

Popular Research Topics in the Recent Journal Publications of Library and Information Science

Guoying Liu & Le Yang*

ABSTRACT:

Research topic studies have gained popularity in many disciplines, including Library and Information Science (LIS). However, the lack of representation of library science and librarianship in literature indicates a research bias due to the preset methodology parameters, which are commonly based on impact factor scores in the Journal Citation Report of Thomson Reuters. In research, the authors utilize an improved selection criterion of journals and author-supplied keyword clustering and analysis technique to study the most recent ten years of LIS journal publications. This article presents a clear picture of popular research topics in seminal literature to help practicing librarians and library science scholars gain a better understanding and considerable prediction on the research trends in the LIS field.

KEYWORDS: Research Topics, Library and Information Science, Keyword Clustering, Keyword Analysis, Web of Science

INTRODUCTION

Studies on research topics in publications have gained popularity in the field of science and technology for decades because new trends and topics emerge rapidly and researchers tend to rely on formal channels to communicate research findings (Chang, Huang, & Lin, 2015). The evolution studies of research topics in science and technology are especially of interest to decision makers such as those within governments, industries, and sciences. In order to trace research topic trends, federal agencies and companies established funding programs to sponsor such studies starting in the 1960s. (Small, Boyack, & Klavans, 2014)

A few research techniques have been developed and utilized in different disciplines for emerging research subject studies and evolution studies of research topics, namely co-citation analysis (Small, 1973; Hou, Yang, & Chen, 2018), bibliographical coupling (Kessler, 1963), co-occurrence network analysis (Boyack & Klavans, 2010; Tsay, Xu, & Wu, 2003), and keyword analysis (Khan & Wood, 2015; Neveol, Dogan, & Lu, 2010). Moreover, recognizing the importance of research topic studies, library and information science (LIS) scholars have also started to employ the developed methodology to the profession.

There is a growing interest pertaining to research topic studies in the field of LIS, such as studies about evolution of the discipline framework (Tuomaala, Jarvelin, & Vakkari, 2014; Walters & Wilder, 2016), longitudinal studies of research subjects (Chang, Huang, & Lin, 2015; Onyancha, 2018), journal categorization (Abrizah, Noorhidawati, & Zainab, 2015), emerging trends (Hou, Yang, & Chen, 2018; Lyu, et al., 2015), publication patterns (Blecic, et al., 2017), and research topic studies in school librarianship (Joo & Cahill, 2018), medical librarianship (Lyu et al., 2015), and knowledge management (Fteimi & Lehner, 2016).

Although researchers have sound findings in some areas, the research topic study in the LIS field is still left with untouched areas for further investigation. In this article, the authors utilized keyword clustering and analysis to study the most recent ten years of tier-selected LIS publications in Web of Science. The authors present a clear picture of research topic analysis that is illustrated with comparative and longitudinal studies on the two tier-selected categories of LIS journal articles. Through the analysis, the authors hope to gauge the popular research topics in the current literature and expect to elicit further discussion on the research trending in the field of LIS.

LITERATURE REVIEW

Studies of research topic can be traced back to the early 1960s when Kessler (1963) introduced bibliographic coupling analysis to the study of science disciplines. According to Kessler, when a same document is cited by two publications, a bibliographical coupling relationship is developed between the two; and a higher number of common documents being cited means a stronger bibliographic coupling of the two publications. Later, Small (1973) introduced another important methodology named co-citation analysis, defining that a co-citation relationship can be established when two publications are cited by a third one; and if more documents cite the same pair of the two publications a co-citation relationship between the two is stronger.

Although both research methods have gained popularity and are used in various disciplines to elucidate the intellectual structure and framework, subtle distinctions can still be observed in the practice of research topic studies (Chang, Huang, & Lin, 2015). Scholars find that while bibliographic coupling analysis is superior in identifying longitudinal changes in research topics (Boyack & Klavans, 2010; Ma, 2012; Zhao & Strotmann, 2008), co-citation analysis has its advantages in disciplinary structure outlining (Bichteler & Eaton, 1980; Sharabchiev, 1989). In addition, scholars continue to contribute different techniques to enrich the body of both methodology groups (Iwami & Sakata, 2015; Qiu, Dong, & Yu, 2014; Zhao & Strotmann, 2014), resulting in a vast development of bibliographic analysis and the establishment of co-occurrence analysis of which the co-citation method becomes a subgroup (Small, Boyack, & Klavans, 2014; Yan & Ding, 2012).

In the field of LIS, scholars have also developed several methods to study research topics. According to Chang, Huang, and Lin (2015), the LIS research topic studies can be divided into three main groups based on the research methodologies, that is content analysis, bibliographic analysis, and a combined method of others. One of the earliest studies conducted by Jarvelin and Vakkari (1993) features the content analysis method. In their study, the researchers made a purposive selection of 40 journals in LIS, then analyzed and classified the already-collected articles published in 1965 (Huusko, 1992), 1975 (Kumpulainen, 1991), and 1985 (Jarvelin & Vakkari, 1990) into 11 topic schemes. The authors found that the research topic interests remarkably had shifted from classification and indexing to information storage and retrieval; while information-seeking and scientific communication were emerging and gaining some attention in the literature during 1965-1985. (Jarvelin & Vakkari, 1993)

Another study following the same approach was conducted in 2014 by Tuomaala, Jarvelin, and Vakkari. They added selected articles published in 2005 and expanded the research range from 10 years to 20 years interval compared to the previous study in 1993. The recent study revealed that the popularity of information-seeking and scientific communication has significantly grown since 1985, and the research standpoint had fundamentally shifted from the library and information organizations to end users and system development. (Tuomaala, Jarvelin, & Vakkari, 2014).

The previous approaches demonstrate a few limitations, such as being time consuming, having a small sample size, and the subjectivity of manual selection (Liu, 2018). Computer aided techniques have enabled researchers to apply more efficient methodologies in research topic and trend studies (Hou, Yang, & Chen, 2018; Small, Boyack, Klavans, 2014; Yang et al., 2016). Advanced Internet technologies make it possible to combine different methods, such as bibliographic analysis and content analysis to facilitate a deeper understanding on the discipline development (Chang, Huang, & Lin, 2015). Using a combined research method of LIS-related database

keyword analysis, bibliographical coupling, and co-citation analysis, Chang, Huang, and Lin (2015) studied 580 published articles between 1995 and 2014 in ten selected LIS journals with highest impact factors. The researchers observed a decreasing trend of research topics in information seeking and information retrieval, whereas an increasing percentage of research articles in bibliometrics.

Keyword and/or subject term analysis is a more popular method in the current literature of LIS (Chen, et al., 2015). Jabeen et al. (2015) identified the most frequently used keywords from articles published from 2003 to 2012 in 40 core LIS journals which selected from 77 LIS journals listed in the Journal Citation Report (JCR) 2010 based on their impact factors. The study concluded that information technology-based theories and digital technology applications played a pivotal role in the LIS research articles in that period. In one of the most recent studies in LIS, Onyancha (2018) extracted author-supplied keyword data from the Thomson Reuters' citation indexes and utilized computer-aided software to analyze the keyword frequencies in each decade since 1971. The author found that the hot research topics in LIS have shifted from information systems and management in the 1970s to knowledge management and user education in 2015. It is also indicated that the application of Information and Communication Technologies (ICTs) had emerged as a prominent topic in the field and shaped the LIS curriculum in the schools. (Onyancha, 2018)

There are a couple of studies on specific LIS areas in the literature as well. Lyu, et al. (2015) studied the emerging MeSH terms and identified evolving stages of medical informatics. They found that the research focus in medical librarianship had shifted from acquisition and storage of healthcare data to semantic analysis for problem solving and clinical decision-making. School librarianship scholars Joo and Cahill (2018) used text mining techniques to examine research topics in the field of school librarianship, and extracted 20 popular research topics in the domain, ranging from the traditional areas such as information literacy and learning ability to more digital-oriented areas including digital technologies and research designs. Fteimi and Lehner (2016) applied content analysis approach facilitated with the statistical software on a total of 755 publications in knowledge management conferences. It is claimed that researchers were strongly interested in emerging fields of knowledge processes, innovation, and learning and technology in the field of knowledge management.

PROBLEM STATEMENT

Previous studies have indicated some interesting findings and useful information for LIS scholars to track the evolution of research topics. Using different indicators and

selection of methodologies, however, researchers focused on a limited list of journals, most of which are labelled as core LIS journals with highest impact factors defined by Thomson Reuters. This limitation was noticed by Abrizah, Noorhidawati, and Zainab (2015) in their preference study, pointing out a fact that only one journal in library science was grouped in the highest quartile by impact factor; in contrast, eight titles in information science and eleven titles in information systems are among the top journals in the Journal Citation Report (JCR) by Thomson Reuters.

The lack of representation of library science and librarianship related journals in the literature indicates a possible bias of research results when researchers set the methodology parameters based on impact factor scores in JCR. The low affinity of library science and librarianship related journals to the field of information science and information systems also creates difficulty for practicing librarians and library science scholars to form an accurate picture of research topics and research trend. Thus, an improved selection criterion of journals other than JCR list or impact factor is needed for research topic studies in order to be more inclusive of library science and librarianship.

In addition, researchers note that author-supplied keywords were rarely used in the relevant studies of research subject and research trends (Onyancha, 2018); whereas Chen et al. (2015) recognized keywords of publications as reflectors of subject development and author-supplied keywords as proxy of research subjects. Considering the negligence of publication selection and the lack of author-supplied keywords analysis, the authors hope to put forward an improved methodology to analyze the popular research topics in the recent journal publications of LIS. The study aims to outline a clear picture of LIS research topics in the most recent decade for practicing librarians and library science scholars to have a better understanding of the research trend in the LIS field and to further their own research in related fields.

METHODOLOGY

In order to address the concerns of lacking library science and librarianship journals in the previous research, the authors selected the LIS journal lists developed by Judith Nixon (2014) for this study. Nixon (2014) combined several variables to create the LIS journal list, including expert opinion surveys, acceptance and circulation rates, h-indexes, impact factors, and journals with librarian articles. All LIS journals were ranked and categorized into three tiers by the matrix. It is believed that Nixon's LIS journal list is specifically intended for librarian-authors who wish to enrich the literature in librarianship and report research findings. Instead of using impact factor as the sole

selection criteria, the final list of 62 LIS journals evaluated by librarians and developed for librarians is more approachable for this study.

Further evaluating these journals with respect to their publication policies, the authors decided to include only peer-review journals for the study. Thus, one journal from Tier One and all journals from Tier Three were excluded because these journals do not implement the scholarly peer-review process for their publications. At this stage the intended journal list for the study based on Nixon’s list include 17 journals of Tier One and 37 journals of Tier Two after the refining of peer-review criteria.

Web of Science, a renowned scholarly database providing reliable data source, has been justified and frequently used in scientometric studies and scientific research in the literature (Chang, Huang, & Lin, 2015; Herther, 2009; Jabeen et al., 2015; Moed, 2006; Onyancha, 2018). In this study, the Web of Science Core Collection is adopted as the data source. After searching the journal titles against the database, the authors found that all 17 journals of Tier One and 24 journals of Tier Two were indexed in Web of Science Core Collection, and the articles in these journals were successfully retrieved. Table 1 includes the list of scholarly journals selected for the study. Please refer to Appendix 1 for a complete Nixon’s list of scholarly journals.

Table 1: Scholarly Journals Selected for the Study

No.	Journal Title	Nixon’s Tier	Peer-Review	Web of Science Index
1	Aslib Proceedings	1	Yes	Yes
2	College & Research Libraries	1	Yes	Yes
3	Collection Management	1	Yes	Yes
4	Government Information Quarterly	1	Yes	Yes
5	Information Technology & Libraries	1	Yes	Yes
6	Journal of Academic Librarianship	1	Yes	Yes
7	Journal of Documentation	1	Yes	Yes
8	Journal of Information Science	1	Yes	Yes
9	Journal of the American Society for Information Science and Technology	1	Yes	Yes
10	Journal of the Medical Library Association	1	Yes	Yes
11	Library Collections, Acquisitions, and Technical Services	1	Yes	Yes

12	Library & Information Science Research	1	Yes	Yes
13	Library Quarterly	1	Yes	Yes
14	Library Resources & Technical Services	1	Yes	Yes
15	Library Trends	1	Yes	Yes
16	Libri	1	Yes	Yes
17	Reference & User Services Quarterly	1	Yes	Yes
18	Canadian & Undergraduate Libraries	2	Yes	Yes
19	College & Undergraduate Libraries	2	Yes	Yes
20	The Electronic Library	2	Yes	Yes
21	Health Information and Libraries	2	Yes	Yes
22	Information Development	2	Yes	Yes
23	Information Processing & Management	2	Yes	Yes
24	Information Research	2	Yes	Yes
25	The Information Society: an International Journal	2	Yes	Yes
26	Interlending & Document Supply	2	Yes	Yes
27	International Journal of Information Management	2	Yes	Yes
28	International Journal on Digital Libraries	2	Yes	Yes
29	Journal of Business & Finance Librarianship	2	Yes	Yes
30	Journal of Information Technology	2	Yes	Yes
31	Journal of Librarianship and Information Science	2	Yes	Yes
32	Journal of Scholarly Publishing	2	Yes	Yes
33	Law Library Journal	2	Yes	Yes
34	Libraries & the Cultural Record	2	Yes	Yes
35	Library Hi Tech	2	Yes	Yes
36	Online Information Review	2	Yes	Yes
37	Portal	2	Yes	Yes
38	Program: electronic library and information systems	2	Yes	Yes
39	Reference Services Review	2	Yes	Yes

40	Restaurator	2	Yes	Yes
41	Serials Review	2	Yes	Yes

To track the most popular research topics in the recent years, the authors selected the time range from 2008 to 2017 and exported the data from Web of Science Core Collection in September 2018 through the advanced operator by limiting the Document Type to Article and Language to English. The data was formatted to tab-delimited in MS Excel for data processing, as shown in Figure 1. There were 38,162 publication records successfully retrieved in the Web of Science-defined category of Library Science and Information Science.

PT	AU	BA	BE	GP	AF	BF	CA	TI	SO	SE	BS	LA	DT	CT	CY	CL	SP	HO	DE	ID	AB	
J	Prince, C				Prince, Christopher			Big Data a	CANADIAN JOURNAL OF INFOR	English		Article							government; informati	Offers a sl		
J	Pierson, CM				Pierson, Cameron M.			Barriers to	CANADIAN JOURNAL OF INFOR	English		Article							LGBTQ; barrier	PUBLIC-LIT	Despite cu	
J	Smiraglia, RP; Park, H				Smiraglia, Richard P.; Park, Hyo			Ontologic	CANADIAN JOURNAL OF INFOR	English		Article							data curation	CULTURAL	The purpc	
J	Apostolou, B; Belanger, F; Schaupp, LC				Apostolou, Barbara; Belanger, I			Online co	INFORMATION RESEARCH-AN I	English		Article; Pr Conferen	DEC 06-08	Wellingto	Victoria Univ	Wellington, Sch infoi	INFORMA	Introducti				
J	Atmore, AW				Atmore, Alex Wylie			Just rol	INFORMATION RESEARCH-AN I	English		Article; Pr Conferen	DEC 06-08	Wellingto	Victoria Univ	Wellington, Sch infoi	INFORMA	Introducti				
J	Boateng, H; Narayan, B				Boateng, Henry; Narayan, Bhuv			Social cap	INFORMATION RESEARCH-AN I	English		Article; Pr Conferen	DEC 06-08	Wellingto	Victoria Univ	Wellington, Sch infoi	MANAGEM	Introducti				
J	Ek, S				Ek, Stefan			Factors re	INFORMATION RESEARCH-AN I	English		Article; Pr Conferen	DEC 06-08	Wellingto	Victoria Univ	Wellington, Sch infoi	UNCERTA	Introducti				
J	Ferrara, S				Ferrara, Stephanie			The infor	INFORMATION RESEARCH-AN I	English		Article; Pr Conferen	DEC 06-08	Wellingto	Victoria Univ	Wellington, Sch infoi	SEEKING; I	Introducti				
J	Frings-Hessami, V				Frings-Hessami, Viviviane			Looking at	INFORMATION RESEARCH-AN I	English		Article; Pr Conferen	DEC 06-08	Wellingto	Victoria Univ	Wellington, Sch informat	Mana	Introducti				
J	Gorichanaz, T				Gorichanaz, Tim			Applied e	INFORMATION RESEARCH-AN I	English		Article; Pr Conferen	DEC 06-08	Wellingto	Victoria Univ	Wellington, Sch infoi	SOCIAL EP	Introducti				
J	Haines, J; Du, JT; Geursen, G; Gao, J; Trevi				Haines, Jelina; Du, Jia Tina; Ge			Understar	INFORMATION RESEARCH-AN I	English		Article; Pr Conferen	DEC 06-08	Wellingto	Victoria Univ	Wellington, Sch infoi	COMMUN	Introducti				
J	Hedvall, KN; Garden, C; Ahlynd, S; Michnii				Hedvall, Karen Nowe; Garden, S			Social me	INFORMATION RESEARCH-AN I	English		Article; Pr Conferen	DEC 06-08	Wellingto	Victoria Univ	Wellington, Sch infoi	INFORMA	Introducti				
J	Henninger, M				Henninger, Maureen			Freedom	INFORMATION RESEARCH-AN I	English		Article; Pr Conferen	DEC 06-08	Wellingto	Victoria Univ	Wellington, Sch informat	Mana	Introducti				
J	Hughes, H				Hughes, Hilary			Charrette	INFORMATION RESEARCH-AN I	English		Article; Pr Conferen	DEC 06-08	Wellingto	Victoria Univ	Wellington, Sch infoi	PUBLIC-LIT	Introducti				
J	Johnston, N; Salaz, AM				Johnston, Nicole; Salaz, A. M.			Using phe	INFORMATION RESEARCH-AN I	English		Article; Pr Conferen	DEC 06-08	Wellingto	Victoria Univ	Wellington, Sch infoi	INFORMA	Introducti				

Figure 1: Sample of Data Exported from Web of Science Core Collection

Following the instruction of Web of Science Core Collection Help (Clarivate Analytics, 2018a), the fields SO (Publication Name), DE (Author Keywords), ID (Keyword Plus), and WC (WoS Categories) were retained for further analysis. The SO fields were sorted and compared against Nixon (2014)'s journal list to retrieve 6,288 scholarly articles in Tier One's 17 journals and 7,099 in Tier Two's 24 journals.

There are two types of keywords available in the remaining dataset, including Author Keywords and Keyword Plus. According to Clarivate Analytics' (2018b) guideline, Keywords Plus is generated from the titles of cited articles by Web of Science algorithm, intending to augment traditional keywords. However, this type of keyword is not appropriate for the study because the terms generated by the algorithm is too broad to reflect a specific topic. For example, Keyword Plus contains keywords such as Information, Model, Behavior, Library, Knowledge, etc. Therefore, only Author Keywords were adopted in the study. After performing data extraction, the authors were able to extract 13,160 valid keywords from the Tier One journal articles and 27,790 from the Tier Two. The overall information and percentage of selected research keywords from the two tiers are presented in Figure 2.

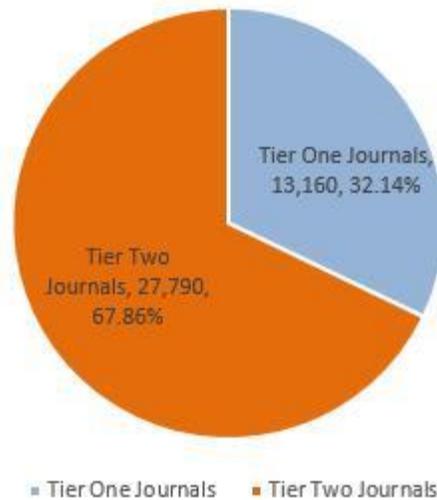


Figure 2: Pie Chart of Extracted Valid Keywords

Keyword grouping and clustering techniques had also been applied in the study to streamline the research process and to optimize the analytical results. For example, singular and plural forms (e.g. blog vs. blogs), different spellings (e.g. behavior vs. behaviour), or different phrases (e.g. academic libraries vs. university libraries) were grouped to reflect as one keyword value. Identifiable tools that belong to one category (e.g. Twitter and Facebook) or subcategories of a main category (e.g. data archive and data management) were clustered to the main category Social Media and Data respectively. Furthermore, the authors also found that some of the terms are too broad to precisely reflect a research topic in the field of librarianship, or the terms are representing a research context instead of a topic, such as Academic Librarians, Librarians, Information Science, etc. Therefore, the authors had to exclude some of these overly broad terms to include more informational ones into the study.

RESULTS

By analyzing the keywords in Tier One journals, the authors found that the total counts of top ten keywords in Tier One journal articles represent almost 15% of the total number of keywords in this category. Some of the most frequently used terms were even indexed over 200 times, including Social Media 264 times, Data 261 times, Web 245 times, and E-Government 225 times. Figure 3 depicts the top ten keywords in the most recent ten years in Tier One journals.

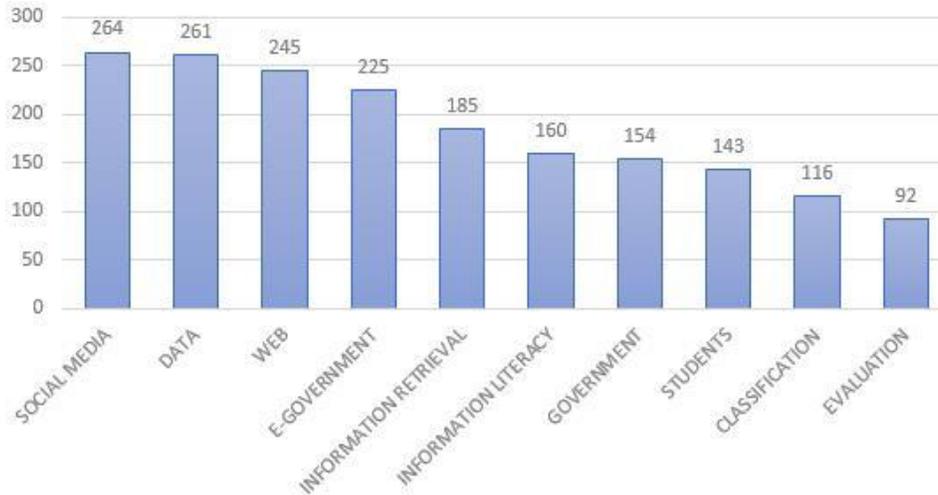


Figure 3: Tier 1 Journals – Top 10 Keywords

This finding echoed some of the recent studies. Onyancha (2018) found that Social Media is among the most frequently used keywords. The two keywords Web and Information Retrieval are also similar to the findings by Chang, Huang, and Lin (2015) and Tuomaala, Jarvelin, and Vakkari (2014).

However, this study also revealed some new terms that being identified first time as the top keywords, including Data, E-Government, Government, and Information Literacy. Moreover, some previously identified top keywords in the literature fell behind and outside of the top scale, sliding to lower places (Figure 4); these keywords include Information Seeking, Knowledge Management, and Bibliometrics (Chang, Huang, & Lin, 2015; Jabeen et al., 2015; Onyancha, 2018).

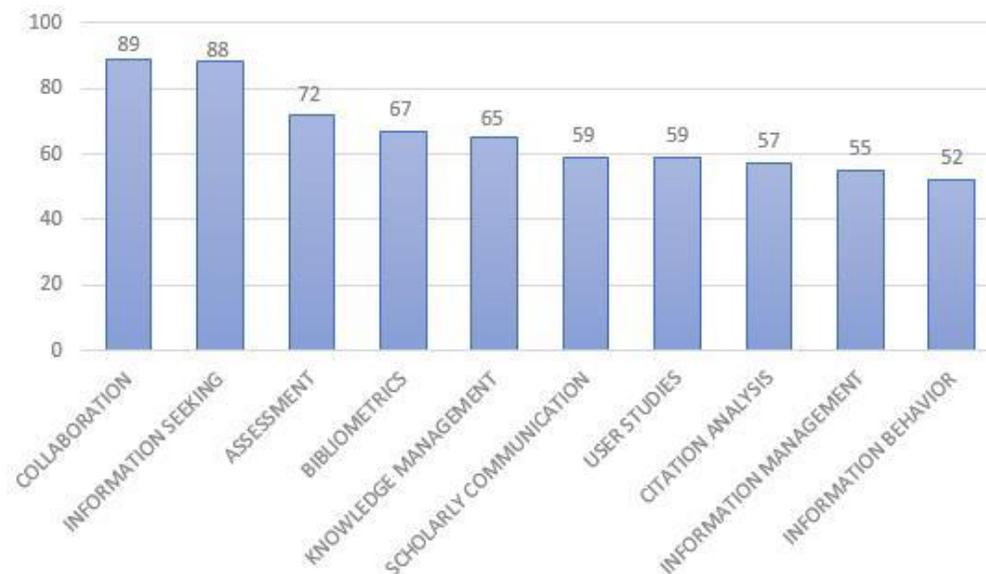


Figure 4: Tier 1 Journals – Top 11-20 Keywords

The new findings justify that when different methodology is employed, especially selection of journals, the results can be different and consequently more applicable to a certain disciplinary group of scholars. It is also because that the time period (2008-2017) selected for the study is the most recent one comparing to the previous studies. By doing this also helps the researchers in the field understand the newest trend of popular research topics.

By taking closer analysis on the keywords, the authors found that in the cluster keyword Social Media, the three specific tools Twitter, Blog, and Facebook have been used most frequently among others, while Youtube and WeChat were also quoted lightly (Figure 5). However, the popular social media tools among the youth group, such as Instagram, Snapchat, or WhatsApp were seldomly identified in the research articles.

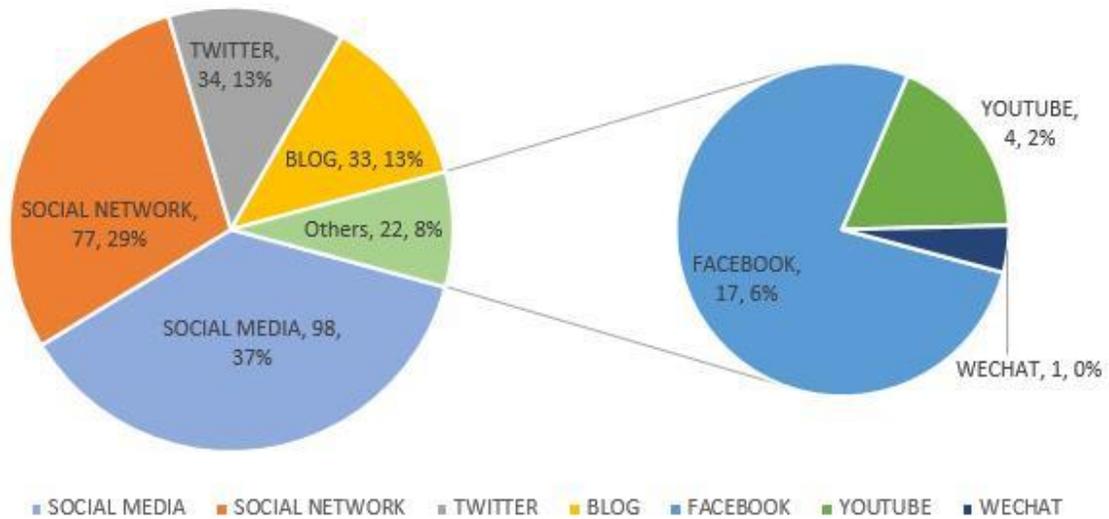


Figure 5: Breaking Down of the Keyword Social Media

Other two keywords that are interesting enough for further analysis are E-Government and Government. As shown in Figure 6, if all government related topics were clustered into one category, the research topic Government (441 occurrences) will be ranked the most popular one among all topics. However, after scrutinizing the related topics, the authors decided to separate the digital related government topics from the more traditional topics that are mostly about government collection and government librarianship. Moreover, keywords in the specific journal Government Information Quarterly contributed tremendously to the prosperousness of government related topics; because unlike other journals covering a wide range of librarianship, the journal most likely accepts only articles about government librarianship.

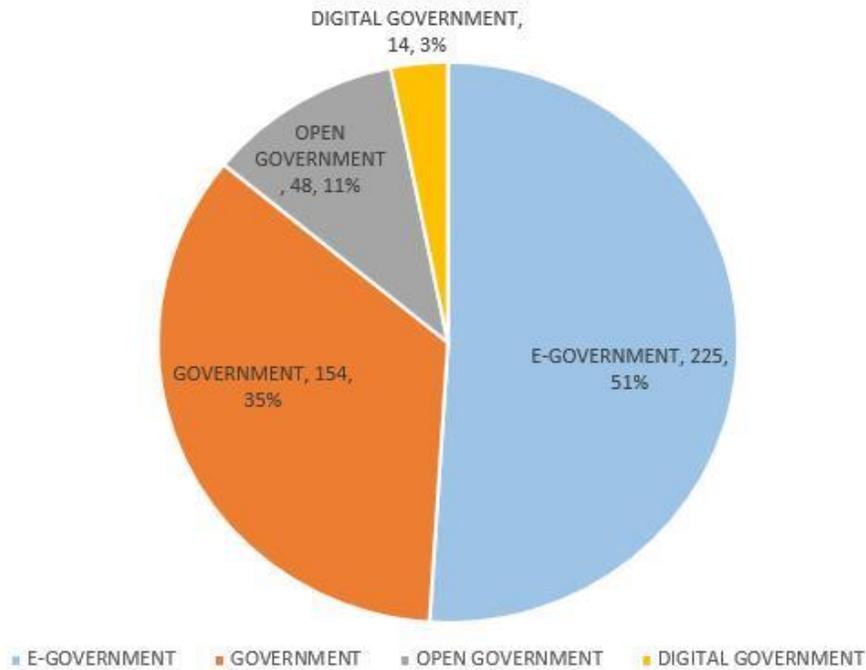


Figure 6: Breaking Down of Keywords of Government

Looking at the Tier Two journal article keywords (Figure 7), one can find that six out of top ten research topics are the same ones in Tier One journal articles and the top three topics are the same even in order. One of the other four research topics can also be found in Tier One and ranked the 11th (Collaboration). For the rest of three topics that are unique in Tier Two's top ten, like the government related topics in Tier One, these journals focusing on a certain discipline with a more specific term in the title, such as interlending, information system, and digital libraries, contribute to the three research topics' being identified as top ranked in Tier Two journals.

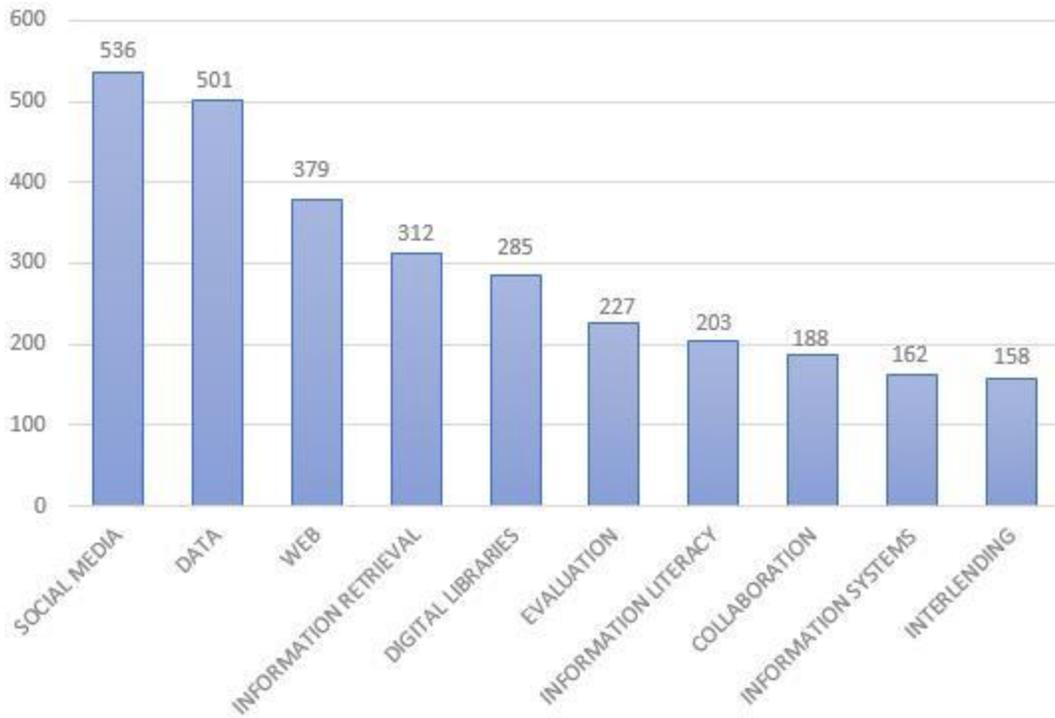


Figure 7: Tier 2 Journals – Top 10 Keywords

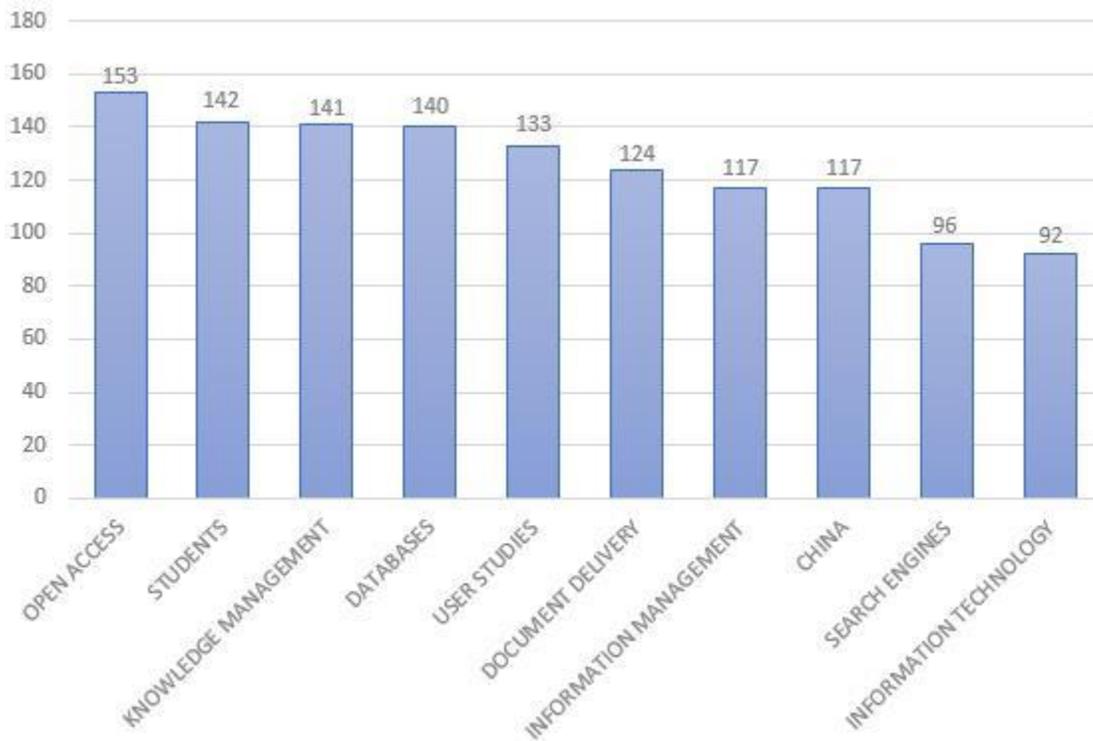


Figure 8: Tier 2 Journals – Top 11-20 Keywords

According to Figure 8, it shows that the journals in the two categories may have a slightly different scope that publish articles in different topics, because many research topics ranked from 11th to 20th are not the same as in Tier One's top 20, including open access, databases, document delivery, search engines, information technology, and China. Vice versa, there are also unique research topics among the top 11th to 20th in Tier One cannot be found in Tier Two. To have a better illustration, Table 2 outlines all top 20 research topics in both Tier One and Tier Two journals, where the same research topics are highlighted in the same colors.

From Table 2, one can find that in the top 20 popular research topics there are 11 common topics shared by Tier One and Tier Two journals. Moreover, the different research topics in the top 20 do not necessarily indicate different research interests or popular topics. It is also likely that some of the journals have a more focused scope and accept articles only in a certain research field. For example, Tier One journal list contains a journal specifically focusing on Government Information, which resulted in high aggregation of government related research topics. Similarly, the journal with a disciplinary scope of international digital library in Tier Two list results in research topic Digital Libraries being ranked in the top ten. Excluding this factor, six out of top ten research topics are the same in both category of journals.

Table 2: Top 20 Research Topics in both Tier Journals

Ranking in Tier One Journals	Top 20 Topics in Tier One Journals	Top 20 Topics in Tier Two Journals	Ranking in Tier Two Journals
1	Social Media	Social Media	1
2	Data	Data	2
3	Web	Web	3
4	E-Government	Information Retrieval	4
5	Information Retrieval	Digital Libraries	5
6	Information Literacy	Evaluation	6
7	Government	Information Literacy	7
8	Students	Collaboration	8
9	Classification	Information Systems	9
10	Evaluation	Interlending	10
11	Collaboration	Open Access	11
12	Information Seeking	Students	12
13	Assessment	Knowledge Management	13
14	Bibliometrics	Databases	14
15	Knowledge Management	User Studies	15
16	Scholarly Communication	Document Delivery	16
17	User Studies	Information Management	17
18	Citation Analysis	China	18
19	Information Management	Search Engines	19
20	Information Behavior	Information Technology	20

DISCUSSION

Based on the results, the authors believe that in the most recent decade the most popular research topics in the LIS journals are closely related to Social Media, Data, Web, Information Retrieval, Information Literacy, Students, Evaluation, Collaboration, Knowledge Management, User Studies, and Information Management; while the authors are attempted but more cautious about drawing conclusions on the research topics of government-related or digital libraries. It can also be interpreted that the popularity of these research topics has three implications: the library service transition to digital platform, the patron-centralization concept, and the emergence of data governance and librarianship.

Firstly, from these research topics the authors believe that the aggregation of Web and Social Media in both categories of scholarly journals indicate that the librarianship has transitioned to the digital service mode. The digital concept related keywords, such as Digital Libraries, Information Systems, Databases, and E-Government have also gained significant popularity in both categories of journals. The rapid development of digital technologies and the cost reduction of access to knowledge have played a critical role in this paradigm shift. From this perspective, one can also picture that librarians are playing a role as a digital enabler, not only helping patrons acquire knowledge but also enabling them of such skills.

Secondly, the appearance of keywords such as Students, User Studies, Evaluation, Open Access, Scholarly Communication, and Collaboration suggests that library service has built its framework and concept on the foundation of user-driven design. In the Tier One journals, keywords relating to human-computer interaction field are also identified in the top 20, including Information Seeking and Information Behavior. Moreover, keywords ranking from the 21st to 24th, e.g. Information Services, Information Searches, Information Use, and Information Needs, that are not presented in the above analysis, all reveal the fact that human-computer interaction studies have emerged in the practice of librarianship and library science based on the concept of user-driven design.

Finally, the emergence of Data related keywords and Knowledge Management indicates the emerging trends in both academic libraries and information institutions, focusing on data governance and institutional knowledge management. Combining the terms such as Data, Web, Open Access, Knowledge Management, and Search Engines into an overview, it should not be surprised for librarians to see the emergence of Dataset Search Engine launched by Google in September 2018, indicating the announcement of discovery search for open research data and the dominance of Schema.org as the linked data metadata schema.

CONCLUSION

Considering the limitations of the previous studies on LIS research topics, the paper employed a different selection and filtration of LIS journals that are more adhesive to library science and librarianship and utilized a keyword clustering analysis method on the data retrieved from the scholarly reliable Web of Science Core Collection. Through the analysis on the two different tier journal lists, the paper concluded that research topics in the most recent LIS journals were associated with the emerging technological and conceptual trends in the field, including the digital mode transitioning, user-centered design concept, and data governance and librarianship.

There are still some limitations in the present study, however, that need to be rectified in future studies. The datasets from Web of Science do not include all intended LIS journals originally identified by Nixon (2014) and Purdue University Libraries, which do not represent the fullest coverage of LIS journals; moreover, not all articles in the journals contain author supplied keywords. These two limitations affect the research population and valid data size, which might cause some deviations to the research result. Meanwhile, the keywords supplied by authors are not controlled vocabularies, which are inconsistent natural languages that require a data processing before the further analysis. Although author-supplied keywords are commonly used in the literature, it would be more reliable if a text-mining algorithm can be developed in future studies to generate accurate and clustered controlled vocabularies from article full texts.

REFERENCE

- Abrizah, A., Noorhidawati, A., & Zainab, A. N. (2015). LIS journals categorization in the Journal Citation Report: A stated preference study. *Scientometrics*, *102*(2), 1083-1099.
- Bichteler, J., & Eaton, E. A. (1980). The combined use of bibliographic coupling and cocitation for document retrieval. *Journal of the American Society for Information Science*, *31*(4), 278-282.
- Blecic, D. D., Wiberley Jr, S. E., De Groote, S. L., Cullars, J., Shultz, M., & Chan, V. (2017). Publication patterns of U.S. academic librarians and libraries from 2003 to 2012. *College & Research Libraries*, *78*(4), 442-458.
- Boyack, K. W., & Klavans, R. (2010). Co-citation analysis, bibliographic coupling, and direct citation: Which citation approach represents the research front most accurately? *Journal of the American Society for Information Science and Technology*, *61*(12), 2389-2404.
- Chang, Y., Huang, M., & Lin, C. (2015). Evolution of research subjects in library and information science based on keyword, bibliographical coupling, and co-citation analyses. *Scientometrics*, *105*(3), 2071-2087.
- Chen, G., Xiao, L., Hu, C. P., & Zhao, X. Q. (2015). Identifying the research focus of Library and Information Science institutions in China with institution-specific keywords. *Scientometrics*, *103*(2), 707-724.
- Clarivate Analytics. (2018a). *Web of Science Core Collection Field Tags*. Retrieved January 22, 2019, from https://images.webofknowledge.com/images/help/WOS/hs_wos_fieldtags.html
- Clarivate Analytics. (2018b). *Full Record*. Retrieved January 22, 2019, from https://images.webofknowledge.com/images/help/WOS/hp_full_record.html
- Fteimi, N., & Lehner, F. (2016). Main research topics in knowledge management: A content analysis of ECKM publications. *Electronic Journal of Knowledge Management*, *14*(1), 5-17.
- Google. (2018). *Making it easier to discover datasets*. Retrieved March 24, 2019, from <https://www.blog.google/products/search/making-it-easier-discover-datasets/>.
- Herther, N. K. (2009). Research evaluation and citation analysis: key issues and implications. *The Electronic Library*, *27*(3), 361-375.

- Hou, J., Yang, X., & Chen, C. (2018). Emerging trends and new developments in information science: a document co-citation analysis (2009-2016). *Scientometrics*, *115*(2), 869-892.
- Huusko, L. (1992). Content analysis of 1965 research articles in the library and information science. Tampere, Finland: University of Tampere, Department of Information Studies, MSc, Thesis.
- Iwami, S., & Sakata, I. (2015). Growing topics and emerging researches in science. In *ISPIM Conference Proceedings* (p. 1). The International Society for Professional Innovation Management (ISPIM).
- Jabeen, M., Yun, L., Rafiq, M., Jabeen, M., & Tahir, M. A. (2015). Scientometric analysis of library and information science journals 2003–2012 using web of science. *International Information & Library Review*, *47*(3-4), 71-82.
- Jarvelin, K., & Vakkari, P. (1990). Content analysis of research articles in library and information science. *Library and Information Science Research*, *12*(4), 395-421.
- Järvelin, K., & Vakkari, P. (1993). The evolution of library and information science 1965–1985: A content analysis of journal articles. *Information Processing & Management*, *29*(1), 129-144.
- Joo, S., & Cahill, M. (2018). Exploring research topics in the field of school librarianship based on text mining. *School Libraries Worldwide*, *24*(1), 15-28.
- Kessler, M. (1963). Bibliographic coupling between scientific papers. *Journal of American Documentation*, *14*(1), 10-25.
- Khan, G. F., & Wood, J. (2015). Information technology management domain: Emerging themes and keyword analysis. *Scientometrics*, *105*(2), 959-972.
- Kumpulainen, S. (1991). Library and information science research in 1975: Content analysis of the journal articles. *Libri*, *41*(1), 59-76.
- Liu, G. (2018). *Hot topics in recent LIS publications*. Presentation from the 9th Shanghai International Library Forum (SILF 2018).
- Lyu, P. H., Yao, Q., Mao, J., & Zhang, S. J. (2015). Emerging medical informatics research trends detection based on MeSH terms. *Informatics for Health and Social Care*, *40*(3), 210-228.
- Ma, R. (2012). Author bibliographic coupling analysis: A test based on a Chinese academic database. *Journal of Informetrics*, *6*(4), 532-542.

- Moed, H. F. (2006). *Citation analysis in research evaluation* (Vol. 9). Springer Science & Business Media.
- Névéol, A., Doğan, R. I., & Lu, Z. (2010). *Author keywords in biomedical journal articles*. Retrieved December 11, 2018, from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3041277/>.
- Nixon, J. M. (2014). Core journals in library and information science: Developing a methodology for ranking LIS journals. *College & Research Libraries*, 75(1), 66-90.
- Onyancha, O. B. (2018). Forty-five years of LIS research evolution, 1971–2015: An informetrics study of the author-supplied keywords. *Publishing Research Quarterly*, 1-15.
- Qiu, J. P., Dong, K., & Yu, H. Q. (2014). Comparative study on structure and correlation among author co-occurrence networks in bibliometrics. *Scientometrics*, 101(2), 1345-1360.
- Sharabchiev, J. (1989). Cluster analysis of bibliographic references as a scientometric method. *Scientometrics*, 15(1-2), 127-137.
- Small, H. (1973). Co-citation in the scientific literature: A new measure of the relationship between two documents. *Journal of the American Society for information Science*, 24(4), 265-269.
- Small, H., Boyack, K. W., & Klavans, R. (2014). Identifying emerging topics in science and technology. *Research Policy*, 43(8), 1450-1467.
- Tsay, M. Y., Xu, H., & Wu, C. W. (2003). Author co-citation analysis of semiconductor literature. *Scientometrics*, 58(3), 529-545.
- Tuomaala, O., Järvelin, K., & Vakkari, P. (2014). Evolution of library and information science, 1965-2005: Content analysis of journal articles. *Journal of the Association for Information Science and Technology*, 65(7), 1446-1462.
- Walters, W. H., & Wilder, E. I. (2016). Disciplinary, national, and departmental contributions to the literature of library and information science, 2007-2012. *Journal of the Association for Information Science and Technology*, 67(6), 1487-1506.
- Yan, E., & Ding, Y. (2012). Scholarly network similarities: How bibliographic coupling networks, citation networks, co-citation networks, topical networks, co-authorship networks, and co-word networks relate to each other. *Journal of the American Society for Information Science and Technology*, 63(7), 1313-1326.

- Yang, S., Han, R., Wolfram, D., & Zhao, Y. (2016). Visualizing the intellectual structure of information science (2006–2015): Introducing author keyword coupling analysis. *Journal of Informetrics*, *10*(1), 132-150.
- Zhao, D., & Strotmann, A. (2008). Evolution of research activities and intellectual influences in information science 1996–2005: Introducing author bibliographic-coupling analysis. *Journal of the American Society for Information Science and Technology*, *59*(13), 2070-2086.
- Zhao, D., & Strotmann, A. (2014). The knowledge base and research front of information science 2006–2010: An author co-citation and bibliographic coupling analysis. *Journal of the Association for Information Science and Technology*, *65*(5), 995-1006.

Appendix 1: Complete Nixon's List of Scholarly Journals

No.	Journal Title	Nixon's Tier	Peer-Review	Web of Science Index	Included in the Study
1	Aslib Proceedings	1	Yes	Yes	Yes
2	College & Research Libraries	1	Yes	Yes	Yes
3	Collection Management	1	Yes	Yes	Yes
4	Government Information Quarterly	1	Yes	Yes	Yes
5	Information Technology & Libraries	1	Yes	Yes	Yes
6	Journal of Academic Librarianship	1	Yes	Yes	Yes
7	Journal of Documentation	1	Yes	Yes	Yes
8	Journal of Information Science	1	Yes	Yes	Yes
9	Journal of the American Society for Information Science and Technology	1	Yes	Yes	Yes
10	Journal of the Medical Library Association	1	Yes	Yes	Yes
11	Library Collections, Acquisitions, and Technical Services	1	Yes	Yes	Yes
12	Library & Information Science Research	1	Yes	Yes	Yes
13	Library Journal	1	No	No	No
14	Library Quarterly	1	Yes	Yes	Yes
15	Library Resources & Technical Services	1	Yes	Yes	Yes
16	Library Trends	1	Yes	Yes	Yes
17	Libri	1	Yes	Yes	Yes
18	Reference & User Services Quarterly	1	Yes	Yes	Yes
19	Archival Science	2	Yes	No	No
20	Canadian & Undergraduate Libraries	2	Yes	Yes	Yes
21	College & Undergraduate Libraries	2	Yes	Yes	Yes
22	The Electronic Library	2	Yes	Yes	Yes
23	First Monday (Chicago)	2	Yes	No	No
24	Health Information and Libraries	2	Yes	Yes	Yes
25	Information Development	2	Yes	Yes	Yes
26	Information Processing &	2	Yes	Yes	Yes

	Management				
27	Information Research	2	Yes	Yes	Yes
28	The Information Society: an International Journal	2	Yes	Yes	Yes
29	Information Science	2	Yes	No	No
30	Interdisciplinary Journal of Information, Knowledge, and Management	2	Yes	No	No
31	Interlending & Document Supply	2	Yes	Yes	Yes
32	International Information and Library Review	2	Yes	No	No
33	International Journal of Information Management	2	Yes	Yes	Yes
34	International Journal on Digital Libraries	2	Yes	Yes	Yes
35	Issues in Science and Technology Librarianship	2	Yes	No	No
36	Journal of Agricultural & Food Information	2	Yes	No	No
37	Journal of Business & Finance Librarianship	2	Yes	Yes	Yes
38	Journal of Digital Information	2	Yes	No	No
39	Journal of Education for Library and Information Science	2	Yes	No	No
40	Journal of Engineering Education	2	Yes	No	No
41	Journal of Information Technology	2	Yes	Yes	Yes
42	Journal of Librarianship and Information Science	2	Yes	Yes	Yes
43	Journal of Scholarly Publishing	2	Yes	Yes	Yes
44	Knowledge Quest	2	Yes	No	No
45	Law Library Journal	2	Yes	Yes	Yes
46	Libraries & the Cultural Record	2	Yes	Yes	Yes
47	Library Hi Tech	2	Yes	Yes	Yes
48	Online Information Review	2	Yes	Yes	Yes
49	Portal	2	Yes	Yes	Yes
50	Program: electronic library and information systems	2	Yes	Yes	Yes
51	Public Library Journal	2	Yes	No	No

52	Reference Services Review	2	Yes	Yes	Yes
53	Restaurator	2	Yes	Yes	Yes
54	The Serials Librarian	2	Yes	No	No
55	Serials Review	2	Yes	Yes	Yes
56	American Libraries	3	No	No	No
57	College & Research Libraries News	3	No	No	No
58	D-Lib Magazine	3	No	No	No
59	Information Outlook	3	No	No	No
60	Online: Exploring Technology & Resources for Information Professionals	3	No	No	No
61	Public Libraries	3	No	No	No
62	School Library Journal	3	No	No	No