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Trends in Research Librarianship Literature: A Social Network Analysis of Articles

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Abstract

The purpose of this article is to identify the bibliometric characteristics of research librarianship literature and to visualize relationships in research librarianship by means of social network analysis. It was found out that the majority (66%) of the articles had single authorship and *College & Research Libraries* is the prominent actor among the research librarianship journals. It was also observed that Peter Hernon is the most productive and cited author in the field. The findings of this study can be used by the research librarianship community to better understand their core literature.

Key Words: research librarianship; bibliometrics; social network analysis

Introduction

The world is changing rapidly. Many factors, such as socio-economical developments, technological developments and globalization determine the speed and direction of these changes. Academic disciplines must try to keep pace with these changes and need to revise their research areas. In turn, academic departments at universities have been changing over time and have also been revising undergraduate programmes. Such scientific evolutions have traditionally engaged the attention of bibliometric researches. Bibliometrics aims to clarify the nature of scholarly communications and reveal trends in scientific disciplines. Although new data sources such as *Scopus* and *Google Scholar* have been added to the bibliometric environment over time, generally, citation indexes such as *Science Citation Index*, *Social Sciences Citation Index*, *Arts and Humanities Citation Index* serve as the primary data source for bibliometric researches.

Bibliometricians aim to understand new trends in scholarly communication through articles and their references. The references or citations cumulatively show the most important topics that were dealt by the scholars. The process of scientific communication is affected by many factors, mainly information technologies, and the structure of scientific communication changes over time. In order to better understand the literature and the direction of new tendencies in different scientific disciplines, these changes and their impact should be investigated. In this study the research librarianship literature was investigated by using bibliometric data and findings were visualized by social network analysis method.

Literature Review

Many studies have examined research trends in different disciplines in the literature (Hu, Ma, Zhang, Gan and Ho, 2010; Ohniwa, Hibino and Takeyasu, 2010; Upham and Small, 2010; Zhang, Xie and Ho, 2010). In these studies, along with various bibliometric analyses, co-word analyses of articles were conducted and the structures of disciplines were investigated. Recent researches have begun to use social network analysis to represent data graphically.

Social network analysis is a method which is often used by disciplines of sociology, anthropology, communication, economics and mathematics. As

an interdisciplinary research area, social network analysis is used to examine and describe the structure of communities. It also helps to visualize and model the relationships between communities which cannot be observed easily. The studies modeled by social network analysis focus on the contacts and relations within the communities (Freeman, 2004; Scott, 1988).

In a study which aimed to draw inferences on international collaboration by using co-author relationships (Leydesdorff and Wagner, 2008), articles published in 1990, 2000 and 2005 were investigated and the changes in the subjects of articles that were produced by collaborating authors from different countries were analyzed. The study showed that international collaboration in the production of scientific papers had increased significantly over time. It was also observed that the number of countries in the collaboration network was increasing as well. After normalization it was found out that France and Russia became prominent as important actors among other countries in terms of producing scientific publications (Leydesdorff and Wagner, 2008, p. 321). In another study that analyzed the collaboration network of different countries in six different disciplines (astrophysics, geophysics, mathematical logic, polymers, soil science and virology), it was concluded that international connections might differ from discipline to discipline and that more research was needed that would deal with co-authorship analysis in different disciplines (Wagner, 2005).

In addition to co-authorship analysis, there are also studies in the literature that work on author co-citations and that map the intellectual structure of different scientific disciplines (McCain, 1986; White and Griffith, 1981). The general assumption behind this genre of studies is, that the more authors are co-cited, the stronger will be the bond they have. This means that authors who conduct similar studies and receive co-citations over and over again tend to cluster together on the map. In this way, some inferences could be made, such as which author(s) groups' studies should be followed carefully. Similarly, by analyzing common terms in the documents, some maps could be produced that display the subjects studied in different fields (Van Den Besselaar and Heimeriks, 2006). As these maps are examined over time, transitions between and links among the disciplines become clear as well as thematic orientations.

In social network analysis studies which use bibliometric data, variables such as articles, citations, co-citation networks, collaborating authors or institutions

are examined. Some concepts are widely used; one of them is 'centrality' (Otte and Rousseau, 2002, p. 441). There are different measures of centrality. Degree centrality, closeness centrality and betweenness centrality are among the most frequently used centrality measures. A unit's degree centrality indicates the number of links that the unit has. Closeness centrality, on the other hand, is the degree of the closeness of a unit to others directly or indirectly. Closeness is the sum of the inverse of a unit's shortest distance to other units. It also reflects how fast a unit can connect to other units in the network. Betweenness is the degree of location of a unit among other units in a network. It shows at which level a unit is connected to other units that are not directly linked to each other. Any unit with a high degree of betweenness acts as an important bridge on the network (Otte and Rousseau, 2002, pp. 442–443). In a study that used the *Journal Citation Reports* journals it was concluded that the betweenness centrality for scientific journals is an indicator of the journals' multidisciplinary approach (Leydesdorff, 2007, p. 1303). For instance, important journals in a network of different scientific fields were identified by using degree centrality, closeness centrality and betweenness centrality techniques (Gao and Guan, 2009).

Methodology

The purpose of this study is to identify the bibliometric characteristics of research librarianship literature and to visualize relationships in research librarianship. The data used in this study are obtained from Thomson Reuters' *Social Sciences Citation Index* (*SSCI*). We searched *SSCI* on January 20, 2010 to identify the 'research librarianship' articles published in the 'Information Science & Library Science' category. To obtain the data, 'research libra*' was entered in the 'topic' field. Our study covers the years between 1956 (which is the publication year of the first research librarianship-related article in *SSCI*) and 2010. A total of 664 articles were identified (Figure 1).

It was observed that some journals have changed their names over time. To be able to make accurate evaluations, changes in the names of journals were determined and all the data belonging to the ones that changed their names were classified under their new names. Some examples are given in Table 1.

We investigated the articles which were written on the 'research librarianship' topic, within the scope of citation indexes. This study will therefore address the following research questions:

Fig. 1: Screenshot of the results page.

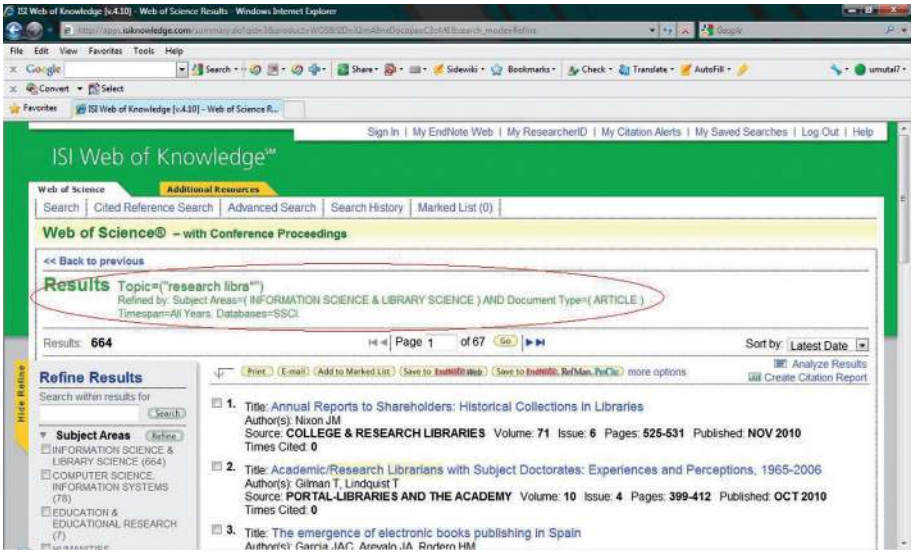


Table 1: Some of the journals that changed their names over time.

Old name	New name
Bulletin of the Medical Library Association	Journal of the Medical Library Association
Information Storage and Retrieval	Information Processing & Management
International Library Review	International Information & Library Review
Journal of the American Society for Information Science	Journal of the American Society for Information Science and Technology
Journal of Library Automation	Information Technology and Libraries
Library Acquisitions Practice & Theory	Library Collections Acquisitions & Technical Services
RQ	Reference & User Services Quarterly

- Who are the most productive and most cited authors in the field of research librarianship? What are the relationships among these authors?
- Which journals publish more articles on research librarianship and which ones are highly cited in the literature and can be named as the core journals in this field?

- What are the most frequently used words in the abstracts of articles related to research librarianship and what is the frequency of common usage of these words in different articles?
- Which new words related to research librarianship are added to the literature over time?

It is important to answer these questions, because new researchers who study research librarianship, should become aware of core journals and researchers, and the changes in research topics. In addition, the answers to these questions may help researchers to gain deeper insights into the discipline of research librarianship.

After determining the research librarianship literature, the social network analysis method was used to better understand the relations between authors and journals. We used CiteSpace application software which is designed as a tool for social network analysis. It is a Java application which analyzes and visualizes co-citation networks (Chen, 2004). CiteSpace supports structural and temporal analyses of a variety of networks derived from scientific publications (Chen, 2010). Publications, journals and authors networks have been examined by many studies using CiteSpace (Larsen, 2008; Liang, Liu, Yang, and Wang, 2008; Tonta and Darvish, 2010).

Findings

There were 664 research librarianship articles indexed in the *SSCI* between the years 1956 and 2010. Figure 2 shows the gradual increase in the number of articles related to research librarianship in five-year periods. The number of articles did not increase much until the 1990s. A total of 222 articles were identified during the first 35 years (1956–1990), constituting only one-third of the total number of articles in this study. Yet the number of articles has more than doubled (442) within the last 20 years (1991–2010), making up the remaining 67% of all articles under review.

Research librarianship articles appeared in 58 different journals. More than 60% of the articles were published in nine different journals, while the rest appeared in 49 journals. There were nine journals which published 21 or more articles on research librarianship. Some 60% (399 articles) of all articles appeared in those nine journals listed in Table 2.

Fig. 2: Number of research librarianship articles in the SSCI database (N = 664).

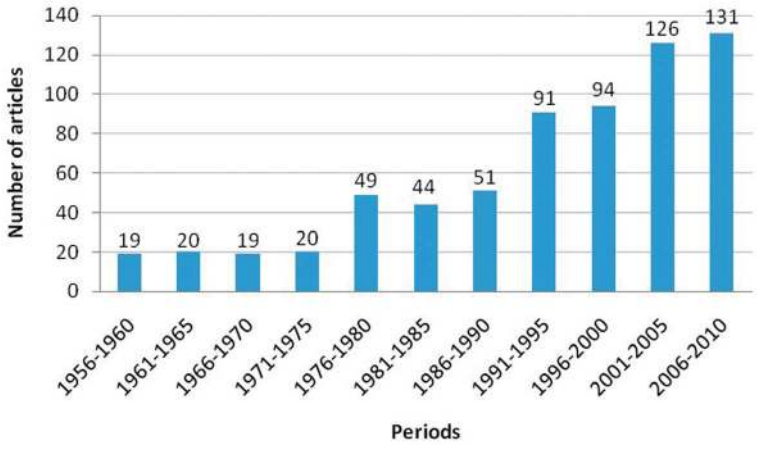


Table 2: Journals which published 21 or more articles on research librarianship.

Journal	N
College & Research Libraries	137
Journal of Academic Librarianship	50
Library Resources & Technical Services	49
Library Trends	39
Portal-Libraries and the Academy	32
Zentralblatt für Bibliothekswesen	28
Library Collections Acquisitions & Technical Services	22
Information Technology and Libraries	21
Interlending & Document Supply	21

Table 3 provides the number of unique articles that cite a particular journal. *College & Research Libraries* has been cited in 231 different articles. This journal is followed by *Journal of Academic Librarianship*, *Library Journal*, *Library Trends*, respectively. *College & Research Libraries* is the most highly cited and the most preferred journal for publications in research librarianship. As can be seen from Tables 2 and 3, *Portal-Libraries and the Academy*, *Zentralblatt für Bibliothekswesen* and *Interlending & Document Supply* were not on the list of most frequently cited journals although they were three of the most preferred journals for publications in research librarianship. In general, it could be said that authors' preferences for journals seemed to be similar for publication and for citation.

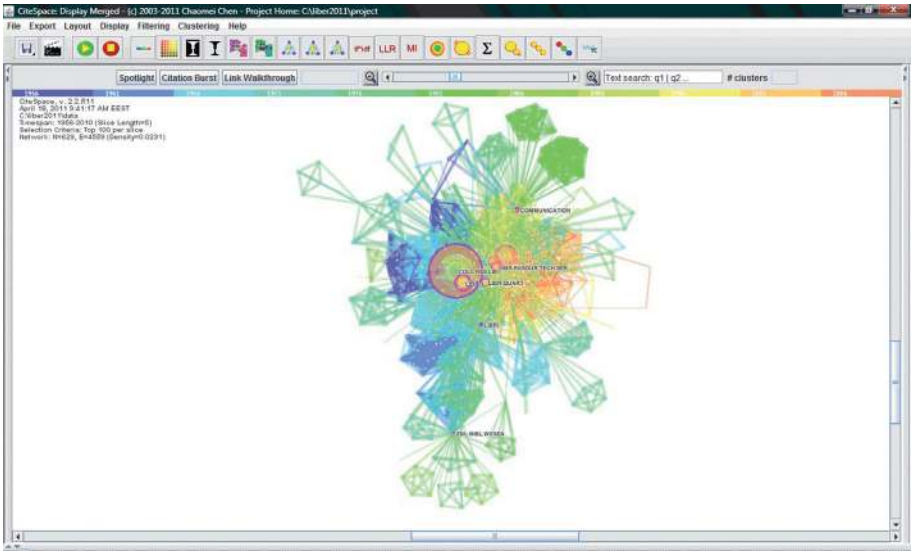
Table 3: Top 20 most frequently cited journals in research librarianship literature.

Rank	Journal	# of citations
1	College & Research Libraries	231
2	Journal of Academic Librarianship	138
3	Library Journal	107
4	Library Trends	90
5	Library Resources & Technical Services	80
6	Journal of the American Society for Information Science and Technology	73
7	Library Quarterly	65
8	Journal of Library Administration	56
9	Serials Librarian	46
10	Collection Management	44
10	Reference & User ServiceS Quarterly	44
12	Information Technology and Libraries	43
13	American Libraries	40
14	Communication	39
15	Journal of Documentation	36
16	College & Research Libraries News	35
17	Library Collections Acquisitions & Technical Services	34
18	Journal of the Medical Library Association	33
18	Library and Information Science Research	33
18	Libri	33

The journal co-citation network contains the most frequently cited 629 journals and 4559 co-citation links among them. Figure 3 displays the journals which have high betweenness centrality. *College & Research Libraries* has the highest centrality ratio (0.27) and papers which appeared in it have been cited since 1956 by authors of research librarianship articles. Other highest betweenness centrality ratios belong to *Library Journal* (0.26), *Communication* (0.24), *Libri* (0.21), *Zentralblatt für Bibliothekswesen* (0.15), *Library Resources & Technical Services* (0.13), and *Library Quarterly* (0.13). This means these seven journals are core nodes that make connections to other nodes in the research librarianship journal co-citation network. While *College & Research Libraries*, *Library Journal*, *Libri*, *Library Resources & Technical Services* and *Library Quarterly* connect the core librarianship journals, *Communication* links journals that were not directly related to librarianship and *Zentralblatt für Bibliothekswesen* connects German journals.

The majority (66%) of the articles had single authorship. Articles with multiple authors constituted 34% of all articles. There were 167 articles with two authors, 45 with three authors, and 11 with four authors. Only three articles

Fig. 3: Journal co-citation network of research librarianship, 1956–2010 (centrality).



had five or more authors. The highest number of contributors to a single article was eight.

The total number of different authors contributing to 664 articles was 840. Six percent of all articles were produced by the nine most prolific authors (Table 4). The overwhelming majority (90%) of authors contributed to the research librarianship literature with only a single article.

Table 4: The most prolific authors of research librarianship.

Author	N
Karen Schmidt	6
Tina Chrzastowski	5
Colleen Cook	5
Peter Hernon	5
Susan Lazinger	5
Richard Dougherty	4
Peter Graham	4
Mary Jackson	4
Lewis Guodo Liu	4

Although one of the most cited authors in our study was a corporate body (Association of Research Libraries), corporate bodies were not included in Table 4. Except for Peter Hernon and Richard Dougherty, who were the most cited authors by different articles, Table 4 does not include any authors from Table 5. In general, it could be said that those who wrote articles and those whose articles were cited, were different people in research librarianship literature.

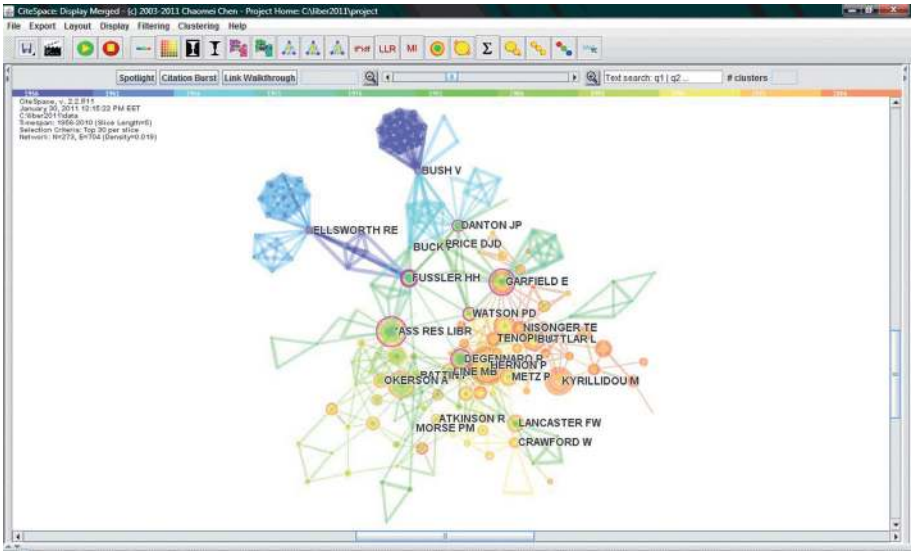
Table 5: Top 20 most frequently cited authors in research librarianship literature.

Author	# of unique articles that cite a particular author	# of total citations
Peter Hernon	31	45
Martha Kyrillidou	23	46
Herbert S. White	22	31
Eugene Garfield	19	45
John M. Budd	18	20
Lois Buttlar	18	19
Richard Dougherty	15	21
Paul Metz	15	15
Beverly P. Lynch	14	16
Richard DeGennaro	14	19
Maurice B. Line	14	27
F. Wilfrid Lancaster	14	20
Hong Xu	12	13
Ann Okerson	12	14
Thomas E. Nisonger	12	25
Blaise Cronin	12	15
Carol Tenopir	12	25
Mary Jo Lynch	12	14
Christine L. Borgman	11	21
Michael Gorman	11	13

The author co-citation network contains the most frequently cited 273 authors and 704 co-citation links among them. Figure 4 shows the authors who have high betweenness centrality. Among them Herman Fussler, Eugene Garfield, Richard DeGennaro, Ralph E. Ellsworth and J. Periam Danton came to the fore since they have the highest betweenness centrality. This means these five authors are core nodes that make connections to other nodes in the research librarianship literature network. On the other hand, Fussler, Ellsworth and Danton were not included in Table 5 which listed the most frequently cited 20 authors.

Figure 5 shows a document co-citation network derived from the citing behaviour of authors writing on research librarianship. This network is a result of

Fig. 4: Author co-citation network of research librarianship, 1956–2010 (centrality).

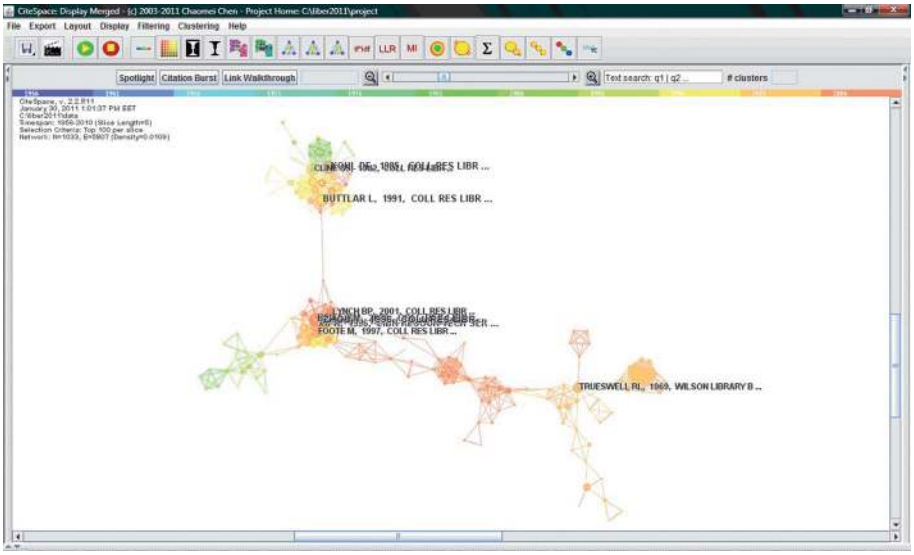


merging 11 five-year document co-citation networks within a time span of 55 years (1956–2010). The document co-citation network consists of 1033 documents and there are 5807 co-citation links between these 1033 documents in the network. The colours are very important as they show the first connection between the two documents. Eight of the most frequently co-cited ten documents are published in *College & Research Libraries*, while the remaining two are published in *Library Resources & Technical Services* and *Wilson Library Bulletin* (Full bibliographic records for all articles in Figure 5 are given in the Appendix).

In Figure 5, three main clusters were observed in the network. One of them was related to bibliometrics (especially analyzing journals) and contained papers by Kohl and Davis (1985), Buttlar (1991) and Cline (1982). Papers of Zhou (1996), Xu (1996), Beile and Adams (2000), Reser and Schuneman (1992) and Foote (1997) about the 'academic library job market' formed the second cluster. The third cluster revolved around Trueswell's famous article (1969) on patterns of library users, which introduced the 20/80 rule.

We also studied the network structure of words' co-occurrences in research librarianship. For this process noun phrases were extracted from titles and

Fig. 5: The network of co-cited documents on research librarianship (1956–2010) based on 11 five-year time slices.



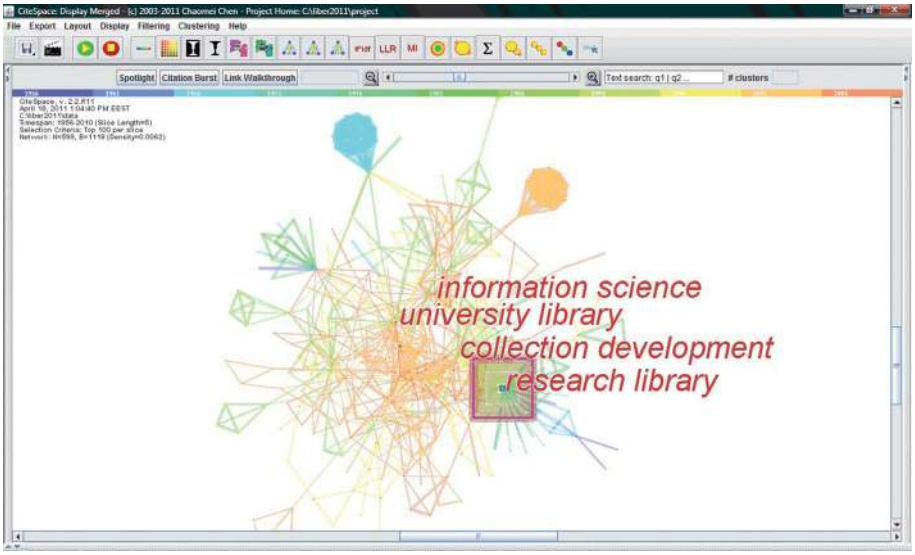
abstracts of articles. The noun phrase 'research library' has a pivotal node and it is the most recurrent noun phrase. It is understood that the authors generally preferred to use the term 'research library' instead of 'academic library' or 'university library'.

The most frequently used words in the titles, abstracts, descriptors and identifiers are 'research library', 'collection development' and 'electronic resources', respectively. It is observed that the highest centrality ratios of noun phrases are 'research library', 'information science', 'collection development', and 'university library' (Figure 6). We did not notice any important new words being added to the literature over time. Particular noun phrases have continued to stay in use.

Conclusions

Social network analysis is frequently used to examine the structure of communities, describe the constructions of networks and model the existing con-

Fig. 6: The network of co-occurred noun phrases in research librarianship literature (1956–2010).



nections by visualizing the relationships between communities. The findings of this study can be used by the research librarianship community to better understand their core literature.

The references of the articles related to research librarianship showed that the discipline does not seem to be very extroversive. In other words, the cited authors and journals generally emerged from within the discipline's own dynamics. It was observed that *College & Research Libraries* has become the prominent actor among the journals in the field in terms of publishing and citing articles in research librarianship literature. In addition, eight of the most frequently co-cited ten documents are published in *College & Research Libraries*.

Karen Schmidt, Tina Chrzastowski, Colleen Cook, Peter Hernon, Susan Lazinger, Richard Dougherty, Peter Graham, Mary Jackson, and Lewis Guodo Liu were the most prolific authors of research librarianship literature. On the other hand, the most cited author was Association of Research Librarianship, a corporate body. The study has also revealed the importance of this associa-

tion. Peter Hernon seemed to be the most prominent author in terms of productivity and citedness.

Unfortunately, new research areas which might have been added to the research librarianship literature over time were not visible in CiteSpace due to a lack of data. Presumably, if the key words had been more specific and some articles did not lack abstracts, CiteSpace would have provided more significant results.

Appendix

The most frequently co-cited ten documents in research librarianship literature within the scope of *SSCI*

- Zhou, Y. (1996), 'Analysis of trends in demand for computer-related skills for academic librarians from 1974 to 1994,' *College & Research Libraries*, 57(3): 259–272.
- Kohl, D.F. and Davis, C.H. (1985), 'Ratings of journals by ARL library directors and deans of library and information science schools,' *College & Research Libraries*, 46(1): 40–47.
- Buttlar, L. (1991), 'Analyzing the library periodical literature: Content and authorship,' *College & Research Libraries*, 52(1): 38–53.
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