

A bibliometric analysis and comparison on three information science journals: JASIST, IPM, JOD, 1998–2008

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Abstract Employing a citation analysis, this study explored and compared the bibliometric characteristics and the subject relationship with other disciplines of and among the three leading information science journals, *Journal of the American Society for Information Science and Technology* (JASIST), *Information Processing and Management* and *Journal of Documentation*. The citation data were drawn from references of each article of the three journals during 1998 and 2008. The Ulrich's Periodical Directory, Library of Congress Subject Heading, retrieved from the WorldCat, and LISA database were used to identify the main class, subclass and subject of cited journals and books. Quantitative results on the number of JASIST, IPM and JOD literature references, average number of references cited per paper, document type of cited literature and the journal self-citation rate are reported. Moreover, the highly cited journals and books, the main classes and subclasses of cited journals and books in papers of the three journals, the highly cited subjects in journals and books of library and information science were identified and analyzed. Comparison on the characteristics of cited journals and books confirmed that all the three journals under study are information science oriented, except JOD which is library science orientation. JASIST and IPM are very much in common and diffuse to other disciplines more deeply than JOD.

Keywords Bibliometric study · Cited books · Cited journals · Subject analysis · *Journal of the American Society for Information Science and Technology* (JASIST) · *Information Processing and Management* (IPM) · *Journal of Documentation* (JOD)

Introduction

As is well-accepted, information science is an interdisciplinary science evolving from the interaction of many other disciplines. Borko (1968) defined that information science is “a

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discipline that investigates the properties and behavior of information, the forces governing the flow of information, and the means of processing information for optimum accessibility and usability. He also commented that information science is an interdisciplinary science derived from and related to such fields as mathematics, logic, linguistics, psychology, computer technology, operations research, the graphic arts, communications, library science, management, and other similar fields". After 30 years, Saracevic (1999) examined the origin of information from various perspectives and dealt with the relation of information science to other fields from several aspects, including historical, sociological, philosophical, technological, educational, and interdisciplinary. He also revealed that "information science is interdisciplinary in nature", "is connected to information technology" and is "an active participant in the evolution of the information society with a strong social and human dimension, above and beyond technology".

Bibliometric techniques using references made to other documents can be employed to establish statistical models of scholarly communication flow. For example, citations can be used to map relationships between documents, between journals or other channels of scholarly communications. It also can be clustered to identify the flow of topics within and among disciplines (Borgman 1999). Indeed, citation analysis is an important area of library and information science. From the studies of citation analysis, one can understand which scholars from which disciplines cite which articles? Which journals are cited more often? Which disciplines cite the journals of other disciplines? (Desai 2003). The results of citation analysis are used for many purposes, for example, to determine the impact of specific articles or journals on subsequent research and to document the interdisciplinary applicability of various journals (Harter 1996).

The purpose of this study is to analyze and compare the characteristics of cited references in the *Journal of the American Society for Information Science and Technology* (JASIST), *Information Processing and Management* (IPM), and *Journal of Documentation* (JOD), which have been recognized as three most important journal sources in the field of information science (Paisley 1990; McCarthy 2000). As addressed in the scope of these three journals, they have been recognized as general-purpose journals, which publish articles about and from most areas of the discipline. As the leading journals in information science, such a study may help to understand the interactions among the disciplines relating to information science.

Literature review

In the literature, there have been some bibliometric studies on the cited reference of a particular journal in information science or scientometrics.

DeHart (1992) studied the end-of-article references appeared in issues, published in 1987–1990, of *Information Processing & Management* (IPM), *Journal of the American Society for Information Science* (JASIS), and *Journal of Documentation* (JD) to identify monographs cited. The percentage of monographic reference to all references in IPM, JASIS and JD were 21, 19 and 26%, respectively. He also identified the five most frequently cited authors and subjects, involving 20 different books, are G. Salton, C.M. van Rijsbergen, R. Schank, M. Kochen, and F. Machlup. The five most cited subjects are information storage and retrieval systems (72 times); artificial intelligence; discourse analysis; database management; and human–computer interaction.

Peritz and Bar-Ilan (2002) studied the extent to which the field of scientometrics and bibliometrics making use of the sources outside the field. The references of the articles

published in *Scientometrics* in the years of 1990 and 2000 were examined. They found that the following three fields: scientometrics and bibliometrics; library and information science; and the sociology, history and philosophy of science contributed to the references of 47.3 and 56.9% for the year of 1990 and 2000, respectively. Moreover, it was found that there is a significant increase in journal self-citation.

Bonnevie-Nebelong (2006) conducted an analysis of the *Journal of Documentation* (JOD) based on journal citation identity, journal citation image and internationalization. The analysis was compared to JASIS(T) and the *Journal of Information Science* (JIS). JOD demonstrates a higher rate of journal diversity in the references and a lower number of scientific publications. Moreover, JOD authors and citers appear to be affiliated to western European institutions at an increasing rate.

Lipetz (1999) studied many bibliometric aspects of papers in JASIS by examining volume of 1955, 1965, 1975, 1985 and 1995. One of his findings revealed that the number of scholarly papers published per year in JASIS has grown exponentially from 21 to 68. From 1955 to 1965, the average number of citations per paper dropped from 8.3 to 7.0; but the ratio increased exponentially thereafter to 30.5 in 1995. Smith (1999) explored how JASIS has developed over the past 50 years. One of her research topics was an analysis of the linkage between JASIS and other publications (which journals JASIS authors most often cite and which journals most often cite JASIS). She then identified the top most frequently cited journals by the authors of JASIS. Koehler (2001) investigated the status of information science as science through a bibliometric analysis of JASIS articles from 1950 to 1999. He concluded that “information may no longer be ‘little’ science, but it is also not ‘big’ science.”

Employing a variety of bibliometric methods, including publication and citation analyses, Bonnevie-Nebelong (2003) investigated a multifaceted portrait of the *Journal of Information Science*, focused on the last quarter of the twentieth century. The study revealed that 2,140 JIS publications in the SSCI and LISA, with 1,228 (57.4%) in SSCI and 912 (42.6%) in LISA, respectively, and 1,326 different authors, after removing of duplicate, wrote in JIS from 1979 to 2001 that were covered in SSCI and LISA. The journal co-citation analysis shows that JIS is mainly co-cited with journals in the field of LIS. *Journal of Documentation*, *JASIS* and *Scientometrics* are the top three journals closest to JIS.

Research questions and methods

As demonstrated in the literature review given in the above section, there are only a few previous studies on the comparison of the two or three journals, though separate studies in each journal are quite abundant. According to the literature review above reveals that most previous studies were on the bibliometric analysis of JIS, JOD, IPM, and JASIS(T). However, subject analysis on the references cited had been seldom studied. According to Paisley (1990) and McCarthy (2000), JASIST, IPM and JOD broadly represent the information science field. The objective of the present study is to analyze and compare the characteristics of cited references in the three studied journals from 1998 to 2008. A review of the references cited by the three journals could be very helpful in understanding the relations between information science and other subject disciplines. The present work focuses on the subject of references contained in the papers published in the three information science journals from 1998 to 2008. The present study identifies the amount of

journals and books cited and analyzes the subject matter of these publications and it may be somewhat a reflection of the disciplines it represents. The research problems include:

- (1) What types of document have been cited by the three information science journals?
- (2) What are the highly cited journals and books of information science?
- (3) What are main class and sub-class for the cited journals?
- (4) What are subjects for the cited journals of library and information science?
- (5) What are main class, sub-class and subject for the cited books?

This study explores the distribution and subjects of references in JASIST, IPM and JOD during 1998 and 2008. There are 2,031, 869 and 881 papers in JASIST, IPM and JOD, respectively, in 11 selected years, and their document types are shown in Table 1. Since this study aims to investigate papers with references, such as articles and review papers, 1,341 (66%), 719 (82.7%) and 354 (40.2%) papers in JASIST, IPM and JOD, respectively, were selected for further exploration. In terms of total articles published, JASIST is the most productive journal, and is more than twice of that published by IPM and JOD, both publish approximately the same number of articles. Interestingly, JOD published more book reviews (54%) than journal articles, while book review only contributes about 15 and 13% of all articles published in JASIST and IPM, respectively.

This study retrieved main class and subclass of cited journals from *Ulrich's Periodical Directory* and OCLC WorldCat on the basis of Library of Congress Classification (LCC). The classification was mainly based on LCC, and supplemented with Dewey Decimal Classification (DDC). In LCC, the first character symbolizes the main class, and second character represents subclass. If journals were classified by DDC, the corresponding LCC number would be examined according to the Dewey-LC Conversion table made by OCLC. If the corresponding LCC number could not be found, the data would not be analyzed. However, the main class, subclass and the subject of cited books were identified by LCC and Library of Congress Subject Headings (LCSH) searching from OCLC WorldCat.

In this study, the subject of cited journals for library and information science were examined on the basis of the descriptor field of each record in the Library and Information Science Abstracts (LISA). The descriptor field utilized controlled vocabulary from a thesaurus or from subject headings list that were created by the database producer. As indicated by Lancaster (1986), a controlled vocabulary would control the synonyms, nearly synonyms, homographs, and related terms; therefore, the search for a descriptor field would retrieve items with particular and comprehensive subject meanings.

Table 1 Types of papers in JASIST, IPM and JOD, 1998–2008

Type	JASIST		IPM		JOD	
	Papers	%	Papers	%	Papers	%
Article	1,341	66	719	82.7	354	40.2
Book review	302	15	112	12.9	476	54.0
Other	388	19	38	4.4	51	5.8
Total	2,031	100	869	100	881	100

Results and discussion

Total published papers references

Table 2 shows the numbers of references that authors cited in their JASIST, IPM and JOD papers. In the 11 selected years, and the average number of references cited per JASIST, IPM and JOD paper was 38 (51,359 references/1,341 articles), 32 (23,210 references/719 articles) and 40 (14,174 references/354 articles), respectively. The differences between the average references cited by any two journals of JASIST, IPM and JOD were examined using the Tukey test within the ANOVA. The p -value is 0.001, 0.015 and 0.414 between IPM and JOD, between IPM and JASIST, and between JOD and JASIST, respectively. Therefore, there is significant difference between IPM and JOD, between IPM and JASIST. However, the difference between JOD and JASIST is insignificant within 95% confidence interval. This may suggest that JOD and JASIST emphasize more on citing previous works than IPM does. Table 2 also demonstrates that after 2004 number of citations increased significantly for the three journals under study, possibly due to the more articles published after 2005. For IPM, the average number of citation also increased significantly after 2005.

Document type of cited literature

Table 3 illustrates the distribution of document type for the references cited in research article and review paper in JASIST, IPM and JOD for the study period. Table 3 indicates that journal articles were the most cited document for all the three journals under study and JASIST has the highest percentage of 50.8%. The book comes as the next most cited document type, i.e. 20.5% for JASIST, 26.8% for JOD, and IPM shows the highest percentage of 30.7%. This is similar to that reported by DeHart (1992) for JASIST (19%), and JOD (26%) during the period of 1987–1990. However, compared to the percentage of about 21% for the period from 1987 to 1990 as reported by DeHart (1992), the percentage of books cited in IPM for the period from 1998 to 2008 increased about 10%. It may reflect the percentage of monographs cited in these three journals is increasing. Authors of IPM

Table 2 Total and average number of references cited in JASIST, IPM and JOD, 1998–2008

Year	JASIST			IPM			JOD		
	References (%)	Paper	Average	References (%)	Paper	Average	References (%)	Paper	Average
1998	3,078 (6.0)	92	33.46	1,345 (5.8)	46	29.24	842 (5.9)	28	30.07
1999	3,702 (7.2)	122	30.34	1,498 (6.5)	43	34.84	979 (6.9)	25	39.16
2000	3,641 (7.1)	104	35.01	1,088 (4.7)	38	28.63	1,197 (8.4)	32	37.41
2001	3,561 (6.9)	102	34.91	1,468 (6.3)	41	35.80	1,411 (10.0)	32	44.09
2002	3,486 (6.8)	104	33.52	1,236 (5.3)	43	28.74	1,200 (8.5)	26	46.15
2003	3,599 (7.0)	102	35.28	1,512 (6.5)	45	33.60	1,182 (8.3)	28	42.21
2004	3,750 (7.3)	97	38.66	1,535 (6.6)	54	28.43	1,097 (7.7)	31	35.39
2005	4,959 (9.7)	119	41.67	2,949 (12.7)	87	33.90	1,417 (10.0)	35	40.49
2006	6,100 (11.9)	158	38.61	3,216 (13.9)	101	31.84	1,215 (8.6)	33	36.82
2007	8,049 (15.7)	174	46.26	3,295 (14.2)	109	30.23	1,739 (12.3)	41	42.41
2008	7,434 (14.5)	167	44.51	4,068 (17.5)	112	36.32	1,895 (13.4)	43	44.07
Total	51,359 (100.0)	1,341	38.00	23,210 (100.0)	719	32.28	14,174 (100.0)	354	40.04

Table 3 Document types of cited literature for JASIST, IPM and JOD, 1998–2008

Document type	JASIST		IPM		JOD	
	Papers	%	Papers	%	Papers	%
Journal	26,083	50.8	9,923	42.8	6,520	46.0
Book	10,544	20.5	7,117	30.7	3,792	26.8
Conference	7,463	14.5	3,614	15.6	1,205	8.5
E-resource	4,568	8.9	1,414	6.1	130	13.1
Dissertation	682	1.3	359	1.5	1,857	0.9
Other	2,019	3.9	783	3.4	670	4.7
Total	51,359	99.9	23,210	100.0	14,174	100.0

tend to cite monographs more in recent years. Conference papers rank third for JASIST and IPM while it ranks fourth for JOD. For JASIST and IPM, the E-resources are the fourth contributor to the cited references, while it ranks third for JOD.

The cited journals

Table 4 lists the top ten highly cited journals for JASIST, IPM and JOD for the study period, contributes 39.0, 49.6 and 40.4% of all journal references.

Significantly, among the top ten most cited journals, there are seven in common for the three journals under study though the ranking may be different. These seven journals are *Journal of the American Society for Information Science and Technology*, *Information Processing and Management*, *Scientometrics*, *Journal of Documentation*, *Communications of the Association for Computing Machinery*, *Annual Review of Information Science and Technology*, *Journal of Information Science*. JASIST is the common most highly cited journal contributing 17.46, 17.16 and 12.34% of journal references for JASIST itself, IPM and JOD, respectively; IPM is the second most highly cited journal for JASIST and IPM itself, while JOD is the second most cited journal for JOD itself. It is also interesting to note JASIST has the highest self-citation percentage of 17.46%, next by IPM of 14.11%, and JOD has the least self-citation percentage of 10.19% among the three journals under study. Moreover, most of the top ten highly cited journals for the three prevalent journals in information science under study, contributing about 40–50% of cited journals, are information science journals, though only two or three journals are library science journals e.g., *College & Research Libraries*, *Library Trends*, *Library Quarterly*. This is another phase of “self-citation”. Peritz and Bar-Ilan (2002) also found that library and information science is one of the three most cited for the references of the articles in *Scientometrics* in the year of 1990 and 2000. The researchers in the information science tend to cite more research outcomes in their own subject fields. This is unexpected but information science is a multidisciplinary subject, one may expect broader citation.

Main class and subclass of cited journals

The top ten main classes among the 20 main classes of journals cited in JASIST, IPM and JOD, 1998–2008 are listed in Table 5 for comparison. These top ten main classes contribute near or more than 99% of journals cited by the three journals under study. Table 5 indicates that there are eight classes in common, though the order may be different.

Table 4 Highly cited journals in JASIST, IPM and JOD, 1998–2008

Title	Rank & times cited (%)		
	JASIST	IPM	JOD
<i>Journal of the American Society for Information Science and Technology</i>	1 (4736, 17.46%)	1 (1747, 17.16%)	1 (856, 12.34%)
<i>Information Processing and Management</i>	2 (1517, 5.59%)	2 (1436, 14.11%)	3 (332, 4.78%)
<i>Scientometrics</i>	3 (1061, 3.91%)	5 (476, 4.68%)	4 (213)
<i>Journal of Documentation</i>	4 (999)	3 (340)	2 (681, 10.19%)
<i>Communications of the Association for Computing Machinery</i>	5 (580)	4 (261)	–
<i>Annual Review of Information Science and Technology</i>	6 (436)	7 (168)	6 (125)
<i>Journal of Information Science</i>	7 (377)	8 (151)	5 (191)
<i>Library and Information Science Research</i>	8 (323)	–	10 (98)
<i>Science</i>	9 (281)	–	–
<i>College & Research Libraries</i>	10 (254)	–	–
<i>ACM Transactions on Information Systems</i>	–	6 (227)	–
<i>Computational Linguistics</i>	–	9 (127)	–
<i>Information Retrieval</i>	–	10 (109)	–
<i>Library Trends</i>	–	–	7 (103)
<i>D-Lib Magazine</i>	–	–	8 (102)
<i>Library Quarterly</i>	–	–	9 (101)
Subtotal	10,564 (39%)	5,042 (50%)	2,802 (40%)
Total journal references	27,115	10,175	6,939

Significantly, the top three main classes are in common and in the same order and account for more than 80% of journals cited. These three main classes in order are: “Bibliography. Library Science. Information Resources (General)”, “Science” and “Social Sciences (General)”. JOD emphasizes more on “Bibliography. Library Science. Information Resources (General)”, which contributes 64.1% of journals cited, than that for IPM (52.9%) and JASIST (46.9%). This suggests that JOD emphasizing more on library science than JASIST and IPM do. Indeed, although “Science” is the second main class, its percentage for JOD is 11.7%, much smaller than that for IPM (24.4%) and JASIST (21.4%). Similar distribution also appears for the class of “Technology”, JOD presents significantly lower percentage than the other two do. This is consistent with that revealed by Bonnevie-Nebelong (2006) who indicated that JOD has a lower number of scientific publications and demonstrates a high rate of journal diversity in the references. The other interesting fact is that JASIST illustrates much higher percentage (12.0%) for “Social Sciences (General)” than that of IPM (7.9%) and JOD (7.1%). These data suggest that the journals cited by JASIST spread to broader subjects than that for IPM and JOD.

Furthermore, there are 143, 86, and 92 subclasses of journals cited in JASIST, IPM and JOD, respectively. Table 6 presents the top ten subclasses of non-LIS journals cited in these three journals. Similar to the main classes of the journal cited, Table 6 indicates that there are seven out of top ten subclasses of non-library and information science journals

Table 5 Main classes of journals cited in JASIST, IPM and JOD, 1998–2008

Rank	JASIST		IPM		JOD	
	Main class	%	Main class	%	Main class	%
1	Bibliography. Library Science. Information Resources (General)	46.9	Bibliography. Library Science. Information Resources (General)	52.9	Bibliography. Library Science. Information Resources (General)	64.1
2	Science	21.4	Science	24.4	Science	11.7
3	Social Sciences (General)	12.0	Social Sciences (General)	7.9	Social Sciences (General)	7.1
4	Technology	5.57	Technology	6.4	Medicine	3.8
5	Medicine	3.53	Language and Literature	3.3	Technology	3.5
6	Philosophy. Psychology. Religion	3.46	Philosophy. Psychology. Religion	1.8	Education	2.6
7	Education	2.60	Medicine	1.2	Philosophy. Psychology. Religion	2.3
8	Language and Literature	2.34	Education	1.1	Language and Literature	2.3
9	Political Science	0.78	Law	0.2	Law	0.8
10	Law	0.38	Geography. Anthropology. Recreation	0.2	General Works	0.4
	% of 11–20th main classes	1.06		0.6		1.4
	Total %	100.0		100.0		100.0

cited in JASIST, IPM and JOD are in common though their ranking may be different. This further demonstrates the similarity of the journals cited in these three journals. Moreover, for JASIST and JOD, the top four subclasses are in common and in the same order, though the percentage for JOD is somewhat lower. This further demonstrates the similarity of the subclass of the journals cited in JASIST and JOD. For IPM, the major subclass is “Electronic Computers. Computer Science” (14.5%), followed by “Science (General)” (8.5%).

Subjects of cited journals for LIS

By examining the descriptor field of each record in the *Library and Information Science Abstracts* (LISA) database, Table 7 illustrates the rank and percentage of cited frequency for the top 20 subject terms cited by the three journals of this study. Table 7 shows that the seven out of the top 10 subjects are in common, though the order may be different, of the LIS journals cited in the three journals under study. The similarity is particularly evident for JASIST and IPM. The top most cited subjects are the same, except the order for the 4th and 5th are alternate. These seven subjects are all library and information science related. In particular, “Searching” is the most cited subject for all the three journals, followed by “Online Information Retrieval” (JASIST, IPM) or “Information Work” (JOD). Interestingly, “Computerized Information Storage and Retrieval” is one of the top ten most cited subjects for JASIST and IPM. “Computerized Information Retrieval Relevance” is in the

Table 6 Top ten subclasses of non-LIS journals cited in JASIST, IPM and JOD, 1998–2008

Subclass	Rank (%)		
	JASIST	IPM	JOD
Science (General)	1 (9.3)	2 (8.5)	1 (6.8)
Electronic Computers. Computer Science	2 (8.1)	1 (14.5)	2 (3.7)
Industries. Land Use. Labor	3 (3.9)	6 (2.5)	3 (2.0)
Commerce	4 (3.6)	4 (3.1)	4 (1.8)
Psychology	5 (3.3)	7 (1.7)	4 (1.8)
Medicine (General)	6 (2.0)	10 (0.7)	4 (1.8)
Electrical Engineering. Electronics. Nuclear Engineering	7 (2.0)	3 (3.3)	9 (1.3)
Technology (General)	8 (1.8)	9 (1.4)	–
Theory and Practice of Education	9 (1.8)	–	7 (1.7)
Sociology (General)	10 (1.8)	–	10 (1.2)
Philology and Linguistics (General)	–	5 (2.8)	8 (1.5)
Engineering (General). Civil Engineering (General)	–	8 (1.4)	–
% of top ten non-LIS subclasses	37.5	40	23.6
% of other subclasses ^a	62.5	60	76.4
Total %	100	100	100
Kinds of subclasses	143	86	92

^a Including LIS subclasses (JASIST, 53%; IPM, 53%; JOD, 64%)

top 20 for JASIST, and “Computerized Information Retrieval” and “Computerized Subject Indexing” are in the top 20 for IPM. However, all of these four computer-related subjects are out of the top 20 most cited journal list of JOD. This indicates that papers published in JOD are less computer-related than JASIST and IPM and JOD is more traditional library science oriented than JASIST and IPM are.

Analysis of cited books

There are 5,565, 1,985 and 2,713 titles of book cited by JASIST, IPM and JOD respectively, for 1998–2008 under study as shown in Table 8. In average, 7.83, 4.13 and 9.33 books were cited per paper by JASIST, IPM, and JOD, respectively. Statistical tests indicate that the difference between any two of these three journals is significant with p -value between IPM and JOD, between IPM and JASIST, and between JASIST and JOD of 0.00, 0.00 and 0.05. This suggests that, in average, JOD cites significantly more books than JASIST and IPM do. IPM cites least books among the three journals under study. All these book references can be divided into 20 main classes, 160 subclasses and 3,748 subjects.

Highly cited books

Table 9 lists the ten most highly cited books by the three journals for the time period under study. The table indicates that there is only one book in common, that is *Seeking Meaning: A Process Approach to Library and Information Services*, authored by Kuhlthau, C.C., which was cited 61, 23, and 15 times by JASIST, IPM and JOD, respectively. However, there are eight in common for JASIST and IPM and *Introduction to Modern Information Retrieval*, authored by Salton, G. and McGill, M. is the top most cited book for JASIST and

Table 7 Top 20 subjects of LIS journal papers cited in JASIST, IPM and JOD, 1998–2008

Subject	Rank (%)		
	JASIST	IPM	JOD
Searching	1 (5.23)	1 (6.9)	1 (3.3)
Online Information Retrieval	2 (3.92)	2 (5.6)	3 (2.9)
Information Work	3 (3.49)	3 (4.5)	2 (3.1)
Subject Indexing	4 (2.71)	5 (3.8)	7 (1.5)
Information Storage and Retrieval	5 (2.57)	4 (3.9)	6 (1.6)
Technical Services	6 (2.15)	6 (3.1)	10 (1.5)
World Wide Web	7 (2.12)	7 (2.8)	4 (2.3)
Computerized Information Storage and Retrieval	8 (1.96)	9 (1.7)	–
Citation Analysis	9 (1.77)	20 (0.7)	11 (1.4)
Bibliometrics	10 (1.47)	17 (0.8)	18 (1.0)
Computerized Information Retrieval Relevance	11 (1.40)	–	–
Information Seeking Behaviour	12 (1.38)	10 (1.5)	5 (1.9)
Research	13 (1.37)	13 (1.3)	8 (1.5)
Periodicals	14 (1.26)	–	9 (1.5)
Evaluation	15 (1.22)	8 (1.8)	14 (1.1)
Library Materials	16 (1.19)	18 (0.7)	12 (1.4)
Relevance	17 (1.04)	11 (1.5)	–
Strategies	18 (0.97)	–	–
Internet	19 (0.96)	–	13 (1.2)
Models	20 (0.95)	15 (0.8)	–
Computerized Information Retrieval	–	12 (1.4)	–
Search Engines	–	14 (0.9)	–
Search Strategies	–	16 (0.8)	–
Computerized Subject Indexing	–	19 (0.7)	–
UK	–	–	15 (1.1)
Information Science	–	–	16 (1.1)
User Surveys	–	–	17 (1.0)
Libraries	–	–	19 (0.9)
University Libraries	–	–	20 (0.9)
% of top 20 subjects	39.11	45.1	32.1
% of other subjects	60.9	54.9	67.9
Total %	100	100	100
Kinds of subjects	2,810	1,629	2,022

IPM, while the most cited book in JOD is articles published in *Encyclopedia of Library and Information Science*. This further shows the similarity of JASIST and IPM and the difference between JOD and these two journals. The number two and number three highly cited books for JASIST and IPM are Van Rijsbergen's *Information Retrieval* and Salton's *The SMART Retrieval System : Experiments in Automatic Document Processing*. Interestingly, Salton, G. and Van Rijsbergen, C.J. are also among the top cited monographic book authors in DeHart (1992) study for the period of 1987–1990.

Table 8 Numbers of cited book titles in JASIST, IPM and JOD, 1998–2008

Year	JASIST			IPM			JOD		
	Book cited	Paper	Ave. no book cited	Book cited	Paper	Ave. no book cited	Book cited	Paper	Ave. no book cited
1998	819	92	8.90	211	46	4.59	169	28	6.04
1999	967	122	7.93	280	43	6.51	203	25	8.12
2000	918	104	8.83	204	38	5.37	262	32	8.19
2001	776	102	7.61	167	41	4.07	331	32	10.34
2002	770	104	7.40	200	43	4.65	292	26	11.23
2003	687	102	6.74	247	45	5.49	252	28	9.00
2004	624	97	6.43	159	54	2.94	282	31	9.10
2005	920	119	7.73	261	87	3.00	469	35	13.40
2006	1,070	158	6.77	288	101	2.85	285	33	8.64
2007	1,653	174	9.50	261	109	2.39	378	41	9.22
2008	1,388	167	8.31	397	112	3.54	404	43	9.40
Total	5,565	1,341	7.83	1,985	719	4.13	2,713	354	9.33

Most books cited in JASIST and IPM papers are about information retrieval, such as *Information Retrieval Data Structures and Algorithms*, *Automatic Text Processing: the Transformation, Analysis and Retrieval of Information by Computer*, *Information Retrieval: Data Structures & Algorithms*.

Main classes of cited books

Based on the LCC, all books that were cited by the three journals were grouped into 20 main classes and the top ten main classes are listed in Table 10. It can be seen that there are eight out of the top ten main classes contributing 94–98% of cited books. Table 10 also shows that “Science” is the most cited class for JASIST (27%) and IPM (35.2%), while the most cited class for JOD is “Bibliography. Library Science. Information Resources (General)” (30%).

Subjects of cited books

The subject of cited books can be retrieved from the LCSH on the WordCat. The books cited by JASIST, IPM and JOD contain 3,748, 1,616, and 2,439 unique subject headings, respectively. Most subjects were cited once only. For JASIST, IPM and JOD, those subjects cited once account for 47.2, 53.3, and 58.2%, respectively. This shows the degree of spreading of cited subjects. On the other hand, Table 11 displays top 20 subjects of cited books of JASIST, IPM and JOD. For the three journals under study, most of the cited subjects are library and information science related, such as information storage and retrieval systems, information retrieval, information science, indexing, etc. Indeed, six out of the 20 most cited subjects are in common and most of these common subjects are information science or information retrieval related. The information storage and retrieval systems is the top most cited subject for all the three journals under study. It accounts for 2.2, 7.1 and 1.8% for JASIST, IPM and JOD, respectively. The high percentage of information storage and retrieval subject cited in IPM suggests that IPM’s nature of

Table 9 Highly cited books in JASIST, IPM and JOD, 1998–2008

Title	Author	Rank & times cited		
		JASIST	IPM	JOD
Introduction to Modern Information Retrieval	Salton, G., & McGill, M.J.	1 (95)	1 (103)	–
Information Retrieval	Van Rijsbergen, C.J.	2 (65)	3 (62)	–
The SMART Retrieval System : Experiments in Automatic Document Processing	Salton, G.	3 (65)	2 (86)	–
Seeking Meaning : A Process Approach to Library and Information Services	Kuhlthau, C.C.	4 (61)	9 (23)	6 (15)
Automatic Text Processing : The Transformation, Analysis, and Retrieval of Information by Computer	Salton, G.	5 (58)	6 (41)	–
Information Retrieval : Data Structures & Algorithms	Frakes, W.B. & Baeza-Yates, R.	6 (52)	4 (58)	–
The Web of Knowledge : A Festschrift in Honor of Eugene Garfield	Cronin, B. & Atkins, H.B.	7 (50)	–	–
Information Seeking in Electronic Environments	Marchionini, G.	8 (49)	7 (29)	–
Scholarly Communication and Bibliometrics	Borgman, C.L.	9 (49)	–	–
Modern Information Retrieval	Baeza-Yates, R., & Ribeiro-Neto, B.	10 (45)	5 (57)	–
Advances in Automatic Text Summarization	Mani, I. & Maybury, M.T.	–	8 (26)	–
Managing Gigabytes: Compressing and Indexing Documents and Images	Witten, I.H., Moffat, A. & Bell, T.C.	–	10 (20)	–
Encyclopedia of Library and Information Science (chapter)	–	–	–	1 (23)
The International Serials Industry	Woodward, H. & Pilling, S.	–	–	2 (19)
Scholarly Publishing: The Electronic Frontier	Peek, R.P. & Newby, G.R.	–	–	3 (18)
Information Seeking and Subject Representation: An activity-Theoretical Approach to Information Science	Hjorland, B.	–	–	4 (17)
Information Retrieval Interaction	Ingwersen, P.	–	–	5 (17)
Theories of Information Behavior	Fisher, K., Erdelez, S., McKechnie, L.	–	–	7 (14)
The Mathematical Theory of Communication	Shannon, C.E., Weaver, W.	–	–	8 (13)
The Discovery of Grounded Theory: Strategies for Qualitative Research	Glaser, B.G. & Strauss, A.L.	–	–	9 (12)
Citation Indexing: Its Theory and Application in Science, Technology and Humanities	Garfield, E.	–	–	10 (12)

Table 10 Main classes of books cited in JASIST, IPM and JOD, 1998–2008

Main class	Rank (%)		
	JASIST	IPM	JOD
Q—Science	1 (27.0)	1 (35.2)	3 (12.5)
H—Social sciences (General)	2 (20.4)	3 (10.6)	2 (16.3)
Z—Bibliography. Library Science. Information Resources (General)	3 (18.0)	2 (26.4)	1 (30.0)
B—Philosophy. Psychology. Religion	4 (11.0)	5 (7.0)	4 (10.9)
P—Language and Literature	5 (8.1)	4 (10.0)	5 (10.7)
T—Technology	6 (5.6)	6 (5.6)	7 (4.0)
L—Education	7 (3.6)	7 (1.8)	6 (5.0)
J—Political Science	8 (1.2)	–	–
R—Medicine	9 (1.2)	8 (0.7)	10 (1.3)
K—Law	10 (0.9)	9 (0.7)	–
G—Geography. Anthropology. Recreation.	–	10 (0.6)	9 (1.4)
D—History (General) and History of Europe	–	–	8 (2.1)
% of 11–20th main classes	3.19	1.44	5.91
Total %	100	100	100

information science. Some subjects on library science appear in JOD's most cited subjects only, such as libraries, library science, public libraries, discourse analysis, indicating JOD is more traditional library science oriented.

Summary and conclusions

The present study conducts a bibliometric analysis and comparison of JASIST, IPM and JOD publications for volumes published from 1998 to 2008. The following conclusions may be drawn from this study:

JASIST published more than twice of articles of IPM and JOD, both published approximately the same number of articles. Interestingly, JOD published more book reviews (54%) than journal articles. The average number of references cited per paper for JASIST and JOD is 38 and 40. It is significantly higher than that of IPM of 32. There is no significant difference between JASIST and JOD in terms of average number of references cited. In average, 9.3, 7.8, 4.1 books were cited per paper by JOD, JASIST and IPM, respectively. JOD cites books per paper most, while IPM cites least.

JASIST has the highest self-citation rate of 17.46%, next by IPM of 14.11% and JOD has the least self-citation rate of 10.19%. Four of the top five highly cited journals are in common, i.e., *Journal of the American Society for Information Science and Technology*, *Information Processing and Management*, *Scientometrics*, and *Journal of Documentation*. On the other hand, the most cited three books in common for JASIST and IPM are Salton and McGill's *Introduction to Modern Information Retrieval*, Van Rijsbergen's *Information Retrieval* and Salton's *The SMART Retrieval System: Experiments in Automatic Document Processing*. For the three journals under study, most of the top ten highly cited journals, contributing about 40–50% of cited journals, are information

Table 11 Top 20 subjects of books cited in JASIST, IPM and JOD, 1998–2008

Subject	Rank (%)		
	JASIST	IPM	JOD
Information Storage and Retrieval Systems	1 (2.2)	1 (7.1)	1 (1.8)
Human–Computer Interaction	2 (1.3)	5 (1.3)	15 (0.5)
Information Retrieval	3 (1.3)	2 (1.7)	3 (1.2)
Information Science	4 (1.1)	10 (1.0)	2 (1.4)
Cognition	5 (0.8)	18 (0.6)	–
Indexing	6 (0.7)	14 (0.7)	5 (0.8)
Science-Philosophy	7 (0.7)	–	9 (0.6)
Reference services (Libraries)	8 (0.7)	–	–
Social sciences-Research	9 (0.7)	–	13 (0.6)
Artificial intelligence	10 (0.7)	9 (1.1)	–
Science-Social aspects	11 (0.6)	–	18 (0.5)
Information behavior	12 (0.6)	12 (0.8)	7 (0.8)
Database management	13 (0.6)	8 (1.2)	–
Library research	14 (0.6)	–	–
Knowledge, Theory of	15 (0.6)	–	14 (0.5)
Social sciences-Statistical methods	16 (0.6)	19 (0.6)	–
Information organization	17 (0.6)	–	–
User interface (Computer systems)	18 (0.5)	–	–
Text processing (Computer science)	19 (0.5)	4 (1.5)	–
Library science	20 (0.5)	–	4 (0.9)
Computer Algorithms	–	3 (1.5)	–
Computational Linguistics	–	6 (1.2)	–
SMART (Information Retrieval System)	–	7 (1.2)	–
Data Structures (Computer Science)	–	11 (0.9)	–
Machine Learning	–	13 (0.8)	–
Natural Language Processing (Computer Science)	–	15 (0.7)	–
Information Science-Statistical Methods	–	16 (0.7)	–
Communication	–	17 (0.7)	–
Cross-Language Information Retrieval	–	20 (0.6)	–
Libraries	–	–	6 (0.8)
Digital Libraries	–	–	8 (0.6)
Public Libraries	–	–	10 (0.6)
Discourse Analysis	–	–	11 (0.6)
Communication in Science	–	–	12 (0.6)
Qualitative Research	–	–	16 (0.5)
Information Technology-Social Aspects	–	–	17 (0.5)
Research	–	–	19 (0.5)
Subject Cataloging	–	–	20 (0.5)
% of top 20 subjects	15.6	26	14.7
% of other subjects	84.4	74	85.3
Total %	100	100	100
Kinds of subjects	3,748	1,616	2,439

science journals indicating that the researchers in the information science field cite more research results in their own field.

The top three main classes of cited journals in papers of the three journals under study are in common and in the same order, i.e., “Bibliography. Library Science. Information Resources (General)”, “Science” and “Social Sciences (General)”. As for the books cited, the most cited main class in JASIST and IPM papers is science, while the most cited main class for JOD is “Bibliography. Library Science. Information Resources (General)”.

The top three highly cited subjects of library and information science journals are in common and encompass “searching”, “online information retrieval”, and “information work”. Papers in JOD are less computer-related than JASIST and IPM and JOD is more traditional library science oriented than JASIST and IPM are. On the other hand, “Information Storage and Retrieval Systems” and “Information Retrieval” are two of the three most cited subjects of books cited by the three journals under study.

Comparison on the characteristics of cited journals and books reveals that JASIST and IPM are much more information science oriented than JOD and they are very much in common and diffuse into other disciplines more deeply than JOD. Results of the present research also suggest that information science, as represented by JASIST, IPM and JOD, is a developing interdisciplinary subject with an expanding literature. Increasingly, there has been great growth in the citing of previous literature in library and information science, social sciences, nature science, industries/land use/labor, and mathematics/computer science, demonstrating the interdisciplinary nature of information science. These findings support the assumption that the three information science journals, JASIST, IPM and JOD accurately represents the information science discipline on the basis of Borko’s (1968) and Saracivic’s (1999) definitions.

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