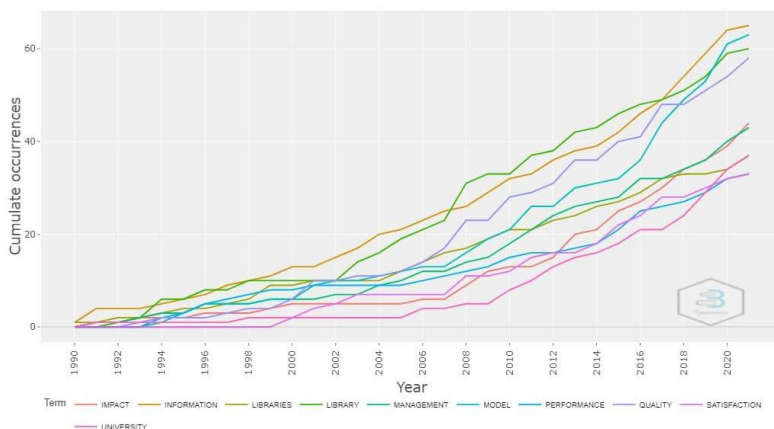


Word Growth

Fig. 5 shows the growth of words over a selected period of time, in which it is clearly visible that information has the highest growth, followed by model and library, while performance, satisfaction, and university show steady growth from 1990 to 2020.

Table 4: Most Frequent Word

Words	Occurrences	Words	Occurrences
Information	67	Perceptions	32
Model	67	Users	29
Library	61	Academic-libraries	25
Quality	60	Behavior	25
Impact	44	Students	24
Management	44	Academic-library	23
Libraries	37	Design	23
University	37	Needs	23
Satisfaction	34	Education	22
Performance	33	Systems	21

Fig. 5: Word Growth

Findings

The effectiveness of an academic institution's digital resources and services in serving its community is fundamental to its sustainability and relevance. The study reveals that the highest mean total number of citations per article was 2011, suggests that during this period, research outputs were not only more visible but also more influential, which could be due to the maturation of digital library systems and wider accessibility of scholarly communication platforms and the year with the most publications was 2015 expansion phase in academic librarianship research, where scholars increasingly engaged with emerging digital frameworks and service models. It was discovered that academic librarianship has the most records (1260) published and the largest number of global citations. Additionally, it comes to light that the academic field of librarianship had the greatest source impact. The keywords "Information" and "Model" are frequently used. The word "Information" has the fastest rate of growth, disclosing focus on structuring, managing, and optimizing information systems. It was found that the United States produces the most articles, or (1398), followed by the United Kingdom (405) and China (356), and is the most referenced nation with 118018 citations indicating that research activities are becoming more globally distributed, even if disparities still exist. With (12) documents each, Cook C. and Thompson B. are the most pertinent and productive authors identified in the study. With 59 publications, it was discovered that the University of Illinois at Chicago has the most pertinent associations reflects that both individual scholars and institutions play a key role in shaping the field, although the concentration of output suggests that influence may be limited to certain groups.

Conclusion

To meet the demands of users in the 21st century and stay relevant in their communities, librarians must constantly engage in professional development due to the rapid changes in technology and their impact on how information is accessed, and library services are provided. Hence, the primary objective of this study was to provide a comprehensive descriptive analysis of the available literature concerning electronic services offered by libraries. In today's digital age, electronic resources and services hold a significant and valuable place. These digital offerings, extended by libraries, play a pivotal role in the functioning of both academic institutions and government entities. The effective utilization of these online tools and services is of paramount importance. Overall, the study indicates that while the field is evolving and expanding, certain imbalances and concentrations of impact still persist.

Implications

The findings can help libraries in developing e-services by highlighting current research trends and identifying leading institutions and authors in the field. This can help in formulating policies and strategies that meet the evolving needs of the digital age.

Limitations of the study

The current study is specifically limited to the document type "Article" sourced exclusively from the Web of Science (WoS) database. Consequently, other widely recognized databases such as PubMed, Dimensions, and Scopus, among others, have not been utilized, leading to a restricted scope of information retrieval from these alternative global databases.

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