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Scholarly research in LIS open access electronic journals: A bibliometric study

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Using 17 fully open access electronic journals published uninterruptedly during 2000–2004 in the field of Library and Information Science the present study investigated the trend of LIS Open Access e-journals' literature by analysing articles, authors, institutions, countries, subjects, & references. Quantitative content analysis was carried out on the data, data were analysed in order to project literature growth, authorship pattern, gender pattern, cited references pattern and related bibliometric phenomena. The analysis indicates that there were as many as 1636 articles published during 2000–2004 with an average increment of 23.75 articles per year. The authorship pattern indicates that team research has not been very common in LIS OA publishing and male authors were keener than female authors. Authors from academic institutions were paid more interest in OA publishing and most of them were from developed nations. The subject coverage of these OA e-journals was very vast and almost all facets of information and library science were covered in these articles. There were 90.10% of articles of these e-journals contained references and on an average an article contained 24 references. Of these, 38.53% of references were hyperlinked and 87.35% of hyperlinked references were live during investigation. The analysis of data clearly indicates that OA e-journals in LIS are rapidly establishing themselves as a most viable media for scholarly communication.

Introduction

The process of scholarly communication has changed through history. Just as Gutenberg's invention of movable type replaced the '*Shruti'* (or oral) communication process of the ancients, so, too, has Charles Babbage's invention of computers replaced paper with the less-paper world. Although the mode of delivery of scholarly communication has changed from the oral to the written to the printed and now to the electronic, the form and function of scholarly communication means have remained essentially unchanged in the last three centuries. One of the most important means of scholarly communication is journal. Scholarly communication through journals was first reported in 1665 [PEEK, 1996; FJALLBRANT, 1997]. During the last three hundred and forty years, information technology – from moveable type to electronic bits – has considerably influenced this most important means of scholarly communication. However, over the past two decades, journal prices – print and electronic both have certainly increased faster than inflation [KING & AL., 1981; TENOPIR & KING, 2000],

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which further hindered the accessibility of scholarly journals. "What is the value of scientific research if the results are not shared freely?" – has become the question among scholars internationally. The "open access" (OA) movement, which calls for the free availability of research literature, was born out of a wide range of issues. Most prominently of them may be the discontent with rising costs. During 1995–1997 there have been an increases in number of research journals which are available freely on the Web. The main goal of these scholarly open access electronic journals is to bridge the gap between digitally divided scholars by solving the *pricing and permission crises* that have imbalanced the scholarly communication process.

In Library and Information Science (LIS), like all other disciplines, a considerable amount of literature is now being published in open access electronic journals (e-journals). It may be interesting to investigate the impact of LIS OA e-journals in terms of articles, authors, institutions, countries, subjects, cited references and to identify the core OA e-journals in LIS. Quantitative techniques especially 'bibliometrics' may be most acceptable techniques in LIS research for measuring impact. A pioneering study has been performed by GARVEY & GRIFFITH [1971]. WHITE & MCCAIN [1989] noted that bibliometrics studies comprise fully half of the entire field of information science. Most of these bibloimetrics studies were based on information use studies [BROWN, 1999] usually based on surveys [VOORBIJ, 1999] or citation analysis study [NISONGER, 1999].

Bibliometric exploration of important journals in library and information science (e.g., [SARACEVIC & PERK, 1973; OLSGAARD & OLSGAARD, 1980; CLINE, 1982; RAVICHANDRA RAO, 1983; SINGH, 1983; SEN & CHATTERJEE, 1990; SENGUPTA, 1990; CARTER & KASCUS, 1991; STEPHENSON, 1993; MAHAPATRA, 1994; SMIRAGLIA & LEAZER, 1995; TERRY, 1996; AL-GHAMDI & AL., 1998; BATES, 1999; CANO, 1999; KOEHLER & AL., 2000; SAHOO, 2002]) has already been well documented. Articles published in scholarly LIS journals reflect changes in the interests and concerns of their author constituencies, and the discipline. These changes have been documented through various studies on bibliometric analyses of journal content (e.g. [JARVELIN & VAKKARI, 1990; JARVELIN & VAKKARI, 1993; BUCKLAND, 1999; CANO, 1999]). But, there is still less amount of literature reported regarding bibliometric study of purely OA LIS only e-journals. HAWKINS [2001] in his study examined 28 e-journals of LIS field, out of which most are OA. Among these, he identified six core journals viz. *Ariadne, D-Lib Magazine, Journal of Electronic Information, First Monday, Information Research* and *Issues in Science and Technology Librarianship* by using Bradford Law. He also examined the coverage of information science e-journals in ISA, LISA, LibLit, INSPEC, ERIC, PAIS, SSCI, SSCI (CW) database. The study as mentioned by author, is based upon a previous study conducted by JACSO [2001] by using 10 OA e-journals.

This study was restricted to the then available OA e-journals published up to 2001. To the best of my knowledge after the study of HAWKINS [2001] no research yet reported regarding quantitative aspects of LIS OA e-journals published during 2000–2004.

Method of study

Since this study has been designed to analyse the bibliometric phenomena of LIS OA e-journals, the use of the survey method has been found suitable. The survey method is an acceptable device for collecting data or factual information on certain decided characteristics or items of a universe of population. FOWLER [1988] also defined survey as "data collection and measurement process". The research was conducted during March 2005 to March 2007. This research focuses on scholarly OA electronic journals that publish articles reporting scholarship or research that are refereed or scholarly/peer-reviewed. Other types of publications – newsletters, non-refereed Web based magazines and the like, are not subject of the present study.

In order to know the authoritative URLs of OA e-journals in LIS discipline three well known non-print (online) directories were consulted. These were: *Directory of Open Access Journals* (Lund University Library), [http://www.doaj.org/ljbs?cpid=129]; *Directory of Journals, Newsletters and Electronic Discussion Archives* (ACQWEBS), [http://acqweb.library. vanderbilt.edu/journals.html]; and *Electronic Journals in Librarianship and Information Science* (Thomas Parry Library, University of Wales) [http://www.inf.aber.ac.uk/tpl/ejlib/]**.** Finally, only those e-journals were selected for the study from the aforesaid directories of which all the following criteria were fulfilled: First, the e-journals must have publication in the English language only and also have one or more articles per issue that reported the results of research or scholarship. These e-journals should be scholarly/peer-reviewed or refereed, as described in the e-journals documentation. Second, all issues of the e-journal should be accessible freely and the e-journals should have commenced their publication on or before 2000 and never ceased or suspended publication during 2000–2004. Third, e-journals should be available only on the Web and they should not have any print counterpart. Many e-journals were eliminated because they failed to meet the first criterion. A few were removed because of the absence of any statement in the e-journal documentation indicating that they were peer-reviewed or scholarly. There were 18 e-journals in the sample meeting these criteria. One e-journal was eliminated from the sample due to its non-accessibility. So, the final list consist 17 OA e-journals. They are: *Ariadne* (ARD)*, Chinese Librarianship: An International Electronic Journal* (CHL)*, Cybermetrics: International Journal of Scientometrics, Informetrics and Bibliometrics* (CYM), *D-Lib Magazine* (DLM)*, The Electronic Journal of Academic and Special Librarianship* (EIS), *Electronic Journal of Information Systems in Developing Countries* (EID), *First Monday* (FIM), *High Energy Physics Libraries Webzine* (HPW), *Information Research:*

An International Electronic Journal (INR), *Information Technology and Disabilities* (ITD), *Issues in Science and Technology Librarianship* (IST), *Journal of Digital Information* (JDI), *Journal of Knowledge Management Practice* (JKM), *Library Philosophy and Practice* (LPP), *LIBRES – Library and Information Science Research Journal* (LRS), *School Library and Media Research* (SMR) and *South African Journal of Information Management* (SJI). All above e-journals except *South African Journal of Information Management* (SAJIM) have been accessible freely – without any registration or any subscription. But for getting full access to SAJIM, registration was essential but no subscription was needed.

In order to perform quantitative analysis, this study considered only articles published in these e-journals during 2000–2004 that reported the results of research or scholarship. Articles classified as 'Editorial materials', 'PowerPoint Slides of Conferences', 'Book Reviews', 'Columns', 'Reports', 'e-Dissertations', 'News items' were not considered for the analyses.

To document the literature growth, authorship pattern, gender pattern, cited references pattern and related bibliometric phenomena the necessary data were collected manually from each article. A computerized data input sheet was prepared in MS-Excel to record all these data. After completion of input work, each data set was checked to determine data accuracy. Where the data error rate was low for a ten-percent random sample of each set, corrections were made as necessary. Where there was a large error rate, the entire set was rejected and a new collection made. Once quality control was accomplished, each of the data sets was merged into a single spreadsheet. Further quality control was accomplished by ordering authors and corporate authors alphabetically and through a series of counts.

Results and discussion

Literature productivity

An attempt was made to analyse the amount of literature that has been published during 2000–2004. Table 1 lists the 17 OA e-journals ranked by the number of articles they have published during the same period. This table also lists the number of issues which appeared each year. The yearwise distribution of issues and articles of these e-journals has been shown in Figure 1. For this purpose the 'Table of Contents' of each issue of 17 OA e-journals was navigated manually. If the publication of any journal (e.g. *Information research*) for a year was spread into two consecutive volumes, this study considered the total articles published in a year, irrespective of volume.

Table 1. Yearwise distribution of issues and articles

Rank	Name of the journal	2000		2001		2002		2003		2004		TI	TA	API	%
		TI	TA	TI	TA	TI	TA	TI	TA	TI	TA				
1	FIM	12	79	12	76	12	86	12	74	12	76	60	391	6.5	23.90
2	DLM	11	48	11	45	11	49	11	52	11	40	55	234	4.2	14.30
3	ARD	03	25	04	39	04	32	04	29	04	30	19	155	8.1	9.47
4	INR	04	23	04	31	04	23	04	21	04	44	20	142	7.1	8.68
5	JDI	02	09	03	15	04	21	05	49	03	36	17	130	7.6	7.95
6	EID	03	20	03	13	04	22	05	35	04	20	19	110	5.7	6.72
7	IST	04	19	04	20	04	17	04	14	04	26	20	96	4.8	5.87
8	SJI	03	18	04	13	04	16	04	15	04	25	19	87	4.5	5.32
9	JKM	01	02	06	12	05	12	06	12	03	17	21	55	2.6	3.36
10	ITD*	01	07	01	03	02	07	02	14	02	16	08	47	5.8	2.87
11	HPW	02	08	04	14	01	04	02	05	02	10	11	41	3.7	2.51
12	LPP	02	07	02	06	02	10	02	09	02	09	10	41	4.1	2.51
13	EAS**	01	04	02	06	02	09	02	07	02	11	09	37	4.1	2.26
14	SMR	01	07	01	06	01	06	01	03	01	04	05	26	5.2	1.59
15	LRS	02	03	02	04	02	05	02	04	02	05	10	21	2.1	1.28
16	CHL	02	00	02	01	02	03	02	02	02	07	10	13	1.3	0.79
17	CYM***	01	04	01	02	01	02	00	00	01	02	04	10	2.5	0.61
	Total	55	283	66	306	65	324	68	345	63	378	317	1636	5.0	99.99

TI= Total Issues, TA=Total Articles, API=Articles per Issue, % = Percentage of Articles out of Total Articles.
Note: * = *Information Technology and Disabilities* (ITD) has published 7 articles in 2000. But full text of these 7 articles was inaccessible.
** = 1&2 issue of 2001 and 2002 and 2&3 issue of 2003 and 2004 of *Electronic Journal of Southern Academic and Special Librarianship* (EAS) was published in combined.
*** = The 2002 and 2003 issue of *Cybermetrics* (CYM) was published as a combined issue.

As on December 2004, 1636 articles were published in 317 issues with an average of 5 articles per issue. Average articles per issue have been found to be highest in 2004 (6 articles) followed by 2002 (5.58 articles), 2000 (5.14 articles), 2003 (5.07 articles) and 2001 (4.63 articles). A steady growth in number of articles has been observed between 2000 through 2004. In 2000 (the starting year of the study), a total of 283 articles were published which rose to 378 in 2004. From 2000 to 2001, the number of articles published increased by an average of 23 items. There was a slight recession from 2001 to 2002 and 2002 to 2003 with an increase of 18 and 21 articles per years respectively. Then, this number jumped to 33 in 2003–2004. The average growth rate of these e-journals is 23.75 articles per year. It is not clear why a drop happened from 2001 through 2003. The increasing number of research articles from 2003 onwards may be an indication of professionals' attitude towards open access publication media and of authors beginning to regard them as legitimate publication media.

As indicate in Table 1, the journals examined for this study exhibit diverse publication behaviour and characteristics. The total number of articles ranging from 10 to 391 in these OA e-journals is an indication of uneven distribution of literature

productivity. The highest number of publications has been found in FIM which at 391 represents 23.90 percent of total publications. This is followed by DLM with 234 articles (i.e. 14.30% of the total). This may be due to the fact that the total number of issues of these two e-journals is much more higher than remaining e-journals (i.e. 15 e-journals) in the sample as their frequency of publication is monthly. Other important e-journals with more than 100 articles during sample period were ARD with 155 articles (9.47% of the total); INR with 142 articles (8.68% of the total); JDI with 130 articles (7.95% of the total) and EID with 110 articles (6.72% of the total). Two e-journals namely, IST and SJI have published just below 100 articles i.e. 96 and 87 respectively. The rest have comparatively less number of publications. Although, the lowest number of publications i.e. 10 has been noted in CYM, the lowest number of articles per issue has been noted in CHL (i.e. overall 1.3 article per issue).

In a study, PERSSON & ASTROM [2005] identified the total articles of 27 ISI indexed journals published during 1990 to 2004. Some of them were *Aslib Proceedings* (557 articles), *College & Research Libraries* (529 articles), *Information Processing & Management* (755 articles), *Information Technology and Libraries* (399 articles), *Journal of Documentation* (309 articles), *Journal of Information Ethics* (132 articles), *Journal of Information Science* (617 articles), *Journal of Librarianship* (10 articles), *Journal of Librarianship and Information Science* (226 articles), *Journal of Scholarly Publishing* (212 articles), *Journal of the American Society for Information Science and Technology* (426 articles), *Knowledge Organization* (186 articles), *Library & Information Science Research* (260 articles), *Library Quarterly* (186 articles), *Libri* (381 articles) etc. Comparing this 15 years data set with the present research it can be said that the publication rate of some of LIS OA e-journals are very much comparable with non-OA journals. This may be due to the fact that authors are accepting both these publication media as equally important vehicles of scholarly communication.

Of these 17 e-journals, 7 e-journals have published more than 5 articles per issue, whereas the rest have published less than 5 articles per issue. The highest number of articles per issue has been found in ARD (8.1 articles) followed by JDI (7.6 articles), INR (7.1 articles), FIM (6.5 articles), ITD (5.8 articles) and EID (5.7 articles). On the other hand e-journals like DLM, EAS, IST, LPP and SJI have published 4 to 5 articles whereas, the rest have only 1 to 3 articles per issue. The number of issues per year (per volume in case of journals not published on calendar year basis) has varied both as inter-journal and intra-journal variables. E-journals like CHL, DLM, FIM, INR, IST, LPP, LRS and SMR have each published equal number of issues per year whereas the rest have not. So, from Table 1, it becomes clear that although the total number of publications in these OA e-journals has increased steadily, the number of issues of each journal is uneven.

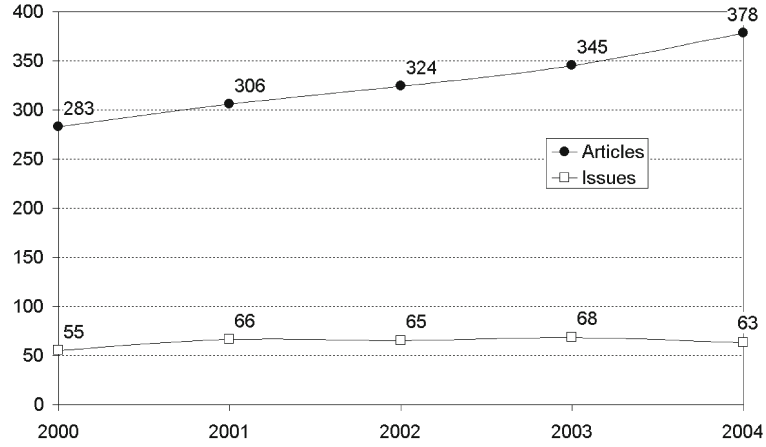

Figure 1. Yearwise growth of issues and articles in LIS open access e-journals

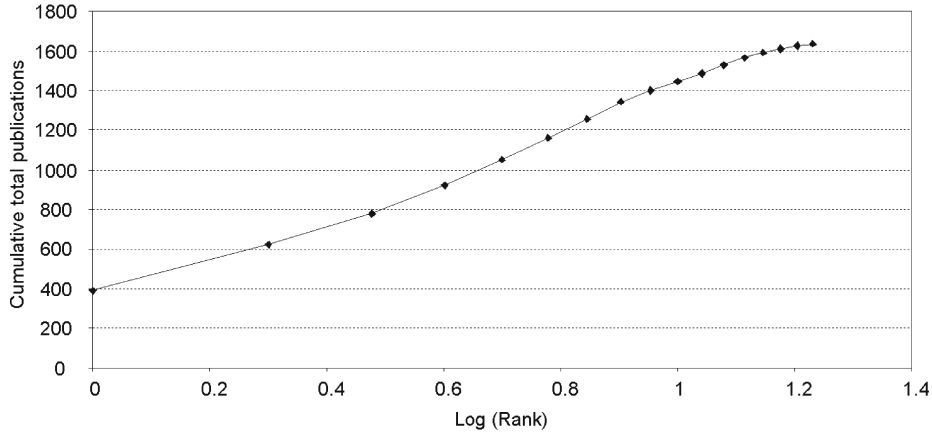

Figure 2. Bradford plot of LIS open access e-journals

This is also seen in Figure 1. This may be due to the fact that publishers of OA e-journals find it worthwhile to publish fewer issues with large number of articles rather than publish number of issues with smaller number of articles, thus leads to reduction in expenditure incurred in developing new Web pages.

This study then tried to identify those e-journals in LIS OA arena that are continuously publishing considerable number of articles per issue. These core e-journals have been identified in Figure 2 by using Bradford Law.

Core journals

Figure 2 is a Bradford plot of the above data in Table 1, in which the cumulative total of publications is plotted against the logarithm of the journal's rank. The classic Bradford plot usually assumes the shape of an elongated 'S'. The Bradford distribution is useful for identifying the 'core' journals – those that are central to a subject because they produce most of the contents. On the Bradford plot, the core journals are those whose points lie on the initial, curved part of the 'S' until it tangentially becomes a straight line [HAWKINS, 2001].

Out of these 17 LIS OA e-journals, the Bradford plot shows that the slope of the curve decreases slightly after eight journals, so it appears that the top eight journals are well on their way to forming the core. These e-journals are *First Monday, D-Lib Magazine, Ariadne, Information Research, Journal of Digital Information, Electronic Journal of Information System in Developing Countries, Issues in Science and Technology Librarianship and South African Journal of Information Management.* All these e-journals are well established, having been founded between 1991 through 1997. In an earlier study, HAWKINS [2001] has pointed out 6 core e-journals in LIS published during 1995 to 2001. All those six e-journals are also identified as core e-journals in the present study, but three more new e-journals namely *Journal of Digital Information, Electronic Journal of Information System in Developing Countries* and *South African Journal of Information Management* are identified here as core e-journals and one e-journal namely *Journal of Electronic Publishing* has lost its position due to its suspension from 2002 to 2005. A final droop has been observed at the end of the curve as typical for the Bradford-Zipf plot. This final droop begins roughly at the journal rank 14. The presence of the final droop portion indicates that the literature has been widely spread to many different other e-journals. HAWKINS [1978] suggested that this phenomenon might be due to the dispersion of literature. This is consistent with the fact that four e-journals contributed only 0.04 percent of articles to the total. On the other hand, the core (top 8 e-journals) contributed 1345 articles (82.21% of total articles). This scattering of information poses a great problem in the retrieval of relevant information.

Authors

The names of all authors were collected in the published order together with authorship of the article, their gender, nationality and their position in the article. For each journal individual spreadsheet (in Excel) was created.

Authorship pattern

As HARSANYI [1993] has shown, different disciplines interpret the order of authorship differently. Some list co-authors alphabetically. Some list co-authors by the order of contribution to the article. There is at least one book where the order of authorship was decided by a coin toss [NYE & KEOHANE, 1972]. There is also a reference to a practice in which the order of authorship was rotated within a group of researchers who published many articles and reports. According to TERRY [1996], there are no established norms in librarianship and the information science for citation order. Table 2 depicts the authorship pattern in 17 OA e-journals.

Table 2. Authorship pattern and quantity of authors in open access articles

Journal name	Number of articles						Total articles	Total authors	Average authors per article
	Single author		Two authors		More than two authors				
	Number	Percent	Number	Percent	Number	Percent			
ARD	108	69.68	28	18.06	19*	12.26	155	231	1.49
CHL	11	84.62	02	15.38		0.00	13	15	1.15
CYM	03	30.00	04	40.00	03	30.00	10	37	3.70
DLM	96	41.03	55	23.50	83	35.47	234	588	2.51
EAS	29	78.38	05	13.51	03	8.11	37	49	1.32
EID	44	40.00	38	34.55	28*	25.45	110	222	2.02
FIM	261	66.75	88	22.51	42*	10.74	391	604	1.54
HPW	23	56.10	9	21.95	9*	21.95	41	68	1.66
INR	76	53.52	44	30.99	22	15.49	142	251	1.77
IST	56	58.33	32	33.33	8	8.33	96	150	1.56
ITD	28	59.57	11	23.40	8	17.02	47	77	1.64
JDI	60	46.15	27	20.77	43	33.08	130	306	2.35
JKM	26	47.27	20	36.36	09	16.36	55	95	1.73
LPP	32	78.04	08	19.51	01	2.44	41	52	1.27
LRS	10	47.62	09	42.86	02	9.52	21	37	1.76
SJI	40	45.97	34	39.08	13	14.94	87	149	1.71
SMR	18	69.23	4	15.38	4	15.38	26	38	1.46
Total	921	56.29	418	25.55	297	18.15	1636	2969	1.81

Note: *Articles from Corporate Authors are kept in 'More than two authors' column.

The majority of articles published in these 17 e-journals have one author, although the trend is toward a growing multi-authorship. The number of authors per article ranges in these OA e-journals from one to fourteen. In a very small number of cases, corporate (identified as body) rather than human authors were indicated (5 or 0.003%). Of the total 1636 articles published so far, 921 articles (56.29%) were by single authors.

The number of articles written by 'two authors' and 'more than two authors' were 418 (25.55%) and 297 (18.15%) respectively. The collaborative coefficient 0.43 indicates that still collaborative research is not very popular in LIS OA arena. This is in agreement with the earlier findings of JOGLEKAR & SEN [2000].

In an earlier study, HAWKINS [2001] calculated the authorship pattern of 28 Information Science e-journals published during 1995 through 2001. Almost 71 percent articles were under single authorship. It was only 16 percent in case of articles written by 'two authors' and 13 percent in case of articles written by 'more than two authors'. A comparison of the results of Hawkins with the results of present research shows that the collaborative research has increased up to 14.71 percent in LIS field during the last 5 years. KOEHLER & AL. [2000], in their study mentioned that "multiple authorship is a sign of a mature discipline, publishing complex articles addressing complex issues". So this hypothesis may indicate that LIS is now becoming a mature field. It appears that because of the increasing amount of interdisciplinary research in LIS discipline and ramification of this subject in various domains, now experts from more than one field contribute jointly in producing scholarly articles. But still the trend of LIS research is mostly single authored.

At individual journal level, except CYM almost in all cases the number of single-author publications was higher than the number of articles by two or more than two-authors. The highest number (84.62%) of single author publications was found in CHL followed by EAS (78.38%), LPP (78.04%), ARD (69.68%), SMR (69.23%), and FIM (66.75). Other e-journals also have higher percentage of single-author publications as compared with other multiple author publications except CYM. In case of joint authorship publications except in the case of DLM and JDI the number of two-author-articles have been found to be higher than more-than-two-author articles.

The average number of authors per article was nearly same (i.e. 1 to 2 authors per articles) in different OA e-journals. Highest number of authors per article have been observed in CYM (3.70 authors/article), whereas in CHL it indicates lowest (1.15 authors/article). On average, each article has 1.81 authors.

Authors' gender

Determining gender of an author is very difficult task. In this study, mostly the gender of an author has been determined by studying short sketches about authors available along with the e-journal's articles. Otherwise, a concerted effort was made to identify authors by gender. There is an assumption that gender specific names are associated with the "appropriate gender" people. While there are rare exceptions, the error rate for this assumption is acceptable. To augment the ability to identify names, various directories were utilized, on-line databases on the WWW were searched, and when that failed, lists of the "gender unknown" among peers were circulated. Sometimes, a simple search was also performed in Google Image for those cases where

the author's identity was unavailable with their articles. The searched image along with the available URL was further checked manually confirming his/her identity. Table 3 illustrates the gender-wise distribution of authors in OA articles.

Though not very clear, gender studies in authorship among librarians seems to have gained momentum in the late 1980s. KORYTNYK [1988] compared the publishing pattern between men and women PhDs in librarianship and reported that among library school faculties in the 1970s, women were more likely to publish than men. In the present study, a total of 2964 (excluding 5 corporate authors) author names appeared on the articles; 2026 (68.95%) of them were male and 912 (31.04%) were female. The gender of 26 (0.88%) authors was unknown. If a first name was non-gender specific, consisted only of initials, or was of foreign origin (with language barriers preventing gender identification), the category "Unknown" was used. The possible reason for higher number of male than female may be due to the fact that female authors prefer print media more than electronic media. The findings of present study is in agreement with the findings of ATINMO & JIMBA [2002] where they have found that, out of 118 authors in African librarianship journals published during 1991 to 1997, 78.8 percent were male and 21.2 percent were female. But present findings indicate slight difference as compared to the findings of TERRY [1996] where she found higher percentage of women contributors (51.7%) than men (47.8%).

Table 3. Genderwise distribution of authors

Journal	Articles	Authors				Total
		Male		Female		
		Number	Percent	Number	Percent	
ARD	155	152	66.09	78	33.91	230
CHL	13	09	60.00	06	40.00	15
CYM	10	31	83.78	06	16.22	37
DLM	234	436	74.15	152	25.85	588
EAS	37	21	42.86	28	57.14	49
EID	110	169	78.24	47	21.27	216
FIM	391	419	69.49	184	30.51	603
HPW	41	56	83.58	11	16.42	67
INR	142	151	60.16	100	39.84	251
IST	96	62	43.97	79	56.02	141
ITD	47	52	67.53	25	32.47	77
JDI	130	228	74.75	77	25.25	305
JKM	55	71	77.77	19	20.00	90
LPP	41	35	67.31	17	32.69	52
LRS	21	24	64.86	13	35.14	37
SJI	87	102	71.83	40	28.16	142
SMR	26	8	21.05	30	78.95	38
Total	1636	2026	68.95	912	31.04	2938

Note: One article each in ARD, EID, FIM, and HPW was published by Corporate author. In JDI personal author and corporate author jointly published one article. For Gender analysis articles from Corporate Authors are excluded. Gender of 9 authors of IST, 7 authors of SJI and 5 authors of EID and JKM each were unknown.

At individual journal level, in most of the cases the percentage of contributions by male authors was higher than those by female authors except in SMR, EAS and IST. The top three e-journals where the contributions from male authors were predominant were CYM (83.78%), HPW (83.58%) and JKM (77.77%). On the other hand, top three other journals where female authors have contributed more than male authors were SMR (78.95%), EAS (57.14%) and IST (56.02%).

Position wise distribution of authors according to their gender

There is a common perception that the first author is indeed *primus inter pares*. Either the first author has made the more significant contribution to the article or is the more senior member of the team. There is a minority view that the order of authorship has little significance. From a practical point of view, it is true that most indexes list at least the first three authors of an article and some reduce all but the first author to the status of "et al." The total number of authors in various positions in an article has been provided through Table 4.

Table 4. Position of authors in articles

Journal	Male				Female				Grand
	Single	First	Other	Total	Single	First	Other	Total	total
ARD*	74	29	49	152	34	16	28	78	230
CHL	5	0	4	9	6	0	0	6	15
CYM	3	6	22	31	0	1	5	6	37
DLM	78	106	252	436	18	31	103	152	588
EAS	13	2	6	21	16	6	6	28	49
EID*	31	50	88	169	13	15	19	47	216
FIM*	197	88	134	419	64	40	80	184	603
HPW*	15	16	25	56	8	1	2	11	67
INR	39	41	71	151	37	25	38	100	251
IST	26	18	18	62	31	22	26	79	141
ITD	23	13	16	52	5	6	14	25	77
JDI*	41	55	132	228	19	13	45	77	305
JKM	21	23	27	71	4	4	11	19	90
LPP	19	8	8	35	13	1	3	17	52
LRS	8	6	10	24	2	5	6	13	37
SJI	24	39	39	102	16	8	16	40	142
SMR	3	1	4	8	15	7	8	30	38
Total	620	501	905	2026	301	201	410	912	2938
Percent	30.60	24.73	44.67	100	33.00	22.04	44.95	100	

* Articles by Corporate Authors are excluded here.

This table illustrate the trend in total authorship for both men and women from 2000 to 2004. From the table and figure there appears to be a slight bias against women and in favour of male authors. The total number of male authors, in any position, in any journal (except *SMR*) is just double of that of female authors – which indicates that men have dominance in the OA publication field of library and information science. But

among 2026 male authors, 30.60 percent (620) male authors published their articles in their own capacity, whereas it was slightly higher in case of female authors where among 912 female authors, 33 percent (301) female authors published their articles in their own capacity. This may be due to the fact that female authors, although less in number, preferred to publish their articles in their own capacity as compared to male authors. This difference was also observed (although very slight) in case of those co-authored articles where position of female author is 'other than first author'. Otherwise male authors hold the position of first author in more cases (24.73%) as compared to female authors (22.04%).

Authors' productivity

Authors' productivity is defined as the number of papers an author has published within a given duration. In fact assessing the importance of multiple authorship is problematic. Giving every author of a paper one credit in measuring author productivity, a total of 2964 authors, including first author and coauthors were identified from the articles of these e-journals. Here articles produced from corporate bodies have been excluded.

There are perhaps slightly more first time and slightly fewer very highly productive authors than might have been expected in a 'classic' literature. Table 5 indicates the number of authors contributing one article, two articles and so on and the distribution of their articles in journals. While most of the authors contributed only once in these OA e-journals, a few contributed more than once. Below mentioned Table 5 clearly indicate that vast majority of authors, i.e. 2658 (89.64%) out of 2965, contributed only one article.

Table 5. Quantity of articles published by a single author

Articles	Authors	Distribution of articles		
		Single journal	Two journals	≥ 3 journals
11	1	0	1	0
10	1	1	0	0
9	1	0	1	0
8	3	2	1	0
7	2	1	1	0
6	7	1	3	3
5	5	2	3	0
4	33	17	9	7
3	52	33	16	3
2	202	153	49	0
1	2658	2658	0	0

Note: 5 publications were by Corporate Authors, but one articles in JDI contained person and corporate author both. This personal author include here. So the sample quantity is 2965. Articles by corporate authors are excluded here.

The percentage of authors contributing only one article is much larger than the 60 percent found in Lotka's original data. This may be indicates that LIS authors are not prefer to contribute their articles frequently in OA e-journals or these e-journals might not yet well popular among scientists. The highest number of articles by one author is 11. The second and third highest are 10 and 9 articles, also by single authors.

Prolific authors

Table 6 lists prolific authors who have contributed at least five articles in the 17 OA e-journals. This list numbers all author contributions, including second and subsequent authorships. This table also indicates the number of articles they have published under single and joint authorships and indicates the names of e-journals where their publications have appeared. It is clear from the table that most of prolific authors contributed their articles in joint authorship and they had some favourite journals. In detailed study it was found that among the first 100 prolific authors, out of their 407 publications, 279 (68.50%) publications appeared in joint authorship and 128 (31.44%) publications appeared in single authorship. Additionally most of their articles appeared in only those one or two e-journals which were identified earlier as core e-journals in LIS.

Table 6 shows that Paul Miller from UKOLN occupies the first position with a contribution of 11 articles; of these 11 articles, 8 articles were published in ARD. He is followed by Harbert Van de Sompel with 10 articles; Carl Lagoze with 9 articles; Andy Powell, Richard E. Higgason and T.D. Wilson with 8 articles each; Deena Larsen and Michael L. Nelson with 7 articles each; Bridget Robinson, G. Sayeed Choudhary, Kurt Maly, Lee L. Zia, Leslie Carr, M.M.M. Snyman and Mike Thelwall with 6 articles each. Among them articles of Mike Thelwall were published in 4 e-journals and articles of G. Sayeed Choudhary and Leslie Carr were published in 3 e-journals. Otherwise most of the authors have some favourite e-journals.

Comparing the lists as given in Table 6 with the earlier study of HAWKINS [2001] it was interestingly observed that most of the prolific authors as identified by Hawkins, are also identified here as prolific authors (marked by Italics). So it can be said that there are some authors in LIS OA arena who are continuously paying their interest in OA publishing. Among them Prof. T.D. Wilson, Herbert Van de Somple and Carl Lagore are most prominent. However, there are also some prolific authors too, who did not appear in the Hawkins lists are listed here. They are for example, Deena Larsen, Bridget Robinson, G. Sayeed Choudhury.

Table 6. Prolific authors in LIS open access e-journals
(Names in *italics* were also found in HAWKINS, [2001]) (Authors published 5 or more articles)

Author	Total articles	Authorship		Distribution in journals
		Single	Joint	
Paul Miller	11	8	3	8 ARD, 3 DLM
Herbert Van de Sompel	10	0	10	10 DLM
Carl Lagoze	9	1	8	7 DLM, 2 JDI
Andy Powell	8	5	3	7 ARD, 1 DLM
Richard E. Higgason	8	8	0	8 JDI
T.D.Wilson	8	3	5	8 INR
Deena Larsen	7	7	0	7 JDI
Michael L. Nelson	7	0	7	6 DLM, 1 JDI
Bridget Robinson	6	0	6	5 ARD, 1 DLM
G. Sayeed Choudhury	6	0	6	4 DLM, 1 FIM, 1 JDI
Kurt Maly	6	0	6	5 DLM, 1 JDI
Lee L. Zia	6	6	0	5 DLM, 1 FIM
Leslie Carr	6	0	6	2 DLM, 2 JDI,1 ARD, 1 HPW
M.M.M. Snyman	6	0	6	6 SJI
Mike Thelwall	6	4	2	3 CYM,1 INR, 1 FIM, 1 LRS
Adrian Miles	5	5	0	5 JDI
Donald W. King	5	0	5	5 DLM
Mohammad Zubair	5	0	5	4 DLM, 1 JDI
Tim DiLauro	5	1	4	3 DLM, 2 FIM
Xiaoming Liu	5	0	5	4 DLM, 1 JDI

Institutional involvement in publication

The names of the institutions were obtained by studying the addresses available in author's affiliation. Table 7 reveals the frequency of academic, organizational and commercial bodies associated with the publication of articles in OA e-journals and Table 8 lists the prominent institutions whose names were available in the author's affiliation. An approximation of the incidence of academia was obtained by verifying the institution with either 'University', 'College', or 'School' in its name. The non-academic institutions were identified as organizations whereas, commercial institutions were identified by verifying the top level domain of institutions' Web addresses. Limiting the data to institutions having at least ten publication produces the results shown in Table 8.

From Table 7 it is clear that authors from academic institutions contribute highest percentage (70.48%) of articles than those from organizations (15.34%) or commercial bodies (5.56%). In 40 articles (2.44%), authors mentioned their professional status but did not mention the address of the institutions to which they belonged whereas in 24 (1.46%) articles no such information was available. The prominent involvement of academic institutions in publication is also common in all individual OA e-journals.

Table 7. Types of institutions and their involvement in publication

Journal	TA	A	O	I	C	A+O	A+C	NT
FIM	391	268	53	22	29	10	06	03
DLM	234	132	68	01	16	12	05	0
ARD	155	110	19	01	05	08	0	12
EID	110	83	09	01	07	07	01	02
CHL	13	12	01	0	0	0	0	0
CYM	10	06	03	0	0	01	0	0
HPW	41	09	30	0	0	02	0	0
ITD	47	26	16	01	02	01	0	01
INR	142	128	07	01	01	05	0	0
IST	96	84	08	0	02	02	0	0
JDI	130	96	11	11	12	0	0	0
SJI	87	62	05	01	11	04	04	0
JKM	55	31	10	0	06	07	0	01
SMR	26	23	01	0	0	02	0	0
LPP	41	37	03	01	0	0	0	0
EAS	37	27	05	0	0	0	0	05
LRS	21	19	02	0	0	0	0	0
Total	1636	1153	251	40	91	61	16	24
Percent		70.48	15.34	2.44	5.56	3.73	0.98	1.46

Legends: TA: Total Articles, A: Academic, O: Organizational, I: Individual, C: Commercial, A+O: Academic + Organizational, A+C: Academic + Commercial, NT: Not available in Text.

This may be due to that fact that acceptance by a recognized journal is seen in the academic world as evidence of scientific quality. University committees weigh the importance of such publications in evaluating the achievements of candidates for promotion or tenure. Another interesting feature as indicated in above table is that about 77 publications appeared in collaboration of two different types of institutions either academic with organizational (3.73%) or academic with commercial (0.98%). This is an indication that collaborative research by various types of institutions are now increasing in OA publication.

A total of 776 unique institution names appeared in the authors' affiliations, out of which authors from 530 institutions have published one article only whereas authors from 246 institutions have contributed more than one article. Table 8 lists names of first twenty institutions. From the table it is clear that first top 5 institutions are academic in nature. Among the academic institutions, United Kingdom Office for Library Networking (UKOLN) has the highest number (45) of publications followed by University of California (35), Cornell University (25), University of Washington (23) and University of Illinois (22).

Table 8. Prolific institutions and their involvement in publication
(First 20 institutions. Almost all names were in Hawkins study, 2001)

Name of the institution	Number of articles	Distribution in journals
UKOLN	45	38 ARD, 7 DLB
University of California	35	13 FIM, 12 DLB, 2 ARD, 3 IST, 3 JDI, 2 EID
Cornell University	25	16 DLB, 4 FIM, 4 IST, 1 JDI
University of Washington	23	7 INR, 6 FIM, 6 ITD, 2 DLB, 1 EID, 1 IST
University of Illinois	22	13 FIM, 3 INR, 2 JDI, 1 DLB, 1 EDI, 1 IST, 1 SMR
University of Maryland	19	6 FIM, 5 DLB, 4 JDI, 3 IST, 1 INR
OCLC Online Computer Library Center, Inc	17	13 DLB, 2 ARD, 1 FIM, 1 JDI
Rand Afrikaans University, Johannesburg, South Africa	17	17 SJI
Manchest Metropolitan University	15	8 INR, 4 ARD, 2 LRD, 1 EID
Pennsylvania State University	13	5 FIM, 4 SMR, 2 INR, 1 DLB, 1 JKM
University of North Carolina	13	3 DLB, 4 JDI, 2 LPP, 1 FIM, 1 INR, 1 IST, 1 SMR
University of Pretoria, South Africa	13	12 SJI, 1 INR
CERN	12	12 HPW
University of Sheffield, Sheffield, U.K.	12	6 INR, 5 ARD, 1 DLB
University of Glasgow, U.K	11	8 ARD, 1 DLB, 1 FIM, 1 JKM
University of Pittsburgh	11	6 DLB, 4 FIM, 1 JDI
University of Tampere, Tampere, Finland	11	11 INR
University of Toronto	11	5 FIM, 5 INR, 1 ARD
Indiana University	10	5 FIM, 2 DLB, 2 SJI, 1 INR
Los Alamos National Laboratory	10	7 DLB, 3 IST

On the other hand, among organizations, top 5 organizations are OCLC, CERN, Los Alamos National Laboratory, National Library of Australia (7 articles), NASA Langley Research Centre (5 articles), and top 5 commercial institutions are Hewlett Packard Laboratories (7 articles), Xerox Palo Alto Research Center (PARC) (7 articles), IBM (4 articles), VTLS Inc. and xrefer.com (2 articles each). Interestingly, among these leading organizations, most of them are of governmental bodies. It is important to note that most of the institutions mentioned here were also identified earlier [HAWKINS, 2001] as leading institutions.

The publications from UKOLN were mostly reported in its own e-journal ARD whereas, in other four academic institutions publications appeared in 4 to 6 different e-journals. The results as indicated in the above table looks promising on the account that although articles from academic institutions were more prominent, authors from almost all types of institutions worldwide are showing interest in publishing articles on OA e-journals. This phenomenon indicates the worldwide acceptability of OA publications.

Pattern of collaborative research

Previously in Table 2, it has already been observed that quantity of article under joint authorship was less than articles published by single authors. However, if one

considers the pattern of collaborative research as reported in these OA e-journals, some interesting results come into the picture.

Table 9. Pattern of collaborative research

Journal	Number of articles			
	Joint authors	Same institutes	Different institutes of same country	Different institutes of different countries
DLM	138	77	53	08
FIM	130	71	42	17
JDI	70	70	00	0
EID	66	38	15	13
INR	66	52	10	04
SJI	47	27	16	04
ARD	43	32	11	0
IST	40	36	04	0
JKM	28	15	13	0
ITD	19	13	06	0
HPW	18	13	02	03
LRS	11	11	0	0
LPP	9	08	01	0
SMR	08	0	06	02
EAS	06	06	0	0
CYM	07	04	02	01
CHL	02	02	0	0
Total (%)	708	475 (67.09)	181 (25.56)	52 (7.34)

Note: 2 articles of FIM & EID and 1 article of DLM, CYM, and HPW published in associations of authors from 3 countries. Total articles by joint-authors here are 708 instead of 715 (Table 2) because 4 articles in ARD, 2 articles in EAS and 1 article in JKM published under joint authorship did not have any address.

As indicated in Table 9, of the total 708 joint author articles, majority of the articles i.e. 475 (67.09%) have been published by more than one author from same institutions whereas 181 articles (25.56%) have been published by two or more than two different institutions. The number of articles with authors from more than one country was 52 (i.e. 7.34%). One might expect that because of the e-mail facility, it has become easier for authors to communicate with one another, no matter where they are located, and e-journals in particular have benefited from this development. HE & SPINK [2002] suggested that the growth of collaborative research and flow of information over the Web contributed to the increasing transnational nature of scholarly publishing. As an effect now scholarly articles jointly contributed by authors of two different point of the globe can be feasible easily. In the present study, the quantity of collaborative research by authors from different countries is evident only in 8 e-journals. In FIM (17 articles) and *EID* (13 articles) this kind of contribution was more common whereas, in *ARD, CHL, ITD, IST, JDI, LPP* and *LRS* collaboration from more than one country was not common.

Geographic distribution of articles

Most articles enlist the authors' affiliations with their complete address. The geographic area from which the author submitted his or her work was identified. The continents represented are listed in Table 10.

Highest number i.e. 864 (51.70%) of publications was reported from North America followed by Europe (488), Africa (107), Oceania (101) and Asia (97). The least number i.e. 14 (0.83%) of publications was reported from South America. The distributions of countries from where author submitted his/her works are listed in Table 11. This table lists 67 identified countries and the number of articles ranks the name of these countries. The names of the countries appeared on the articles in the OA e-journals 1671 times which is greater than the total number of articles in the e-journals. This phenomenon occurred because of multiple-authored articles (as mentioned in Table 2) where two authors from two different countries jointly contributed one article.

Table 10. Appearance of continent-name in articles

Rank	Continents	Counts	Percentage
1	North America	864	51.70
2	Europe	488	29.20
3	Africa	107	6.40
4	Oceania	101	6.04
5	Asia	97	5.44
6	South America	14	0.83
	Total	1671	99.61

The dataset shows that for the period of 2000 to 2004, the top 2 countries (US and UK) contributed 64.03 percent of all articles (Table 11). This finding is in accordance with findings of SIN [2004] where the author also found that 66.99 percent (out of 12511 research papers) of authors were from the US (56.95%) and the UK (10.04%) for ISI indexed top 20 journals (in terms of the journal impact factor) during 1981 to 2003. In the present study it was found that an overwhelming number i.e. 806 (48.23%) of articles were of the United States origin, followed by a considerable percentage from the United Kingdom (15.79%), South Africa (5.68%), Australia (4.54%) and Canada (3.35%). The remainder came from 62 different countries. It suggests that the authorship distribution was uneven in OA e-journals. In an earlier study [SIN, 2004], it was mentioned that researchers could be influenced by factors other than the substantive content of the work itself. Authors working in reputed organizations were more likely to be perceived favorably. It may be that authors in low-income countries might be placed in a less advantageous position. Nevertheless, it was gratifying to see the publication from every part of the globe. Among them the contributions from countries like Fiji, Brunei, Uganda, and Latvia are also interesting.

Table 11. County of origin of articles

Country	#	Country	#	Country	#	Country	#
US	806	Singapore	13	Georgia	2	Iran	1
UK	264	Italy	12	Ghana	2	Latvia	1
South Africa	95	Brazil	10	Lithuania	2	Lebanon	1
Australia	76	Belgium	8	Nepal	2	Malta	1
Canada	56	France	7	Russia	2	Mozambique	1
Germany	39	Greece	7	Serbia	2	Pakistan	1
India	23	Denmark	6	Sierra Leon	2	Peru	1
New Zeeland	23	Japan	6	South Korea	2	Poland	1
Finland	21	Israel	5	UAE	2	Portugal	1
The Netherlands	21	Austria	4	Vietnam	2	Saudi Arabia	1
Spain	20	Mexico	3	Albania	1	Slovakia	1
Switzerland	20	Nigeria	3	Brunei	1	Slovenia	1
China	14	Thailand	3	Chile	1	Tanzania	1
Ireland	14	Cameroon	2	Croatia	1	Turkey	1
Malaysia	14	Cuba	2	Ecuador	1	Uganda	1
Sweden	14	Estonia	2	Guinea	1	Ukraine	1
Norway	13	Fiji	2	Hungary	1	Not identified	24

Frequency of international authors

An international author is defined as an author affiliated with an institute outside of a journal's country of publication. KOEHLER & AL. [2000] and others have reported a slow but increasing growth in international authorship in LIS. The overall international authorship in these 17 OA e-journals was 0.49. Table 12 illustrates the OA e-journals ranked according to the journal affinity.

In fact, it is difficult to say the actual country of origin or to measure international contribution of an OA e-journal. EID is based in Hong Kong, but strong links exists with University of Nebraska and appears to have involvement from authors in Europe, Africa etc. Similarly, LRS is currently based in Australia, but has previously been based in the US. Nevertheless, the above-mentioned table depicts that the highest percentage of international contribution has been observed in EAS (100%) and it was lowest in the case of IST (5.67%). EID ranked second with affinity 96.25 percent, LRS third with affinity of 86.49 percent, CYM fourth with affinity of 83.78 percent and INR fifth with affinity of 80.48 percent. This finding is different from the earlier finding of KOEHLER & AL. [2000] where they hypothesized that the older an e-journal, the broader is its author pool with more contributions from non-anglophone countries.

As analysis of the Table 12 shows that the age of publication does not significantly affect journal's international contributions. EAS started publication much later than IST, however the international contributions to EAS are much higher that that to IST. The higher value of journal affinity is an indication that most of the articles of these OA e-journals were contributed by author from various parts of the globe other than the

country from where the journal originated. This may also indicates wide acceptance of OA model among scholars and the vast popularity of World Wide Web which further increases the research ability among authors from less developed countries too.

Table 12. Percentage of share of international authors

Journals/ Country of origin	Year of initiation	Total authors*	International authors	Percentage of international authors
EAS/ Canada	1999	44	44	100.00
EID/ China	2000	214	206	96.26
LRS/ Australia	1996	37	32	86.49
CYM/ Spain	1997	37	31	83.78
INR/ UK	1995	251	202	80.48
HPW/ Switzerland	2000	67	47	70.15
JKM/ US	1998	89	58	65.17
JDI/ US	1997	305	148	48.52
CHL/ US	1996	15	6	40.00
FIM/ US	1996	598	220	36.79
LPP/ US	1998	52	17	32.69
DLM/ US	1995	588	169	28.74
SMR/ US	1998	38	7	18.42
ARD/ UK	1996	213	35	16.43
ITD/ US	1994	76	12	15.79
SJI/ South Africa	1999	142	18	12.68
IST/ US	1991	141	8	5.67
Total		2907	1260	43.34

Note: * The country from where author submitted articles was unknown in case of 17 authors of ARD, 5 authors in EAS & FIM each, 2 authors of EID, 1 author of ITD and JKM each. Articles by corporate authors excluded here.

Subjects

The subject scope of each individual article was identified by checking the keywords assigned by the author or metadata tag 'Keywords' of article's source code. In cases where keywords were not given, author produced abstracts were examined. In order to categorize subject scope, the keywords of the titles were classified into four levels. Descriptions of the subject scope for these four levels were drawn from *JITA Classification Scheme of Library and Information Science* (http://eprint.rclis.org/jita.html) and *NISC-LISA Plus* (CD-ROM) subject descriptors. Both of them are authoritative sources for subject description. Due to limitation of space Table 13 summarizes only the first level of subjects and quantity of articles under individual subject heading. This table also elaborates the names of the e-journals where the articles under various subject scopes were published.

Table 13. Journal wise quantity of articles under broad subject headings

Name of subjects	Quantity of articles	Distribution in journals
Theoretical and General Aspects of Libraries and Information	31	7 LPP, 5 CHL, 5 EAS, 5 INR, 3 DLM, 2 IST, 1 FIM, 1 LRS, 1 ARD, 1 SJI
Relationship of LIS with other Fields	53	29 EID, 17 FIM, 5 SJI, 1 ARD, 1 JKM
Knowledge and Learning	124	50 JKM, 19 FIM, 12 INR, 12 SJI, 8 JDI, 8 ARD, 5 EID, 2 IST, 2 EAS, 2 ITD, 2 DLM, 1 HPW, 1 LRS
Information Use and Sociology of Information	50	14 FIM, 10 INR, 6 JDI, 5 SJI, 4 SMR, 3 IST, 2 DLM, 3 LPP, 1 EAS, 1 ARD, 1 EID
Information Users, Users Literacy, Training	90	27 INR, 18 IST, 8 SJI, 6 ARD, 6 DLM, 6 FIM, 4 JDI, 4 SMR, 3 ITD, 3 LPP, 2 EID, 1 CHL, 1 EAS, 1 LRS
Profession, Professionals and Professional Education	16	5 INR, 3 SMR, 2 FIM, 1 ARD, 1 EAS, 1 IST, 1 LPP, 1 LRS, 1 SJI
Libraries and Resource Centres	34	6 EAS, 6 LPP, 6 SMR, 4 FIM, 4 LRS, 2 ARD, 2 EID, 1 DLM, 1 HPW, 1 INR, 1 IST
Management and Housing Technology in Libraries and Information Centres	17	5 DLM, 3 EAS, 3 FIM, 2 LPP, 1 ARD, 1 CHL, 1 EID, 1 JDI
Information Processing Industries	17	12 EID, 3 FIM, 1 INR, 1 ITD
Publishing and Legal Issues	82	42 FIM, 19 DLM, 10 ARD, 3 IST, 3 INR, 1 EAS, 1 EID, 1 ITD, 1 LPP, 1 LRS
Information Communication	97	22 FIM, 20 ITD, 12 INR, 8 DLM, 6 CYM, 5 SJI, 4 ARD, 4 HPW, 4 IST, 3 JDI, 2 EAS, 2 EID, 2 LPP, 1 CHL, 1 JKM, 1 LRS
Information Sources	245	46 DLM, 38 ARD, 48 IST, 22 FIM, 18 HPW, 17 SJI, 12 INR, 12 JDI, 7 EAS, 5 LPP, 5 SMR, 4 LRS, 3 JKM, 2 CHL, 2 EID, 2 ITD
Information Treatment for Information Services	185	66 JDI, 40 DLM, 18 ARD, 16 FIM, 13 INR, 8 EID, 7 HPW, 7 IST, 4 LRS, 4 SJI, 1 CHL, 1 EAS
Technical Services in Libraries and Archives	30	9 DLM, 4 IST, 3 EAS, 3 HPW, 3 SJI, 2 CHL, 2 INR, 2 ITD, 1 FIM, 1 LPP
Information Storage and Retrieval	82	18 DLM, 17 FIM, 15 ARD, 12 JDI, 9 INR, 3 SJI, 2 ITD, 1 CYM, 1 EAS, 1 EID, 1 IST, 1 LRS,
Information Technology (IT)	308	167 FIM, 41 EID, 23 SJI, 21 INR, 17 ARD, 17 DLM, 9 JDI, 7 ITD, 2 CYM, 2 HPW, 1 EAS, 1 SMR
Library Technology-Computers-Digital libraries, Applications of IT	169	59 DLM, 34 FIM, 32 ARD, 9 JDI, 8 LPP, 7 ITD, 5 HPW, 4 LRS, 3 EID, 3 INR, 2 EAS, 2 IST, 1 CYM

The coverage of subjects for the period 2000–2004 was quite impressive in these 17 OA e-journals. Almost all aspects of librarianship have been reported in these OA e-journals. There were 442 unique subject headings were assigned to all articles for this period; this excluded columns and editorial materials. Irrespective of e-journals, the predominant subject was Information Technology (308 articles) followed by Information Sources (245 articles). Other well-defined topics of interest were Information Treatment for Information Services (185), Library Technology, Computers, Digital Libraries, Applications of IT (169 articles), Knowledge and Learning (124 articles). All these top five subject headings were clearly slanted towards various aspects of information technology. Information Technology in terms of open source software (28), Internet usage-survey (26), Internet and World Wide Web-issues, infrastructure etc. (25) and issues in information technology (22) were the most

predominant topics. The traditional concepts like information seeking behaviour (20), librarianship (17), information literacy (14) as well as relatively newer ones such as information presentation-hyperlinks, hypermedia system (57), knowledge management (57), electronic commerce (46), digital libraries-issues, concept etc. (42), digitization (34), Web pages (29), digital repositories (28), digital preservation (24), electronic publishing (24) and online databases (20) were well represented.

At individual level, there was wide difference of subject coverage among the OA e-journals under studied. ARD, DLM, FIM and JDI can be considered to address mostly new concerns, but others like CHL, EAS, EID, INR, LPP, LRS and SJI did not entirely devote themselves to various issues of information technology. The coverage of subjects in e-journals like CYM, ITD, JKM, IST, HPW and SMR were very much specific to particular domain of LIS, but its "n" were too small.

Cited references

The cited references available in articles were scanned thoroughly and the functionality of hyperlinked references was examined manually. The distribution of cited references, hyperlinked references and live hyperlinked references are shown in Table 14. This table provides the ranking of the e-journals on the basis of percentage of cited references per article. The 3rd column of the table indicates the articles without any references. Out of 1636 articles, 162 (9.90%) articles were without any references. This indicates that the number of articles with references dominated over articles without any references in LIS OA e-journals under studied. At individual journal level, the percentage of articles without any cited references varied from a minimum of 2.30 percent in SJI to a maximum of 42 percent in ITD. All articles of INR, LRS and CYM contained references.

It can also be inferred from Table 14 that average cited references per article in 17 LIS OA e-journals were 23.76 during 2000–2004. The average references per article were observed highest in SMR (overall 55.36 references per article) followed by ITD (32.40 references per article), FIM (31.74 references per article), INR (30.23 references per article), LRS (28.76 references per article). In a study SCHLOEGL & STOCK [2004] measured that the average references of some highly reputed international LIS journals were 18.3 during 1997–2000. Among the journals with the highest number of references were *Library Quarterly* (42.9 references) followed by *Library & Information Science Research,* (36.8 references), *Information Processing and Management* (33.1 references), *Journal of Documentation* (32.6 references) and *JASIST* (32.0 references). So comparing this finding (although sample date is different) with present research it can be said that some of the LIS OA e-journals are at par with highly reputed international journals in terms of references. If one goes by the number of references as an indicator for objective quality of a paper, in such a case some LIS OA e-journals

compare favourably with some international journals as mentioned above. It is interesting to see that FIM, although contributing the largest number of cited references, could not get the first position in the rank of references per article.

Table 14. Pattern of cited references in LIS open access articles

Journals	Articles	Articles without refs	Number of cited refs	Refs per article	Hyper-linked refs	Percentage of hyperlinked refs	Live hyperlinked refs	Percentage of live hyper-linked refs
SMR	26	01 (3.85%)	1384	55.36	97	7.01	63	64.95
ITD	47	20 (42%)	875	32.40	418	47.77	311	74.40
FIM	391	45 (11.51%)	10985	31.74	4599	41.87	4181	90.91
INR*	142	0	4294	30.23	798	18.58	567	71.05
LRS	21	0	604	28.76	120	19.87	74	61.67
JDI	130	08 (6.15%)	2980	24.42	1198	40.20	1037	86.56
CYM	10	0	239	23.90	31	12.97	26	83.87
EID	110	11 (10%)	2278	23.01	366	16.07	288	78.69
JKM	55	02 (3.64%)	1212	22.86	88	7.26	53	60.23
SJI	87	02 (2.30%)	1655	19.47	470	28.40	412	87.66
DLM	234	12 (5.13%)	3944	17.76	2642	66.99	2391	90.50
HPW	41	09 (21.95%)	537	16.78	341	63.50	298	87.39
EAS	37	07 (18.92%)	497	16.56	149	29.98	122	81.88
ARD	155	14 (9.03%)	2132	15.12	1788	83.86	1670	93.40
LPP	41	05 (12.20%)	463	12.86	144	31.10	107	74.31
IST**	96	24 (25%)	841	11.68	211	25.09	167	79.15
CHL	13	02 (15.38%)	113	10.27	38	33.63	23	60.53
Total	1636	162 (9.90%)	35033	23.76	13498	38.53	11790	87.35

Note: Notes available in articles were considered as references for those cases where there were no such individual references. But if references and notes both appeared, then only references were considered, because it was assumed that references are citations of other works.

* 6 non-English articles of INR are included here.

** Of the total 24 articles without any cited references of IST, 8 articles contained only abstract, and no references were available.

Of the total cited references, 38.53 percent references were hyperlinked. This percentage varied from journal to journal. It was above 50 percent in case of e-journals like ARD, DLM and HPW but below 50 percent for the rest of the e-journals. The overall percentage of hyperlinked references out of total references indicates that authors of LIS OA e-journals are more likely to cite print sources than e-sources or online articles are yet to be cited by most of the authors. This may be due to non-availability of much more authoritative open sources on the Web or non-willingness of authors of OA e-journals to cite those sources which need authentication for accessing full-text. During investigation it was also observed that some authors of all these e-journals used a comparatively higher number of hyperlinked resources, while others did not. This coincides with the findings of ZHANG [1998] "citing e-sources may depend on the authors rather the journal format in which authors chose to publish their work (p. 249)". The percentage of live hyperlinked references was 87.35 percent (in

December 2006). This percentage varied from 93.40 percent in *ARD* to 60.53 percent in *JKM*. This indicates that although authors of OA e-journals use less hyperlinked references, they prefer to cite those sources which are permanent on Web. The reason behind this loss of 12.65 percent is partially due to shifting of pages or incorrect hyperlinked address used by the authors in their articles but mostly due to withdrawal of temporary pages from the Web.

Conclusion

Some years back nobody knows whether the OA model in general of OA e-journals model in particular will survive longer or whether the scholarly communities accept this new venture profoundly. With the declaration of OA from major societies, publishers, consortiums, or government agencies and active participation of people around the world, both expected and unexpected, the number of open access journals has risen exponentially and new publishing models are rapidly evolving to test new ways to increase readership and access.

This study endeavoured to investigate the status of LIS OA e-journals by analyzing its bibliometric phenomena like articles, authors, subjects, cited references etc. The findings obtained in this study showed that scientific communities of LIS are now paying interests in publishing research articles in OA e-journals as there is an increasing body of OA scholarly literature. However, the journals included in the present study differ from one another in some very important ways. Of the total seventeen e-journals under studied eight e-journals have good publication record during 2000–2004, other did not. *D-Lib Magazine* and *Information Research* began their publication in 1995; *First Monday*, *Ariadne*, and *Chinese Librarianship* in 1996; and *Journal of Digital Information* and *Cybermetrics* in 1997. Among these e-journals *First Monday* and *D-Lib Magazine* have a very good publication record, *Ariadne, Information Research*, and *Journal of Digital Information* are also productive but *Chinese Librarianship* and *Cybermetrics* have lower publication record. The possible explanation for this is that the first two e-journals published 11–12 issues per year; the next three e-journals published 3–4 issues per year and the last two e-journals 1–2 issue(s) per year. So it can be said that quantity of articles in any journal is directly associated with the number of issues it has, not the age of publication. It is needless to mention that publishing more issues needs more monetary support. Thus, it can also be concluded that some of the OA e-journals are getting very strong support from their sponsoring bodies and these bodies are continuously supporting these e-journals for promoting scholarly communication freely.

The gender analysis, authorship pattern and institutional involvement of OA e-journals indicates that male authors are keener in getting their articles published in OA e-journals than female authors and team research has not been very common in LIS OA

publishing. However, comparing with other bibliometric studies like HAWKINS [2001], it can be said that collaborative research in LIS had increased up to 14.71 percent during 2000–2004. At individual journal level, team research was found more prevalent in *Cybermetrics, Electronic Journal of Information System in Developing Countries, D-Lib Magazine, Journal of Digital Information, LIBRES, South African Journal of Information Management*, and *Journal of Knowledge Management Practice* however, others were more slanted toward individual research. Authors from academic institutions mostly prefer to contribute articles in these OA e-journals. Comparing the result of present research (2000–2004) with the earlier research (1995–2000) of HAWKINS [2001] it was found that, even though individual institutional and author rankings might have fluctuated within the two time periods, the United States dominance at the institutional and author level remained significant within the 17 LIS OA e-journals selected for this study. It was also found that with the increasing use of electronic communication technologies authors from more than one institution of two different countries have started contributing articles under joint authorship.

Although the productivity is not directly proportional to the available funding in all the cases, there are reasons to believe that funding plays a significant role in the overall productivity of the scientists. The financial assistance helps the scientists to meet research expenditure, including purchase of scholarly journals. It has been widely known that the financial assistance for research is not adequate in developing countries. Additionally, with the increasing price of research journals in every discipline, including LIS most of the institutes of developing countries discontinued journal purchasing. As a result there is an increasing gap of research accessibility, which ultimately affects qualitative research. One of the major intension of OA model is to reduce the gap between digital divide scientific communities around the globe and increase the research ability. However, on analyzing the country of origin of articles, it may be said that there is still need of qualitative scholarly OA literature in LIS discipline. Knowledge production is still very uneven across the countries. Authors from developed nations are paying more interest towards publishing including publishing in OA e-journals.

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References

AL-GHAMDI, A., AL-HARBI, M., BEACOM, N. A. B., DEDOLPH, J., DEIGNAN, M., ELFTMANN, C. & AL. (1998), Authorship in JASIS: A quantitative analysis. *Katherine Sharp Review,* 6. Retrieved 13 July, 2006, from http://edfu.lis.uiuc.edu/6/al_ghamdi.pdf

ATINMO, M. I., JIMBA, S. W. (2002), Gender and authorship pattern in an African librarianship journal, 1991–1997. *Library Review*, 51 (9) : 458–463.

BATES, M. (1999), A tour of information science through the pages of JASIS. *Journal of the American Society for Information Science,* 50 : 975–993.

BROWN, C. M. (1999), Information seeking behavior of scientists in the electronic information age: Astronomers, chemists, mathematicians, and physicists. *Journal of the American Society for Information Science,* 50 : 929–943.

BUCKLAND, M. (1999), The landscape of information science: The American Society for Information Science at 62. *Journal of the American Society for Information Science*, 50 : 970–975. Retrieved 12 January, 2006, from http://www.ischool.berkeley.edu /~buckland/asis62.html

CANO, V. (1999), Bibliometric overview of library and information science research in Spain. *Journal of the American Society for Information Science*, 50 : 675–680.

CARTER, R. C., KASCUS, M. A. (1991), Cataloging & Classification Quarterly, 1980–1990: Content, change, and trends. *Cataloging & Classification Quarterly,* 12 : 69–79.

CLINE, G. S. (1982), College and research libraries: Its first forty years. *College and Research Libraries,* 43 : 209–232.

FJALLBRANT, N. (1997), *Scholarly Communication: Historical Development and New Possibilities*. Retrieved 22 July, 2005, from http://www.iatul.org/conference/ proceedings/ vol07/papers/full/nfpaper.html

FOWLER, F. J. (1988), *Survey Research Methods*. Rev. ed. Newbury Park: Sage Publications, p. 9.

GARVEY, W. B., GRIFFITH, B. C. (1971), Scientific communication: Its role in the context of research and creation of knowledge. *American Psychologist*, 20 (1) : 349–362.

HARSANYI, M. A. (1993), Multiple authors, multiple problems – bibliometrics and the study of scholarly collaboration: A literature review. *Library and Information Science Research*, 15 (Fall) : 325–154.

HAWKINS, D. T. (1978), Bibliometrics of the online information retrieval literature. *Online Review*, 2 : 345–351.

HAWKINS, D. T. (2001), Bibliometrics of electronic journals in formation science. *Information Research*, 7 (1). Retrieved 22 April, 2006, from http://informationr .net/ir/7-1/paper120.html

HE, S. Y., SPINK, A. (2002), A comparison of foreign authorship distribution in JASIST and the Journal of Documentation. *Journal of the American Society for Information Science and Technology,* 53 (11) : 953–959.

JACSO, P. (2001). Electronic shoes for Cobbeler's children: Treatment of digital journals in library and information science database. *Online*, 25 (4) : 46–52.

JARVELIN, K., VAKKARI, P. (1990), Content-analysis of research articles in library and information-science. *Library and Information Science Research*, 12 : 395–421.

JARVELIN, K., VAKKARI, P. (1993), The evolution of library and information science 1965–1985: A content-analysis of journal articles. *Information Processing and Management*, 29 : 129–144.

JOGLEKAR, N., SEN, B. (2000), Evaluation of electronic journals in library and information science. In: I. K. RAVICHANDRA RAO (Ed.), *Annual Seminar on Electronic Sources of Information.* 1–3 March 2000, Bangalore.

KING, D. W., MCDONALD, D. D., RODERER, N. K. (1981), *Scientific Journals in the United States: Their Production, Use, and Economics* (Hutchinson Ross Publishing, Stroudsburg, Pennsylvania).

KOEHLER, W., AGUILAR, P., FINARELLI, S., GAUNCE, C., HATCHETTE, S., HEYDON, R. & AL. (2000), A bibliometric analysis of select information science print and electronic journals in the 1990s. *Information Research*, 6 (1). Retrieved 12 April, 2006, from http://InformationR.net/ir/6-1/paper88.html

KORYTNYK, C. A. (1988), Comparison of the publishing patterns between men and women Ph.D.s in Librarianship. *Library Quarterly*, 58 (1) : 52–65.

MAHAPATRA, G. (1994), Indian library and information science journals: A bibliometric analysis of the rate of citations and their characteristics. *Library Review*, 43 (3) : 41–46.

NISONGER, T. E. (1999), JASIS and library and information science journal ranking: A review and analysis of the last half century. *Journal of the American Society for Information Science and Technology*, 50 : 1004–1019.

NYE, J. S., KEOHANE, R. O. (1972), Introduction. In: R. O. KEOHANE, J. S. NYE (Eds), *Transnational Relations and World Politics*. Cambridge, MA: Harvard University Press.

OLSGAARD, J., OLSGAARD, J. (1980), Authorship in five library periodicals. *College and Research Libraries*, 41 : 49–54.

PEEK, R. P. (1996), Scholarly publishing, facing the new frontiers. In: R. P. PEEK, GREGORY B. NEWBY (Eds), *Scholarly Publishing: The Electronic Frontier* (pp. 3–15). Cambride, MA, USA: MIT Press.

PERSSON, O., ASTROM, F. (2005), Most cited universities and authors in library & information science 1990–2004. *Bibliometric Notes*, 7 (2), Retrieved 12 January, 2007, from http://www.umu.se/inforsk/BibliometricNotes/BN2-2005/BN2-2005.htm

RAVICHANDRA RAO, I. V. (1983), *Quantitative Methods for Library and Information Science* (pp. 179–217). New Delhi: Wiley Eastern.

SAHOO, K. C. (2002), *Information Use Pattern of Researches in Bio-Sciences: A Bibliometric Study*. Ludhiana: Medallion Press.

SARACEVIC, T., PERK, L. (1973), Ascertaining activities in a subject area through bibliometric analysis. *Journal of the American Society for Information Science*, 24 : 120–134.

SCHLOEGL, C., STOCK, W. G. (2004), Impact and relevance of LIS journals: A scientometric analysis of international and German-language LIS journals-citation analysis versus reader survey. *Journal of the American Society for Information Science and Technology*, 55 (13) : 1155–1168.

SEN, S. K., CHATTERJEE, S. K. (1990), An introduction to researches in bibliometrics, part 1: Background and perspective, *IASLIC Bulletin*, 35 (3) : 105–117.

SENGUPTA, I. N. (1990), Bibliometrics and identification of core periodicals. *Herald of Library Science*, 29 (3–4) : 226–247.

SIN, S-C. J. (2004), Are library and information science journals becoming more internationalized? – A longitudinal study of authors' geographical affiliations in 20 LIS journals from 1981 to 2003. In: A. GROVE (Ed.), *Proceedings 68th Annual Meeting of the American Society for Information Science and Technology (ASIST),* 42, Charlotte, US.

SINGH, S. N. (1983), *The Use of Social Science Literature in India: A Bibliometrics Study.* A thesis submitted to the BHU for the degree of Doctor of Philosophy. Varanasi: Banaras Hindu University.

SMIRAGLIA R. P., LEAZER, G. H. (1995), Reflecting the maturation of a profession: Thirty-five years of library resources and technical services. *Library Resources and Technical Services*, 38 : 27–46.

STEPHENSON, M. S. (1993), The Canadian library journal, 1981–1991: An analysis. *CJILS/RCSIB,* 18 : 1–18.

TENOPIR, C., KING, D. W. (2000), *Towards Electronic Journals: Realities For Scientists, Librarians, And Publishers* (Special Libraries Assoc., Washington DC,). Retrieved 18 March, 2007, from http://www.sla.org

TERRY, J. L. (1996), Authorship in college & research libraries revisited: Gender, institutional affiliation, collaboration. *College and Research Libraries*, 58 : 377–383.

VOORBIJ, H. (1999) Searching scientific information on the Internet: A Dutch academic user survey. *Journal of the American Society of Information Science*, 50 (7) : 598–615.

WHITE, H. D., MCCAIN, W. (1989), *Bibliometrics. Annual Review of Information Science and Technology,* 24 : 120. Medford, NJ: Information Today Inc.

ZHANG,Y. (1998), The impact of Internet based electronic resources on formal scholarly communication in the area of library and information science: A citation analysis. *Journal of Information Science*, 24 : 241–254.