Journal Impact and Proximity:

An Assessment Using Bibliographic Features

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Abstract

Journals in the "Information Science and Library Science" category of Journal Citation Reports (JCR) were compared using both bibliometric and bibliographic features. Data collected covered: journal impact factor, number of issues per year, number of authors per paper, longevity, editorial board membership, frequency of publication, number of databases indexing the journal, number of aggregators providing full text access, country of publication, Journal Citation Reports categories, Dewey Decimal Classification, and journal statement of scope. Three features significantly correlated with journal impact factor: number of editorial board members and number of Journal Citation Report categories in which a journal is listed correlated positively; journal longevity correlated negatively with journal impact factor. Co-word analysis of journal descriptions provided a proximity clustering of journals, which differed considerably from the clusters based on editorial board membership. Finally, a multiple linear model was built to predict the journal impact factor based on all the collected bibliographic features.

Introduction

Bibliometric studies are intriguing for the moments of illumination they provide on, for example, an individual career, the pecking order of journals in a discipline, apparent affinities among scholars, or (dis)similarities among journals in a field. In one of the first attempts at journal clustering using bibliometric methods, Carpenter and Narin (1973, p. 425) noted the “practical and aesthetic motivation” for the work. Their research revealed both (sub)disciplinary and geographic clusters among publications. Bibliometricians usually study authors and keywords associated with journal articles, as well as the collections of articles that form journals. The journal thus becomes an essential component in many bibliometric analyses. Although researchers have produced many groupings and rankings of authors, institutions, and journals, readers are left to assess how well these bibliometrics-based presentations actually represent a field. In addition, the selection or preferencing of certain bibliometric measures may influence researchers’ interpretations of relationships among journals and even the performance of scholarly communication (e.g., when authors are rewarded for publishing in highly ranked journals).

Journal assessments have been based on a variety of bibliometric measures, but other features of a journal might also influence its impact. Zwemer (1970) identified seven characteristics of a quality journal: 1) high standards for acceptance of manuscripts, 2) a broadly representative editorial board with appropriate representation of subdisciplines, 3) a critical refereeing system, 4) promptness of publication, 5) coverage by major abstracting and indexing services, 6) authors’ confidence in the journal content, and 7) high frequency of citation by other journals; ISI (Garfield, 1990) added: 8) including abstracts or summaries in English, 9) including author’s addresses, and 10) providing complete bibliographic information.

For example, authors seeking insightful comments and suggestions in referee reviews may value editorial board prestige; or, the number of papers published or number of issues per year can be seen as indicators of a journal’s ability to reach a large audience. Both a low acceptance rate and coverage in prestigious databases indicate quality journals for some tenure committees and other institutional reviewers. Few studies have focused on how such non-bibliometric features may influence journal impact. This paper presents a systematic analysis of 66 journals in ISI's information science and library science (IS&LS) category to examine how certain bibliographic features relate to journal impact. The IS&LS journal set provides an interesting test case; several researchers have interpreted bibliometric data to indicate distinct sub-groups within this category (e.g., Boyack, Klavans, & Börner, 2005; Marshakova-Shaikevich, 2005; Ni & Ding, 2010).

In this analysis, the bibliographic features for each journal were compiled from the Web of Science and *Ulrich's Periodicals Directory*, which includes brief descriptions from *Magazines for Libraries*. We compare journal ranking by impact factor and mean citation rate with the following bibliographic features: 1) publisher, 2) place of publication, 3) duration of publication (how long has the journal been published?, or journal "longevity"), 4) publication frequency, 5) inclusion in *Social Sciences Citation Index*, 6) inclusion in *Science Citation Index*, 7) number of abstracting and indexing databases in which the journal is covered, and 8) number of online aggregators (e.g., EBSCOhost) that include the full text of the journal. Furthermore, we generate maps based on a textual analysis of journal descriptions in *Magazines for Libraries*.

This paper is organized as follows. Following this introduction of the problem, we review work on journal relationships and journal impact evaluation using other-than-bibliometric features. We then discuss the research methods used. The next section discusses major findings; and a conclusion suggests questions for future research.

Related Work

The journal remains an important unit for assessing scholarly impact through measures such as impact factor (Garfield, 2006; Leydesdorff, & Bornmann, 2011), citation analysis (Leydesdorff, 2006), and co-citation analysis (Ding, Chowdhury, & Foo, 2000). Bibliometric measures have been extended to provide graphs of relationships among journals. As discussed in the next subsections, non-bibliometric measures such as journal usage (e.g., download and inter-library loan), geographic penetration, and make-up of editorial boards have also been used to examine journal impact.

Graphic relationships among journals

Bibliometricians have studied many kinds of citation networks to create graphic representations of scientific and scholarly communication (e.g., Garfield, 1979; McCain, 1991) and research areas (Boyack & Klavans, 2010; Bramm, Moed, & van Raan, 1991; Bricker, 1991; Zhang, Liu, Janssens, Liang, & Glänzel, 2009). Some researchers have compared the networks, clusters, or maps produced by bibliometric analysis with other observations of the same data (e.g., Tijssen, & Van Leeuwen, 1995). Börner, Chen, and Boyack (2003) compared author co-citation, document co-citation, and various keyword approaches in their tutorial on visualization techniques. Klavans and Boyack (2006) developed a framework to compare and assess the performance of intercitation and co-citation relatedness measures. Liu, Yu, Janssens, Glänzel, Morea, and De Moor (2010) combined lexical (derived from text mining) and citation-based methods for generating journal clusters.

Journal usage as indicator of impact

Bollen, Van de Sompel, Smith, and Luce (2005) used clickstream data to form networks of journals and calculated network centrality metrics to rank journals. They reported moderate deviation between their journal rankings and those using the ISI journal impact factor. Kurtz, Eichhorn, Accomazzi, Grant, Demleitner, and Murray (2005) examined the electronic accesses of journal articles hosted by the NASA Astrophysics Data System. They compared obsolescence (decline in use over time) as measured by user access and by citation, finding that citations decline more rapidly than readership. Kurtz and colleagues cite and discuss other examples that compare patterns of citation with evidence of use. Darmoni, Roussel, Benichou, Thirion, and Pinhas (2002) found significant positive correlation between reading (number of online accesses) and impact factors of medical journals; however, the significance disappeared after removing two high impact journals from the calculation. Garfield (2006) argued that readership (or downloading) differs from citation in a journal article, and thus should not be employed as a measure of impact; the relationship and comparability of use and impact remain interesting topics for exploration.

JOURNAL IMPACT USING OTHER FEATURES

Rousseau (2002) provided an overview of journal evaluation indicators. He pointed out that, although the impact factor is probably the most used, it does not reflect library usage or journal popularity. He also noted that “geographical distribution patterns of subscribers, authors, and citers, as well as the correlations between them is still another indicator” (Rousseau, 2002, p. 419). He mentioned other factors that could be used in evaluating journals, including the quality of the editorial board, papers published, and the illustrations, as well as the number of institutional and individual subscriptions.

Rousseau (2002) chose interlibrary lending as an indicator of journal’s importance for the community served by a library. Wormell (1998) analyzed geographic distributions of authors and citers of several LIS journals, noting, for example, that *College & Research Libraries* is particularly targeted toward a U.S. audience. Peritz (1995) studied journal subscription data, comparing circulation and impact. Ni and Ding (2010) explored editorship/editorial boards for 48 LIS journals and were able to identify clusters of journals that differed from the ISI categorization. Garfield (1996) discussed potential ways to improve a journal's impact factor, such as publishing authoritative review articles, research methods papers, and the work of highly cited authors.

Online access and open access raise further questions on how to assess journal impact. Walters and Linvill (2011) investigated database coverage, journal size (number of articles), subject, publisher, and language of open access journals; they reported that impact factor correlated with database coverage. Bornmann, Neuhaus, and Daniel (2011) analyzed journals in chemistry and physics to see if the impact factors were influenced by a new two-stage publishing process. Serenko and Dohan (2011) compared expert opinions with impact factors for journals in artificial intelligence, concluding that these two methods were complementary.

Some researchers have counted links from websites, links from other e-journals, blog mentions, or tweets in Twitter as measures of impact (e.g. Weller, Droge, and Puschmann, 2011) but the validity and reliability of these measures have yet to be demonstrated. Few studies explain the dependent variables (e.g., journal citation counts) as a function of the proposed independent variables (e.g., number of journals in the field or number of active scientists) (Rousseau, 2002). However, standard bibliographic features are readily available and also ready for investigation as sources of insight on journal impact, perceptions, and categorization.

METHODS

The subjects are the 66 journals that Web of Science categorized in "Information Science and Library Science" in the 2009 Journal Citation Report (JCR). Three different sources provided the data used in this study. From Web of Science we recorded the number of articles (published material classified as

“Article” or “Review”) and number of authors per paper for each journal from 1955 through 2009 (inclusive). From JCR we recorded any additional subject categories, as well as journal impact factor (JIF), title, abbreviated title, ISSN, and publisher address.

Information on editorial board membership was collected either directly from the journal’s website, or, if the website was inaccessible, from the hard copy of the journal. These data were collected in December, 2009 (Ni & Ding, 2010); the list includes 1,561 editorial board members.

Bibliographic data, collected from *Ulrich’s Periodicals Directory*, are: country of publication, date of first publication (length of time published), abstracting and indexing databases covering the journal, and full text aggregators of the journal. Ulrich’s also provided: subject, alternate subject(s), frequency of publication, Dewey Decimal Classification, Library of Congress classification, publisher, and description (from *Magazines for Libraries*). Table 1 shows the description of features collected for each journal.

Table 1. Journal features collected

Feature	Feature Description
Impact Factor (IF)	Journal impact factor
Papers	Number of research articles in the journal
Authors per paper	The average number of authors per paper in the journal
Longevity	The number of years since the journal began publication (through 2010)
Editorial board	The number of editorial board members listed by the journal
Publishing frequency	The number of issues published per year
Databases	Number of abstracting and indexing databases in which the journal is indexed
Aggregators	Number of online aggregators that include the full text of the journal
Country of publication	The place where the journal is published
Additional categories	Additional social science categories in which JCR classifies the journal
SCI	Whether the journal is indexed by Science Citation Index
DDC	Dewey Decimal Classification number assigned to the journal
Description	Text describing the journal, from Magazines for Libraries

Finally, it should be noted that this paper chose the journal impact factor as the indicator of journal assessment, though we do realize that the measures of journal influence have gone beyond journal impact factor, e.g. Article Influence Score, Eigenfactor measures and successive h-index. There are two main reasons for choosing journal impact factor here. Firstly, journal impact factor is the one that has longest history in use, and is widely known by people outside of the informetric community. Therefore, it would be easier for the public audience of this paper to accept the idea of journal influence assessment. Besides, historical data of journal impact factor may be easy to be obtained by informetricians if they want to replicate this study. Secondly, the main purpose of this paper is to present a method for comprehensive examination of possible features towards journal influence. By using journal impact factor here, we are not claiming that it is the only one but a representative one. Any replication of this study can easily extend this method to investigate the relationships between those journal features and other indicators of journal influence (e.g. Article Influence Scores and Eigenfactor measures).

RESULTS AND DISCUSSION

Table 2 provides descriptive statistics for several of the quantitative features; these are discussed in the following subsections.

Table 2. Descriptive Statistics for Features of IS&LS Journals (n=66)*

Feature	Mean	Std. Dev	Median	Min	Max
JIF	1.175	0.971	0.970	0.001	5.183
Papers	1269.470	1522.860	660.5	88	9273
Authors per paper	1.805	.604	1.675	1.044	4.017
Longevity**	40.190	23.570	34	4	135
Editorial board	30.780	21.333	25	1	107
Publishing frequency	5.650		4	1	20
Databases	10.280		11	3	15
Aggregators	7.259		7	1	10

*It should be noted that the data displayed here were collected in 2009. Other features like publisher and description are not displayed in this table because they are not eligible for descriptive statistics.

** It means how many years journals have published for.

EDITORS

In IS&LS journals, 1,785 editorial board seats exist and are occupied by 1,561 individuals[1]. On average, each journal has about 31 editorial board members, and each member serves on 1.14 editorial boards. The number of board members per journal varies greatly, with a standard deviation of 21.33. About one third of the journals have 20 to 30 board members. Only one journal, *Information & Management*, has more than 100, *Journal of the Association for Information Systems* is next, with more than 80 (Ni & Ding, 2010). The number of editorial board members is correlated with JIF, with a correlation coefficient of 0.618 ($p \leq 0.05$), representing a higher than moderate correlation.

PUBLISHER

The 66 journals are published by 37 publishers. Forty journals (60.6%) are published by 11 publishers (29.7%); Elsevier publishes the most (10) IS&LS journals. Table 3 displays the publishers with two or more journals as well as the mean number of citations and mean impact factor of the journals they publish. Journals published by John Wiley & Sons have the highest arithmetic mean JIF, followed by those from Springer and Elsevier.

Table 3. Publishers of two or more IS&LS journals

Publisher	#Journals	JournalMeanCitation	JournalMeanIF
John Wiley & Sons, Inc.	4	1843.5	2.22
Springer, LLC.	2	151	1.957
Elsevier, Ltd.	10	916.3	1.485
Taylor & Francis, Inc.	3	1203.3	1.329
Information Today, Inc.	3	239.3	1.103
Sage Publications, Ltd.	4	510.75	0.882
Emerald Group Publishing, Ltd.	5	385.2	0.778
The Johns Hopkins University Press	2	338	0.645
American Library Association	3	136	0.532
De Gruyter Saur	2	135.5	0.28
University of Toronto Press	2	46	0.119

PLACE OF PUBLICATION

Journals, even those published by the same publisher, are published in different places. An analysis of the geographic location from the Web of Science "publishing address" found that the 66 journals are published in 10 different countries, shown in Figure 1. More than half (36) of the journals are published in North America (32 in USA, 3 in Canada, and 1 in Mexico). Four European countries publish IS&LS journals (19 from the UK, 4 from Germany, 3 from the Netherlands, and 1 from Spain). Nigeria is the only African country on the list. In Asia, Japan and Malaysia each contribute one journal. No significant difference in JIF was found among journals published in North America, Europe, and other territories ($p \geq 0.1$).

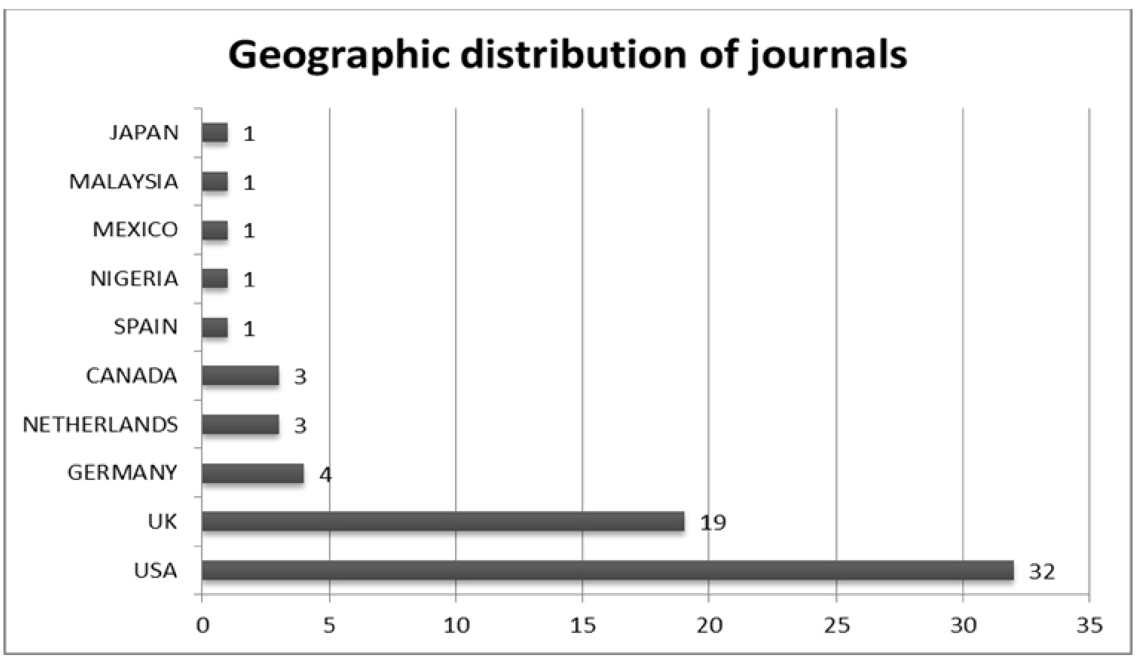

Figure 1. Geographic distribution of journals

PUBLISHING LONGEVITY

The date of the first issue of these journals ranges from 1876 to 2007. *Library Journal* is the earliest and *Journal of Informetrics* started to publish most recently. Figure 2 shows the 66 journals coded by the decade when they first appeared. The number of new IS&LS journals increased consistently from the

1940s through the 1970s, then slowed dramatically.

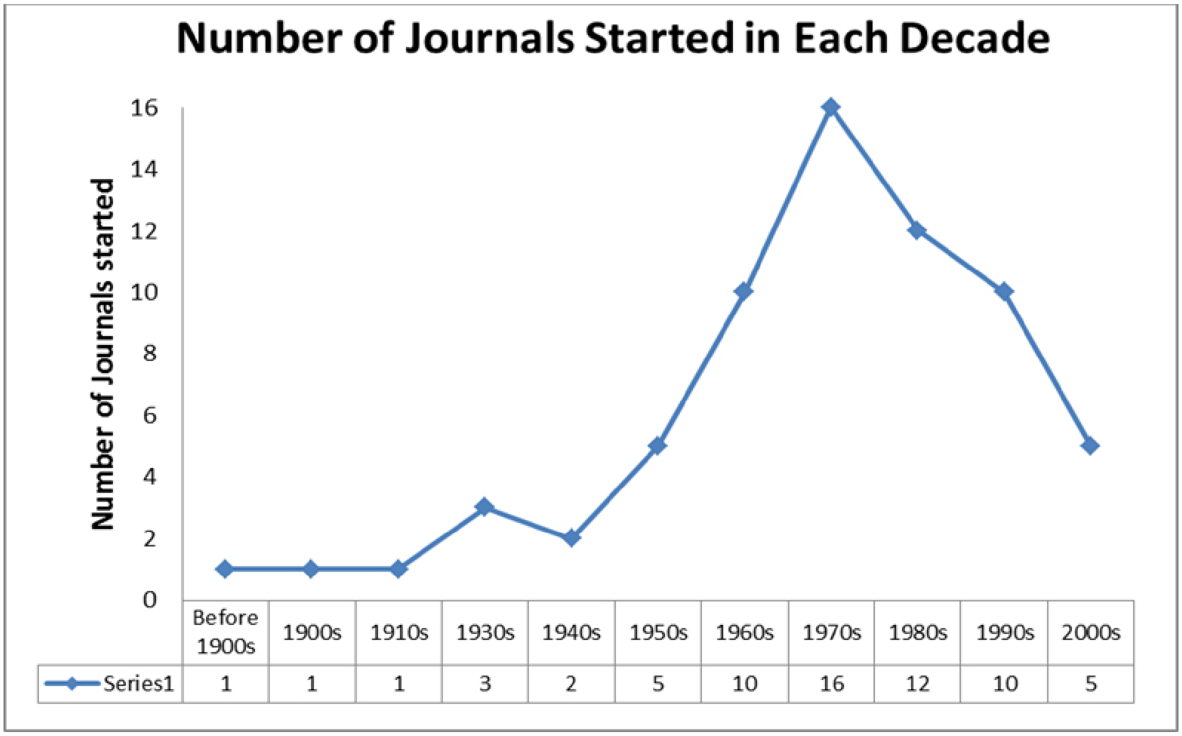

Figure 2. Number of journals began publication, by decade

A journal's publishing life is calculated by subtracting the year the journal began publication from the year 2009 to determine journal longevity. Figure 3 displays the distribution of journal longevity, with the blue line showing the cumulative percentage. Fourteen journals have been published for more than a half-century, and 2 for more than a century. More than 75% of the journals have appeared for fewer than 50 years; just over 20% are under 20 years old. A journal's longevity and its 2009 JIF have a significant negative correlation at the .05 level (r^2 = -.295, $p < 0.05$).

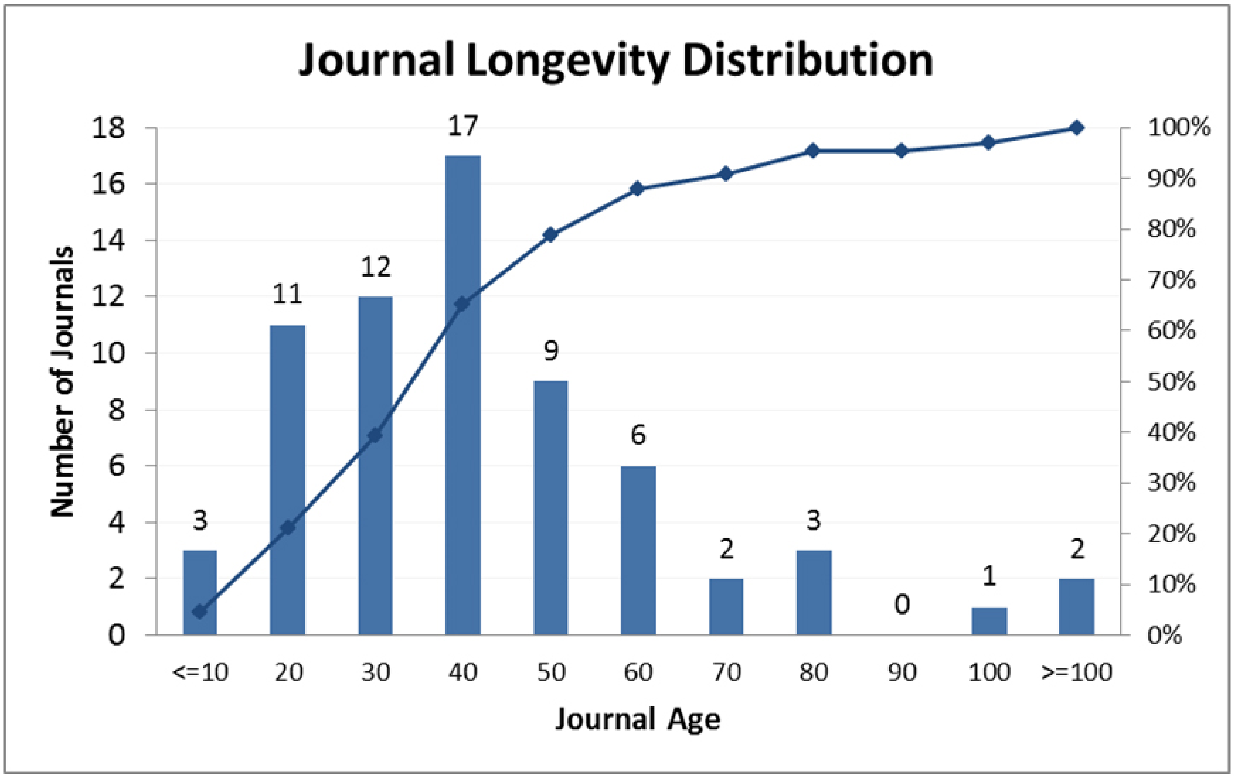

Figure 3. Journal Longevity Distribution

Publication frequency

These journals publish with considerably different frequencies. The *Annual Review of Information Science and Technology* appeared once a year (it has since ceased); *Library Journal* has 20 issues annually. More than half of the journals (55%) publish quarterly; 57 journals (86%) publish no more than six times per year. Publishing frequency is shown in Figure 4. Publication frequency did not correlate with JIF *(r*=0.027) at .the 05 confidence level.

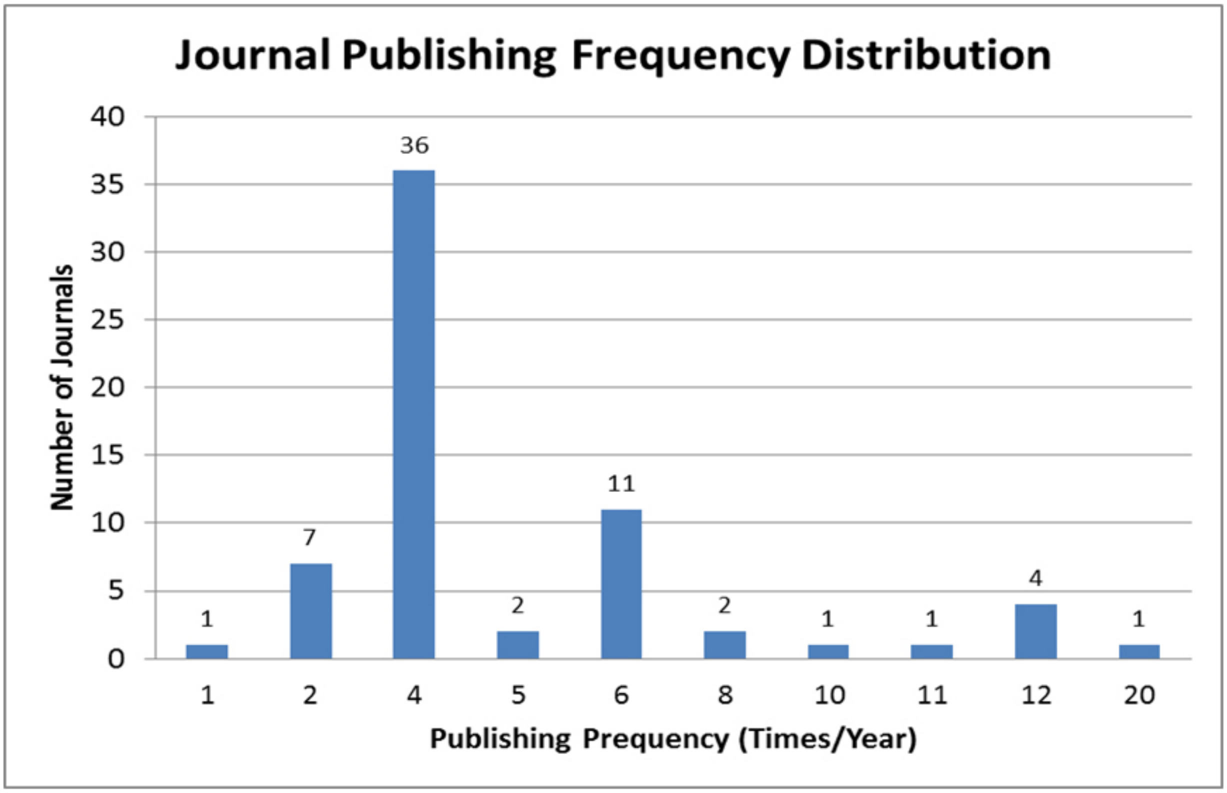

Figure 4. Publishing Frequency of IS&LS Journals

INCLUSION IN ADDITIONAL SOCIAL SCIENCE CATEGORIES

Thirteen journals are indexed in one or more of six JCR social science subject categories (in addition to IS&LS), as shown in Table 4. Six are in Management, reflecting a connection to management information systems. Two, *Journal of Computer-Mediated Communication* and *Journal of Health Communication*, are in Communication. The remaining 53 journals are in only the IS&LS category. Comparing the average number of citations and the mean JIFs, the journals in more than one category are cited more frequently (1,675 to 566) and have a greater impact (1.905 to 0.938). A significant difference in JIF was found between journals included in only the IS&LS category and those also included in another social science category (p=0.00133, α=0.05).

Table 4. Journals indexed in JCR categories in addition to IS&LS

(Journal abbreviations with corresponding full titles are listed in Appendix)

Category	Journal	Citation2009	IF2009
Communication	JCMC	1279	3.639
	JHC	1010	1.344
Education & Educational Research	IJCSC	229	2.692
Geography	IJGIS	1997	1.533
Law	LLJ	197	0.385
Management	IM	3276	2.282
	ISRes	3037	1.792
	ITM	73	1.222
	JIT	879	2.049
	JMIS	2650	2.098
	MIS	6186	4.485
Social Sciences, Interdisciplinary	SSCR	502	0.635
	SSInf	463	0.604

INCLUSION IN THE *SCIENCE CITATION INDEX*

Of the 66 journals, 48 are indexed only in *Social Sciences Citation Index*; the other 18 appear in *Science Citation Index* as well. The mean JIF of the SSCI-only journals is 0.8398, significantly lower than the 1.9691 mean i JIF for journals covered in both places (p = 0.000063, α=.05). The mean number of citations for SSCI-only journals is 360, again significantly lower that the mean of 1,914 for journals in both indexes (p = 0.000001, α=.05).

Most journals in IS&LS are categorized in one or two categories in JCR, but three are listed in more categories: *Information & Management*[2], *International Journal of Geographical Information Science*[3], and *Social Science Computer Review*[4].

COVERAGE IN ABSTRACTING AND INDEXING DATABASES

Ulrich's Periodicals Directory lists 21 abstracting and indexing services that cover the 66 journals. Thomson Reuters (the source for the sample) includes all 66. Other services with more than 60 journals are Elsevier and EBSCOhost (65 each) and OCLC (63). Table 5 lists all the A&I services that cover at least one of the journals.

Table 5. Abstracting and indexing services covering IS&LS journals

A&I Service	**Number of Journals**
Thomson Reuters	66
EBSCOhost	65
Elsevier	65
OCLC	63
CSA	55
Ovid	52
Gale	47
ProQuest	45
H.W. Wilson	41
Centre National de la Recherche Scientifique * Institut de l'Information Scientifique et Technique	38
VINITI RAN	31
National Library of Medicine	25
Chadwyck-Healey	24
Taylor & Francis Ltd.	11
De Gruyter Saur	8
American Statistical Association	6
Adis International Ltd.	4
ERIC (Education Resources Information Center)	4
CABI	3
Contemporary Science Association	2
Royal Anthropological Institute	1

A typical journal is indexed in about 10 A&I databases. *Journal of Documentation* has the most coverage (15 databases), followed by *College & Research Libraries, Journal of the American Society for Information Science and Technology*, and *Library Quarterly* (14 databases each). *Journal of Informetrics* and *Journal of Library and Information Science* are covered by only three databases (Thomson Reuters, Elsevier, and EBSCOhost). Table 6 gives the complete list. The number of databases indexing the journal does not share strong correlation with the JIF (r=0.125, p<.05).

Table 6. Number of abstractive and indexing services covering each journal

Journal	A&I Services	Journal	A&I Services
JDoc	15	IM	10
CRLib	14	ISJ	10
JASIST	14	ISR	10
LibQ	14	InterDoc	10
IPM	13	JAMIA	10
JIS	13	JMIS	10
JMLA	13	LLJ	10
JSP	13	Libri	10
LRTS	13	MIS	10
LTrend	13	Program	10
EContent	12	Restaurator	10
ELib	12	ITM	9
ITLib	12	Portal	9
IJGIS	12	Scientist	9
IJIM	12	TelePol	9
JALib	12	HILJ	8
Online	12	IJCSC	8
RUSQ	12	JGIM	8
SSInf	12	JHC	8
Aslib	11	LIS	8
CJILS	11	SerRev	8
InfSoc	11	ARIST	7
JIT	11	JCMC	7
KO	11	LPub	7
LCA	11	MJLIS	7
LHT	11	Prof	7
LISR	11	AJLAI	6
LibJ	11	InfRes	5
OIR	11	JAIS	5
Scientometrics	11	ResEva	5
SSCR	11	InvBib	4
ZBB	11	JInformetrics	3
GIQ	10	JLIS	3

Online aggregators

Some 11 different online aggregators (e.g., EBSCOhost) include the full text of articles from 63 of the 66 IS&LS journals. The three journals not covered by any aggregator are *African Journal of Library Archives and Information Science*, *Journal of the Association for Information Systems*, and *Investigacion Bibliotecologica*. Ingenta Connect is the source covering the most journals (61), followed by Information Express (60). Table 7 lists the online aggregators and the number of IS&LS journals they include.

Table 7. Aggregators providing full text of IS&LS journals

Aggregator	Number of Journals
IngentaConnect	61
Information Express	60
Thomson Reuters	58
British Library Document Supply Centre	57
Infotrieve	53
Centre National de la Recherche Scientifique	46
AskIEEE	37
Linda Hall Library of Science, Engineering & Technology, Document Delivery Services	36
Chemical Abstracts Service Document Detective Service	23
German National Library of Medicine	7
LexisNexis Academic & Library Solutions	3

Articles in the typical IS&LS journals are available from nearly seven aggregators. *Interlending and Document Supply* and *Online* top the list, with 10 sources each; the open access online journal *Information Research* is available only through Thomson Reuters (the low aggregator coverage may be attributable to its open access status). Table 8 lists the number of sources for online access to each journal. The number of sources for full text of journal articles did not correlate with JIF(r=0.120) at .05 confidence level.

Table 8. Journals with full-text available from more than five sources

Journal	# Aggregators	Journal	# Aggregators
IDS	10	CJILS	7
Online	10	GIQ	7
Aslib	9	InfSoc	7
Econtent	9	IJIM	7
IPM	9	JALib	7
ITLib	9	JIT	7
JASIST	9	JMIS	7
JDoc	9	KO	7
JMLA	9	LLJ	7
LCA	9	LPub	7
LHT	9	LISR	7
LibJ	9	Libri	7
LibQ	9	OIR	7
LRTS	9	RUSQ	7
LibTrend	9	SerRev	7
Program	9	ZBB	7
Scientist	9	HILJ	6
ARIST	8	ISJ	6
CRLib	8	ISR	6
ELib	8	IJGIS	6
IM	8	JAMIA	6
JGIM	8	JSP	6
JIS	8	MIS	6
Restaurator	8	Portal	6
Scientometrics	8	Prof	6
SSCR	8	SSInf	6
TelePol	8		

Dewey Decimal Classification

Ulrich's places the 66 journals in 18 Dewey classifications; five journals are assigned to two classes. Thirty are classified in 020 - library and information sciences, 7 in 003 - systems, and 6 in 025 - library operations. Table 9 gives the complete list, and the mean JIF of each Dewey Class. Class 384-Communications &Telecommunication has the highest mean JIF, 340-Law the lowest.

Table 9. Dewey Decimal Classifications of journals and Mean IF

Dewey Class Number	Dewey Class Title	Number of Journals	Mean JIF
003	Systems	7	2.165
004	Data processing & computer science	3	0.887
020	Library & information sciences	30	0.828
025	Library operations	6	0.832
026	Libraries for specific subjects	3 (2 multi-class)	0.710
027	General libraries	2	0.876
070	News media, journalism & publishing	2	0.480
306	Culture & institutions	1	0.604
340	Law	1 (1 multi-class)	0.385
351	Public administration	1	2.098
370	Education	2	1.664
384	Communications; telecommunication	1	3.639
500	Natural sciences & mathematics	3	1.147
610	Medicine & health	4 (1 multi-class)	1.932
621	Applied physics	1	0.969
651	Office services	1	1.222
658	General management	2(1 multi-class)	0.393
910	Geography & travel	1	1.533

JOURNAL DESCRIPTIONS

Magazines for Libraries provides descriptions for 64 of the 66 journals. Descriptions for the two not covered, *Library and Information Science* and *Restaurator*, were taken from brief statements on their websites. After excluding some stop words, 233 unique words remained. The most frequent word, "Information" appears 64 times, far more than "library," which ranks second with 24 occurrences. The top ranking 50 words are displayed in Table 10.

Table 10. Words used most frequently in journal descriptions

Word	Frequency	Word	Frequency	Word	Frequency
information	64	communication	7	archive	4
library	24	policy	6	academic/academia	4
management	18	international	6	teaching	3
practice	15	worldwide	5	society	3
technology	14	scholar	5	serve	3

system	12	material	5	report	3
profession	12	design	5	regulator	3
theory	10	application	5	reflect	3
forum	9	advance	5	product	3
develop	9	trend	4	process	3
review	8	social	4	present	3
organization	8	significance	4	industry	3
librarian	8	resource	4	impact	3
field	8	original	4	feature	3
user	7	health	4	English	3
study	7	community	4	automation	3
publishing	7	collection	4	approach	3

The descriptions provided the basis for assessing journal similarity. After removing stop words and high-frequency words ("information" and "library"), each description was examined word by word. The similarity of each pair of journals, measured by the number of words that co-occur in those two journals' descriptions, was calculated using cosine similarity. Figure 5 presents the hierarchical clustering results (see appendix for journal abbreviations). The 66 journals grouped into four clusters, which we tentatively identify as: 1) international library practice (red), 2) information systems and technology (yellow), 3) online information systems and access (brown), and 4) contemporary library practice and research (green). This analysis produces some odd neighbors. For example, *College & Research Libraries*, *Journal of Academic Librarianship*, and *Library Hi Tech* appear together in the contemporary library practice and research group. However, *portal: Libraries and the Academy* is in the international library practice cluster.

Ni and Ding's (2010) analysis of interlocking editorial board membership provides a useful comparison with Figure 5. For example, almost all the journals that do not share editorial board members appear in the international library practice cluster. The eight that Ni and Ding labeled as MIS journals are again grouped together by their descriptions, but are joined by others that focus on information science research (e.g., *JASIST* and *JDOC*) to form the information systems and technology cluster. Table 11 shows the 19 "practice-oriented LIS" journals and the 8 "MIS" journals from Ni and Ding's study of editorial board members. When clustered by words from the journal descriptions, the "MIS" journals remain close together; the LIS practice journals, however, land in different groups.

Table 11. Comparison of clusters by editorial board membership and journal description

Journal	Editorial board membership cluster	Journal description cluster
ASLIB	Practice-oriented LIS	Information systems and technology
CRL	Practice-oriented LIS	Contemporary library practice and research
ELIB	Practice-oriented LIS	International library practice
GIQ	Practice-oriented LIS	Online information systems and access
HIL	Practice-oriented LIS	online information systems and access
ITLib	Practice-oriented LIS	International library practice
IDS	Practice-oriented LIS	Contemporary library practice and research
JALib	Practice-oriented LIS	Contemporary library practice and research
JLIS	Practice-oriented LIS	International library practice
JSP	Practice-oriented LIS	Contemporary library practice and research
JMLA	Practice-oriented LIS	online information systems and access
LCA	Practice-oriented LIS	online information systems and access
LHT	Practice-oriented LIS	Contemporary library practice and research
LISR	Practice-oriented LIS	International library practice
LibQ	Practice-oriented LIS	Contemporary library practice and research
LRTS	Practice-oriented LIS	International library practice
PORTAL	Practice-oriented LIS	International library practice
RUSQ	Practice-oriented LIS	online information systems and access
SR	Practice-oriented LIS	Information systems and technology
IM	MIS	Information systems and technology
ISJ	MIS	Information systems and technology
ISR	MIS	Information systems and technology
JGIM	MIS	Information systems and technology
JIT	MIS	Information systems and technology
JMIS	MIS	Information systems and technology
JAIS	MIS	Information systems and technology
MIS	MIS	Information systems and technology

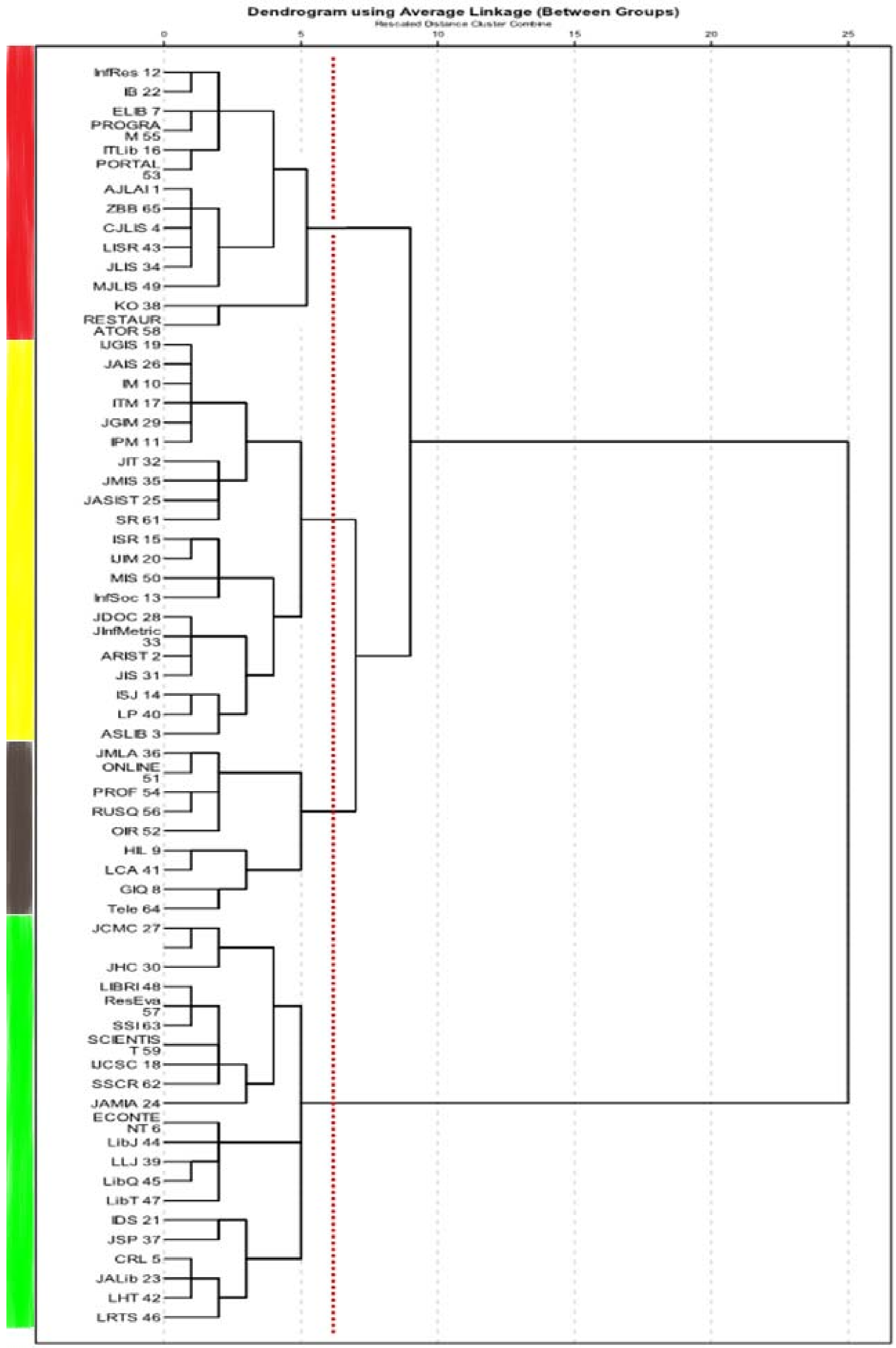

Figure 5. Hierarchical clustering through co-word analysis of journal descriptions

Finally, Quadratic Assignment Procedure (QAP) correlation was used to calculate the correlation between cosine similarity matrices obtained from co-editor, co-citation, and description co-word analysis. Social network analysis researchers commonly use QAP to test the correlations between two or more networks with the same set of nodes. In this analysis, QAP actually tests the correlation between the journals' co-citation, description co-word, and co-editor relationships.

Table 12. QAP correlation of journal proximities through co-citation, co-editorship, and co-word occurrences in journal descriptions

	Co-citation	Co-editor	Co-word (description)
Co-citation	1.000	0.986	0.128
Co-editor	0.986	1.000	0.108
Co-word (description)	0.128	0.108	1.000

*Significant at .05 level.

The data analyzed here can represent a journal from three different perspectives: 1) Editorial board membership reflects how a journal implements its self-image; 2) citation patterns, constructed by authors, represent the field's understanding of the journal's domain; and 3) the bibliographer's perception, is reflected in the journal's description from *Magazines for Libraries* (or in its placement in a classification scheme). Data for the IS&LS journals demonstrate that the editorial board and citation representations for these journals are very similar and strongly correlated: the journals' editors and citing authors have similar understandings of these journals (reflected by editorial board membership and journal co-citation). Journal descriptions, however, correlate with neither editorial board members nor topic recognition. Table 12 shows the measures of correlation.

LINEAR REGRESSION FOR JIF AND OTHER FEATURES

In this section, we attempt to create a linear model to represent the relationships between JIF and the 10 other features of the journals: number of papers, authors per paper, journal longevity (duration), number of editorial board members, publishing frequency, database coverage, and aggregator coverage. Figure 6 shows the plots for these proposed relationships, aiming to give a preliminary impression of the correlation relationship between JIF and other features for further analysis. Linear relationships are evident in some cases (e.g., authors per paper) but not in others (e.g., databases and aggregators). Plots for three categorical variables (country of publication, additional JCR social science categories, and inclusion in *Science Citation Index*) are not presented in the figure. Numerical indices will be given later to further securitize the relationships between JIF and the other 10 features.

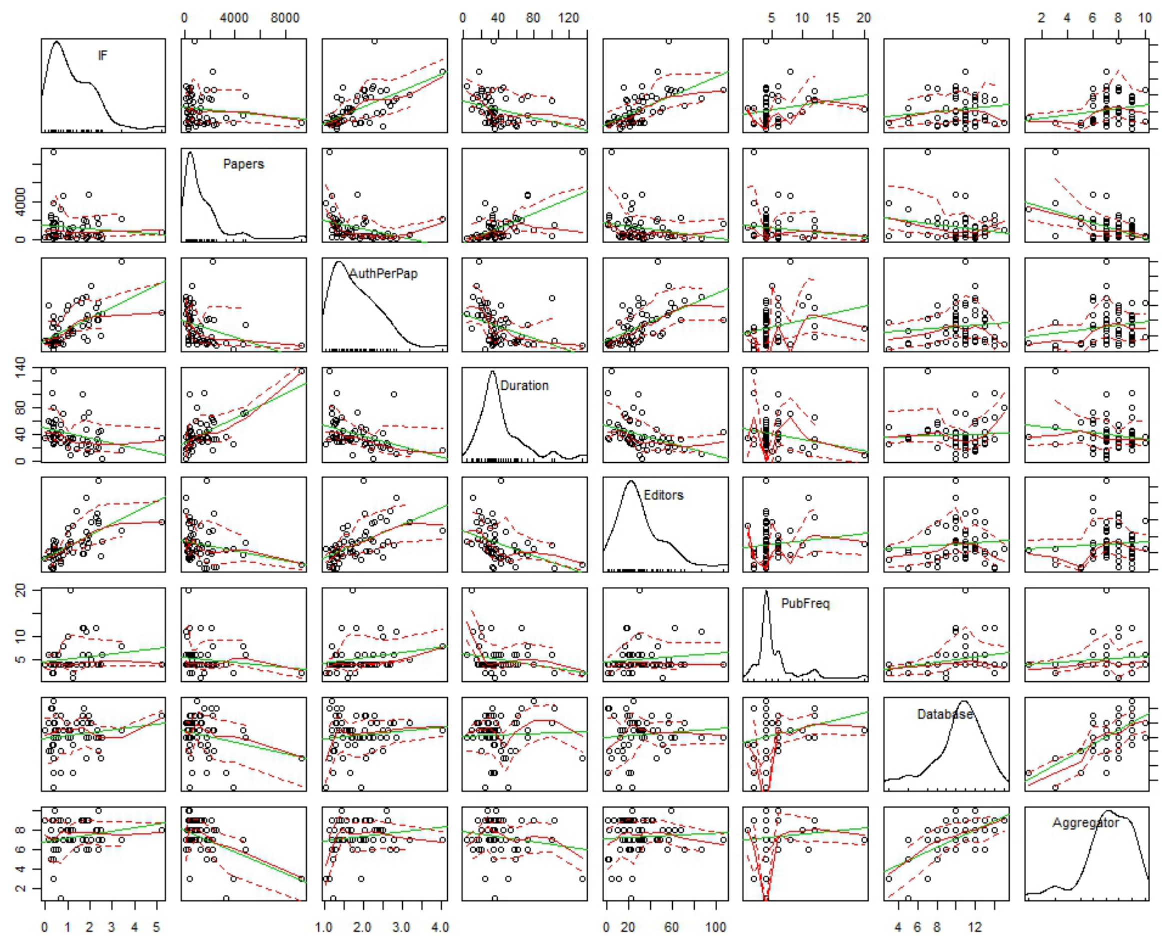

Figure 6. Scatterplot of IF and 10 bibliographic features

In multiple linear regression, a model incorporating all the possible independent variables is called the full model. Models obtained after deleting some independent variables (those not contributing much to the prediction of the dependent variable) are called reduced models (Myers, 1990). Table 13 shows the results of the first full model fitting; journal longevity, country of publication, additional JCR categories, and database coverage did not add significantly to the model. Therefore, we can claim that, based on the first iteration of linear regression, including these four features does not change the JIF significantly. The R-squared[5] value for this model is 0.639, indicating only about 64% of variety in the data is explained by the estimated model. For a better model in terms of R-squared value, more effort is needed.

Table 13. Coefficient estimation from the full model using raw data

	Estimate	**Std. Error**	**t-value**	**Pr(>|t|)**	**VIF**
Intercept	0.5915984	0.6408056	0.923	0.36061	
Number of papers	0.000242	0.000108	2.252	0.02903**	3.704176
Authors per paper	0.490075	0.190715	2.57	0.01341**	1.831815
Longevity	-0.00413	0.005062	-0.816	0.41879	1.965455
Editorial board	0.016921	0.005565	3.041	0.00385**	1.945707
Publication frequency	-0.09007	0.04353	-2.069	0.04406**	2.722472
Databases	0.040188	0.047908	0.839	0.40579	2.166050
Aggregators	-0.13555	0.071768	-1.889	0.06511*	2.309814
Publication country	-0.28449	0.180205	-1.579	0.12111	1.128451
Additional JCR categories	0.072531	0.254381	0.285	0.7768	1.397292
SCI inclusion	0.741964	0.222466	3.335	0.00167**	1.488287
**Significant at .05 level; *Significant at .1 level Residual standard error: 0.6425 on 47 degrees of freedom Multiple R-squared: 0.639, Adjusted R-squared: 0.5621 F-statistic: 8.318 on 10 and 47 DF, p-value: 1.391e-07					

To use linear regression effectively for further prediction, the data should meet important assumptions with respect to normality and multicollinearity. The Shapiro-Wilk and correlation tests assess normal distribution of data values; both tests found that the distributions of the 8 variables[6] are not approximately normal. Table 14 displays the ***w*** statistics and ***p*-**values[7] for the Shapiro-Wilk test and the ***r*** correlation[8] value for each variable, before and after some power transformations[9]. The table shows that all eight variables follow approximately normal distributions after these transformations.

Table 14. Shapiro-Wilk test and correlation test before and after transformation

	Before			**After**		
Variable	***W***	***P***	***r***	***W***	***P***	***r***
IF	0.8560	6.262e-06	0.9227317	0.9664	0.1079	0.9810759
Number of papers	0.6799	5.76e-10	0.8190308	0.9816	0.5235	0.9918411
Authors per paper	0.8976	1.397e-4	0.946532	0.9635	0.07804	0.9834533
Longevity	0.8535	5.292e-06	0.9211221	0.9733	0.2278	0.984112
Editorial board	0.9079	3.296e-4	0.9520282	0.9824	0.5628	0.9913617
Publication frequency	0.6822,	6.352e-10	0.8208954	0.9613	0.05110	0.97154
Databases	0.9234	1.305e-3	0.9613515	0.9709	0.1772	0.9864728
Aggregators	0.8804	3.602e-05	0.9371708	0.9772	0.05894	0.9792473

Multicollinearity assumes that no significant correlation relationship exists between independent variables in a linear model. Variance inflation factor[10] (VIF), which is a widely used indicator of multicollinearity problem, was employed.

After the data transformations, we fitted models with different variables in order to determine which model(s) best described the observed data. Five important measures of model fitting—R^2, adjusted R^2, Mallows' C_p, PRESS 1 and PRESS 2—were used as the criteria for model selection. The adjusted R^2 is similar to R^2, indicating the percentage of variance in the data explained by a fitted model. The larger the R^2 and adjusted R^2 values, the better the model. Mallow's C_p, the conceptual predictive criteria, indicates a model's biases by including or excluding some variables. The smaller the Cp value, the less biased the fitted model. PRESS, the Prediction Sum of Squares, measures a model's true prediction errors and is an important criterion that can be used as a form of validation during model building. For the choice of the best model, one might favor the model with the smallest PRESS[11].

In most cases, the best model should be the one with the fewest independent variables and best model selection criteria values. In this case, we aim for the best guess about the journal impact factor by using as few independent variables as possible (because collecting the data for each variable is costly). As noted, 10 variables might have an impact on the single dependent variable: JIF. We calculated the five measures of model fitting for all combinations of the 10 independent variables, attempting to determine the best-fit model that involved the fewest independent variables.

Table 15 displays the possible “best models” in terms of the five measurements, each of which performs well on one of the five criteria. Considering only these five criteria, all five models appear to be candidates. However, because the measurements do not differ greatly among the models, it may be possible to reduce the number of variables required. There is a trade-off between the number of variables used and the model’s goodness of fit. Analysis of Variance (ANOVA) tests each pair of models to reveal whether they differ significantly (see Table 15). The significant differences between reduced model 1 and reduced model 2 indicate that these two models are telling: Adding variable x10 (inclusion in SCI) to reduced model 2 significantly improved the predication performance. However, adding x6 (databases), x7(aggregators), or x9 (additional JCR social science category) to reduced model 2 did not improve it significantly. No statistically significant difference exists between each pair of the remaining models. Therefore, we conclude that x1 (number of papers), x2 (number of authors per paper), x3 (journal longevity), x4 (number of editorial board members), and x5 (frequency of publication) could predict a journal’s impact factor quite well, but adding x8 (country of publication) could predict the JIF best. In other words, x6 (databases), x7(aggregators), and x9 (additional JCR categories) are not influential variables in predicting JIFs. It should be noted, however, that the variables used here have been transformed in order to fit the model better. Employing the predictor variables as collected, without transformation, would likely produce different JIF predictions..

Table 15. "Possible Best Models" in terms of R^2, adjusted R^2, Mallows' C_p, PRESS 1 and PRESS 2

Model Name	#Variables	Variables involved	R^2	adj R^2	Cp	PRESS1	PRESS2
Reduced 1	6	x1,x2,x3,x4,x5,x8	0.655	0.592	9.014	26.747	26.346
Reduced 2	7	x1,x2,x3,x4,x5,x8,x10	0.672	0.614	7.106	25.682	26.605
Reduced 3	8	x1,x2,x3,x4,x5,x7,x8,x10	0.676	0.623	7.266	25.420	26.762
Reduced 4	9	x1,x2,x3,x4,x5,x6,x7,x8,x10	0.666	0.616	9.051	26.685	27.312
Full Model	10	x1,x2,x3,x4,x5,x6,x7,x8,x9,x10	0.677	0.608	11.000	27.830	27.763

Table 16. ANOVA test results of selected models

	Reduced 1	Reduced 2	Reduced 3	Reduced 4	Full Model
Reduced 1	1				
Reduced 2	0.048*	1			
Reduced 3	0.1013	0.2221	1		
Reduced 4	0.1924	0.4328	0.6563	1	
Full Model	0.3208	0.6455	0.9047	0.948	1

*significant at .05 level.

Based on the model selection analysis (Table 16), the model that best predicts IS&LS JIF is:

$$IF^{(0.35)} = 5.070 + (-6.217)*Paper^{(-0.04)} + (-1.257)*AuthPerPaper^{(-0.8)} + (-0.264)*Longevity^{(0.25)} + (0.097)*EditorBd^{(0.46)} + (2.063)*PubFreq^{(-0.1)} + (-0.16)*PubCountry + (0.148)*SCI$$

Table 17. Coefficient estimation of selected model

	Coefficient	Std. Error	t value	Pr(>|t|)
(Intercept)	5.070	1.389	3.648	0.000629*
Paper^-0.04	-6.217	1.641	-3.788	0.000409*
AuthPerPaper^-0.8	-1.257	0.330	-3.808	0.000384*
Longevity^0.25	-0.264	0.125	-2.121	0.038921*
EditorBd^0.46	0.097	0.028	3.44	0.001184*
PubFreq^-0.1	2.063	0.957	2.156	0.035884*
PubCountry	-0.150	0.065	-2.465	0.017163*
SCI	0.148	0.082	1.799	0.078069*
*Significant at .05 level. Residual standard error: 0.2421 on 50 degrees of freedom Multiple R-squared: 0.672, Adjusted R-squared: 0.614 F-statistic: 15.47 on 7 and 50 DF, p-value: 1.392e-10				

Table 17 shows that the R-square value in this new model compared with the first iteration has been improved from 0.639 to 0.672.

Conclusions

The project studied 66 journals categorized in "Information Science & Library Science" by the 2009 Journal Citation Reports and attempted to correlate various bibliographic characteristics with the journals' impact factors. Using bibliographic information for bibliometric analysis reveals some interesting, if not surprising, observations. Several characteristics did correlate with journal impact factor:

- number of papers published
- number of authors per paper
- number of editorial board members
- number of years a journal has been published (longevity) (negative correlation)
- indexed in *Science Citation Index* as well as SSCI

Other bibliographic features did not correlate with JIF:

- frequency of publication
- number of abstracting and indexing services covering the journal
- number of aggregators providing full text of the journal
- place of publication

Journal longevity correlates positively with inclusion in abstracting and indexing databases ($r^2 = .484$, $p <$

0.01), availability of full text articles ($r^2 = .468$, $p < 0.01$), and publication frequency ($r^2 = .299$, $p < 0.05$). Perhaps not surprisingly, the number of sources of full text document availability is significantly correlated with the number of databases indexing the journal ($r^2 = .749$, $p < 0.01$).

The analysis also reinforces the perception that JCR's category of "Information Science and Library Science" is not a cohesive grouping. Within this larger group, subfields with differing publishing and citation patterns are evident, as Ni and Ding (2010) noted. Moreover, when clustering is based on the similarity of journal descriptions, rather than editorial board membership, different groupings appear. This suggests that bibliographic perspectives may differ from insiders' perceptions of an academic field.

The authors attempted to create a multiple linear model for journal impact factor prediction using the bibliographic data. In this case, the best model of journal impact factor included seven features: number of papers published, number of authors per paper, journal longevity, number of editorial board members, frequency of publication, country of publication, and coverage in *Science Citation Index*. All but the last two features needed to be transformed in order to build a model for the successive prediction of JIF. Statisticians say: There is no perfect model, only the most useful one for a given situation. This proposed (and admittedly imperfect) model does illustrate the relationship between JIF and other journal features. It, or another model constructed using the procedures outlined, could have potential in predicting JIF for these journals in future years or for journals in other disciplines.

Clearly, the work reported here would benefit from replication and the analysis of additional data. Including more IS&LS journals (beyond ISI's coverage, or including those added to the category since

2009) would produce more robust findings. Observing this cohort of journals over time would also reveal the ebb and flow of the discipline's assessment of its journals. Extending the analyses to additional subject domains would test the approaches used here and probably suggest novel interpretations. Replicating this approach with different dependent variables, such as successive *h*-index, Eigenfactor, or Article Influence Score, could also improve understanding of how bibliographic factors relate to journal impact. As has been indicated in the methods section, there are other newly emerged indicators of journal influence. The JIF was chosen in this paper as one indication of journal influence. Any replication of this research can easily choose other journal influence indicators and investigate their relationships with journal bibliographic features. In sum, questions about whose perceptions of a field are validated by which datasets is ripe for investigation; the views of journal editors, publishers, researchers, and bibliographers can form the basis to investigate many complexities of scholarly communication.

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[1] It should be noted that, although the 2009 JCR included 66 journals in the IS&LS category, information for editorial board members was accessible for only 58.

[2] *Information & Management* appears in three categories: Information Science & Library Science (SSCI), Management (SSCI), and Computer Science-Information Systems (SCI).

[3] *International Journal of Geographical Information Science* appears in four categories: Information Science & Library Science (SSCI), Geography (SSCI), Computer Science-Information Systems (SCI), and Geography-Physical (SCI).

[4] *Social Science Computer Review* appears in three categories: Information Science & Library Science (SSCI), Social Sciences-Interdisciplinary (SSCI), and Computer Science-Interdisciplinary Applications (SCI).

[5] R^2, called the coefficient of determination in linear models, ranges from 0 to 1. It tells how much variation in the data was explained by the fitted model. To some extent, it is an indicator of how good a model is. The larger the R^2 value, the better the fitted model. In the following sections, R^2 from each model is used as one of the criteria for identifying the best predictor of journal impact.

[6] Three of the 11 variables (1 dependent and 10 independent), are categorical and were not tested for normality or multicollinearity.

[7] If the tested distribution is normal, p-value should be greater than a criterion value, in this case, .05.

[8] *r*-value greater than 0.98 in this case is an indication of normality.

[9] In a linear model, data may be transformed on the dependent or independent variable. To transform on a dependent variable (in this case, IF), BoxCox is a common technique. For an independent variable transformation, log and Box-Tidwell transformations are both commonly used. Box-Cox and Box-Tidwell transformations were used for the dependent variable and independent variables in this project.

[10] Variance Inflation Factors (VIF) is a common way to detect multicollinearity, the strong correlation between certain independent variables. VIF represents the inflation that each regression coefficient experiences above the ideal, where the correlation between each pair of variable is zero. If a regressor variable has a strong linear association with the remaining variables, the corresponding VIF will be large. Generally, it is believed that if any VIF exceeds 5 or 10, there is reason for at least some concern of multicollinearity (Myers, 1990).

[11] PRESS 1 is the sum of squared prediction errors; PRESS 2 is the sum of absolute values of prediction errors.

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APPENDIX

Journal Abbreviations

Journal	Abbreviation
Error! Main Document Only. African Journal of Library Archives and Information Science	AJLAI
Error! Main Document Only. Annual Review of Information Science and Technology	ARIST
Error! Main Document Only.ASLIB Proceedings	ASLIB
Error! Main Document Only. Canadian Journal of Information and Library Science	CJLIS
Error! Main Document Only. College & Research Libraries	CRL
Error! Main Document Only. Econtent	ECONTENT
Error! Main Document Only. Electronic Library	ELIB
Error! Main Document Only. Government Information Quarterly	GIQ
Error! Main Document Only. Health Information and Libraries Journal	HIL
Error! Main Document Only. Information & Management	IM
Error! Main Document Only. Information Processing & Management	IPM
Error! Main Document Only. Information Research-An International Electronic Journal	InfRes
Error! Main Document Only. Information Society	InfSoc
Error! Main Document Only. Information Systems Journal	ISJ
Error! Main Document Only. Information Systems Research	ISR
Error! Main Document Only. Information Technology and Libraries	ITLib
Error! Main Document Only. Information Technology & Management	ITM
Error! Main Document Only. International Journal of Computer-Supported Collaborative Learning	IJCSC
Error! Main Document Only. International Journal of Geographical Information Science	IJGIS
Error! Main Document Only. International Journal of Information Management	IJIM
Error! Main Document Only. Interlending & Document Supply	IDS
Error! Main Document Only. Investigacion Bibliotecologica	IB
Error! Main Document Only. Journal of Academic Librarianship	JALib
Error! Main Document Only. Journal of the American Medical Informatics Association	JAMIA
Error! Main Document Only. Journal of the American Society for Information Science and Technology	JASIST
Error! Main Document Only. Journal of the Association for Information Systems	JAIS
Error! Main Document Only. Journal of Computer-Mediated Communication	JCMC
Error! Main Document Only. Journal of Documentation	JDOC
Error! Main Document Only. Journal of Global Information Management	JGIM
Error! Main Document Only. Journal of Health Communication	JHC
Error! Main Document Only. Journal of Information Science	JIS
Error! Main Document Only. Journal of Information Technology	JIT
Error! Main Document Only. Journal of Informetrics	JInfMetric
Error! Main Document Only. Journal of Librarianship and Information Science	JLIS

Error! Main Document Only. Journal of Management Information Systems	JMIS
Error! Main Document Only. Journal of the Medical Library Association	JMLA
Error! Main Document Only. Journal of Scholarly Publishing	JSP
Knowledge Organization	KO
Error! Main Document Only. Law Library Journal	LLJ
Error! Main Document Only. Learned Publishing	LP
Error! Main Document Only. Library Collections Acquisitions & Technical Services	LCATS
Error! Main Document Only. Library Hi Tech	LHT
Error! Main Document Only. Library & Information Science Research	LISR
Error! Main Document Only. Library Journal	LibJ
Error! Main Document Only. Library Quarterly	LibQ
Error! Main Document Only. Library Resources & Technical Services	LRTS
Error! Main Document Only. Library Trends	LibT
Error! Main Document Only. Libri	LIBRI
Error! Main Document Only. Malaysian Journal of Library & Information Science	MJLIS
Error! Main Document Only.MIS Quarterly	MIS
Error! Main Document Only. Online	ONLINE
Error! Main Document Only. Online Information Review	OIR
Error! Main Document Only. Portal-Libraries and the Academy	PORTAL
Error! Main Document Only. Profesional de la Informacion	PROF
Error! Main Document Only. Program-Electronic Library and Information Systems	PROGRAM
Error! Main Document Only. Reference & User Services Quarterly	RUSQ
Error! Main Document Only. Research Evaluation	ResEva
Error! Main Document Only. Restaurator-International Journal for the Preservation of Library and Archival Material	RESTAURATOR
Error! Main Document Only. Scientist	SCIENTIST
Error! Main Document Only. Scientometrics	SCIENTOMETRICS
Error! Main Document Only. Serials Review	SR
Error! Main Document Only. Social Science Computer Review	SSCR
Error! Main Document Only. Social Science Information sur les Sciences Sociales	SSI
Error! Main Document Only. Telecommunications Policy	Tele
Error! Main Document Only. Zeitschrift für Bibliothekswesen und Bibliographie	ZBB