Google Book Search Citation as Impact Indicator: A Case Study on Information and Library Science Journal Articles

Kayvan Kousha[1] and Mike Thelwall[2]

[1] *kkoosha@ut.ac.ir*
Department of Library and Information Science, University of Tehran (Iran)

[2] *m.thelwall@wlv.ac.uk*
School of Computing and Information Technology, University of Wolverhampton, Wulfruna Street, Wolverhampton WV1 1ST (UK)

Abstract

In the social sciences, books and monographs play significant role in research communication. The absence of citations found in most books and monographs from the ISI databases has been widely criticized and many attempts have been made to include these types of publications for social science research evaluation. This article examines whether the Google Book Search can help to fill this gap. We used Google Book Search to explore how Information Science and Library Science (IS&LS) articles were cited by books based upon all 1923 articles in all 51 ISI indexed journals published in 2003. The results showed that IS&LS journal articles attracted about a third (31%) as many Google Book Search citations as ISI citations. The result also showed that highly book-cited articles tended to receive higher citations from journal articles indexed in ISI (r=0.635**, p=0.000), indicating a significant relationship between the two types of citation data, with some important exceptions. Finally, we found significant citation data from Google Book Search, suggesting that it is valuable source for social science impact assessment.

Introduction

Research evaluation often relies upon the extent to which scientific research (e.g., research articles) is used by the other academic publications based upon citation counts. It is known that different disciplines in science, social science and humanities use different types of publications for research communication (Moed, 2005). For instance, books, book chapters and monographs have a significant role in social science and humanities research communication (for reviews see, Glänzel & Schoepflin, 1999; Hicks, 2004; Nederhof, 2006; Huang & Chang, 2008), but they seem less important in science. Although the ISI (Institute for Scientific Information, now Thomson Reuters) has been the predominant source for impact assessment even in the social sciences (e.g., Glänzel, 1996; Ingwersen, 2000; Van Leeuwen, 2006), the ISI database does not cover citations from most books and monographs and mainly restricts its coverage to high impact journals and selected serials. This can be a problem for social science research evaluation (Cronin, Snyder, & Atkins, 1997; Hicks, 1999; Moed, 2005; Nederhof, 2006) and benchmarking the output of countries in the social sciences and humanities (Archambault et al., 2006).

Hicks argued that "indicators built from SSCI indexed material - journal and citations to them - will miss the 40% of citations received by books. Because authors' book and journal citations are not well correlated, indictors built from total citations will differ from indictors built from citations to journals" (Hicks, 1999, p. 198). Consequently, it seems that citation analysis based upon the ISI databases is less appropriate in subject areas in which non-serial publication is a major scholarly platform for research communication.

Although books are a key scholarly platform in many social sciences and humanities, cited references in books can be difficult to locate and analyse. Therefore, traditional bibliometric methods need to be extended to include books and monographs, if possible and practical. For this purpose, many attempts have been made to cover wider types of scholarly publication including books, book chapters and monographs (e.g., Lindholm-Romantschuk & Warner, 1996; Cronin, Snyder, & Atkins, 1997; Yates & Chapman, 2005; Tang, 2008) and to mine ISI

Proceedings of ISSI 2009, pages 218–229.
Edited by B. Larsen and J. Leta.

databases for cited references to books (Butler & Visser, 2006). ISI founder Eugene Garfield has also discussed challenges for future citation analysis using new sources such as books and monographs for impact assessment, *"the creation of a Book Citation Index*" (Garfield, 1996).

Whilst there is much discussion surrounding the role of books, book chapters, and other monographs in social science research evaluation, not much is known about the potential value and application of the bibliographic information and cited references from online book databases and digital archives for monitoring the impact of research. Although no study has directly examined citations from online books for impact assessment, several Webometrics investigations have reported the proportion of Web citations or links from books and monographs, showing that book references are sometimes available online but falling short of evaluating book coverage or demonstrating that book references are sufficiently numerous online to make a difference in research evaluation (Cronin, Snyder, Rosenbaum, Martinson, and Callahan, 1998; Vaughan & Shaw, 2005; Kousha & Thelwall, 2006; Kousha & Thelwall, 2007b; Kousha & Thelwall, 2007c).

Although several papers have discussed the application of new citation-enhanced databases (e.g., Google Scholar, Scopus, CiteSeer, CrossRef, Science Direct, Chemical Abstracts) for bibliometric research (Hood & Wilson, 2003; Jacsó, 2004; Roth, 2005; Frandsen & Nicolaisen, 2008), it seems that no previous study used Google Book Search (http://books.google.com) to explore the extent of cited references in online books (e.g., versus ISI citations) for impact assessment of the published academic journal articles.

We used Google Book Search as a source of citation impact to answer above question and to assess the role of disciplinary differences in Google Book Search citation coverage and its application for impact assessment. We examined how results from citation Google Book Search citation searching can successfully measure the impact of published academic journal articles. For this purpose, we compared the citation rate from books against that from ISI-indexed journals. The study is designed to shed light on how Google Book Search can be used as a complimentary source for impact assessment, especially in the social sciences in which books have a significant role for research communication.

Literature review

Bibliometric characteristics of books

Many studies have discussed the potential role of books, edited volumes and monographs for research communication and evaluation in social science and humanities disciplines (e.g., Small & Crane, 1979; Nederhof, 1989; Cronin et al., 1997; Thompson, 2002; Glanzel & Schoepflin, 1999; Nederhof, 2006; Huang & Chang, 2008). Books are sometimes regarded in social science and humanities disciplines as precursors to journal articles. Some studies have argued that disciplinary difference is important for book and monographic citation patterns. Tang (2008), for instance, reported findings of earlier studies that the proportion of citations to monographs was 48%-51% in economics, 5% in chemistry, 8% in physics (Broadus, 1971) and that "books account for 46 percent of the overall citations to U.K. social science literature, whereas only 12 percent of the citations in natural science were to books " (Earle & Vickery, 1969 as quoted by Tang, 2008, p. 357). Small and Crane (1979) reported early evidence about the share of the cited items from books in science and social sciences. They found that the proportion of book cited items was about 40% in sociology and 25% in economics, compared to about 1% in high-energy physics. Clemens (1995) also showed that sociological books tend to attract more citations than journal articles "by a ratio of 3:1" (Clemens et al., 1995 as quoted by Nederhof, 2006). Nederhof and van Raan (1993) examined scientific productivity and the impact of six research groups in economics (1980-1988), finding that the number of citations per publication was higher for books (3.15) than for ISI articles (0.95). They also

found that 63% of the references to the studied publications were from journal articles and 26% were from both books and book chapters.

Lindholm-Romantschuk and Warner (1996) studied the relative impact of monographs and journal articles produced within a discipline by a single author. They found that in philosophy, sociology and economics monographs attract 7.7, 2.6, and 2.4 times more citations than journal articles written by the same authors respectively. In a comprehensive study using all bibliographic citations indexed in the year 1993 in the Science Citation Index (SCI) and Social Science Citation Index (SSCI) databases, Glanzel, and Schoepflin (1999) studied the percentage of references to serials. They found that while about 80% of all science journals cite more than 70% of all references to serials, the same percentage of all social science journals have less than 70% of references to serials. Chung (1995) analyzed 5,302 references in sixty-eight monographs and 352 journal articles (1981-1990) in the library and information science (classification literature), finding that 51% were from books and book chapters and 38% were from journal articles. Robinson and Poston (2004) studied a sample of 1,759 cited references found in 78 research articles from three journals in economic discipline published in 1999, finding that 58% were from scholarly journals, 15% from monographs (including books) and 14% from working papers. Porta, Fernandez and Puigdomènech (2006) searched for the number of times 14 important books in epidemiology and public health had been cited based upon the Web of Science (cited references option). The average citation per year for the all studied journals was 76 citations, indicating the importance of the some books in epidemiology and public health research. Krampen, Becker, Wahner and Montada (2007) analysed references in random samples of English and German journal articles as well as German textbooks, encyclopedias, and test-manuals from psychology, finding that more than 40% of the cited references were books and book-chapters. Finally, Yates and Chapman (2005) examined references from three Communication journals for the years 1985, 1995, and 2005 to investigate the role of the scholarly monograph in the discipline of communication. They found that over 50% of the references were to monographs published in the previous fifteen years, although there was a noticeable drop in the number of references to monographs published in the previous 5 years.

Evidence of online book impact

Although it seems that no investigation has directly used Google Book Search for online quantitative citation data for impact assessment of the scientific papers, several Webometric studies have reported the proportion of Web citations or links created from books, book chapters or edited volumes for scholarly-related reasons. The purpose of these studies was to understand the potential value of Web-extracted citations or links mentioning or targeting scientific journal articles or scholars' names.

Cronin, Snyder, Rosenbaum, Martinson, and Callahan (1998) examined why the names of highly cited academics were mentioned in Web pages. Using five commercial search engines, they searched for the names of five highly cited library and information science full professors and classified the reasons for mentioning (invoking) them in 11 categories (including a book chapter sub-class). One of the sub-classes that they used under the main category of "articles" was "book chapter". However, they did not state the exact proportion of invoked names in the book chapter(s) in a separate category so their figures are not reported here.

Vaughan and Shaw (2005) searched for "*Web citations*" (exact article titles in Web pages) as online impact indictors for journals in four disciplines. They used a commercial search engine and phrase searches for article titles to count the number of times the articles were mentioned online. They classified a sample of Web citations from 114 ISI-indexed journals. They also used the sub-class "online textbook" under the general category of "other intellectual impact"

to reflect online scholarly use of the cited papers. They did not report the number of citations in online textbooks in a separate group, perhaps because of a low rate of citations from them.
Using Google searches, Kousha and Thelwall (2006) studied motivations for creating 3,045 URL citations (mentions of an URL in the text of a Web page) to the library and information sciences (LIS) open access journal articles. They used the separate category "book/book chapter" to assess the extent of formal citations in books or book chapters on the Web. They found that about 2% (58) of the URL citations targeting LIS journal articles were from the reference sections or footnotes of online books. This was perhaps the first quantitative evidence about the potential value and application of online book for monitoring impact performance of the research, but the very low value was not promising.
Using a different multi-disciplinary data set of articles in the four science disciplines (Kousha & Thelwall, 2007b) and in the four social science subject areas (Kousha & Thelwall, 2007c), a new technique, '*Google unique Web/URL citation*', was applied to maximise the number of citations per web site from online documents. In both studies, sub-classes of "books or book chapters" were used to assess if the studied articles were citied in online books or book chapters. In four science disciplines (biology, chemistry, physics and computing) 1,577 web citations 0.5% (8) were from the references or footnote sections of online books or book chapters (Kousha & Thelwall, 2007b). In four social science disciplines (education, psychology, sociology and economics) of 1530 web citations analysed only 0.3% (5) were online book titles (Kousha and Thelwall, 2007c). Again few web citations were from online book titles.

Research questions

The main aim of this study is to assess whether the Google Book Search database is useful for citation impact assessment of published academic journal articles across multiple disciplines, addressing the specific questions below. Although bibliographic databases can only include a sub-universe of the scholarly documents and Google Book Search also represents only the portion of the book titles published in the world literature, it seems to be the largest book database supporting full-text searches and so seems to be the best choice for this study.

1) Is the number of citations from books indexed by Google Book Search sufficiently numerous for monitoring the impact of research?
2) Do Google Book Search citations to journal articles correlate with ISI citations at the article and journal levels?

Methods

Research Population

We selected all research articles (omitting reports, editorials, book reviews, etc.) published in the 51 ISI indexed journals in IS&LS (Information Science & Library Science) subject category. We searched the selected journal names in the "source field" of the ISI/Thomson Reuters Web of Science and then saved the required bibliographic information for each article, including article title, author name(s), journal name and times cited. Therefore, for the ISI citation count we used number of citations to each articles as reported by the Web of Science (WoS) at the time of this study (November 2008). We chose the year 2003 to give IS&LS journal articles sufficient time (about five years) to receive citations from books and to assess recent citations (see Table 1).

Google Book Search Citations

In this study we defined book citation as citations in books including book chapters, research reports, or conference papers which were published in book format (usually with an ISBN)

and indexed by Google Book Search facility (http://books.google.com). Google Book Search allows full text searching of books (e.g., under or out of copyright), but this does not mean that users can download or read all pages of books under copyright without paying for them. Nevertheless, Google Book Search displays the full page for each keyword in the text (in yellow) and in many cases allows browsing several adjacent pages. Whilst in many cases Google Book Search only allows a limited preview of the books (sample page views), it is possible to locate a citation data in the whole text of the books. This full-text search capability of Google Book Search makes it useful for locating citations.

For Google Book Search citation counts, we manually searched the exact titles of all 1923 articles as phrase searches in the advanced Google Book Search interface and selected "all book" (either limited preview or full view) and the option to locate as many citing books as possible. We also restricted our search content to "books" to retrieve citations to articles in the book sources (usually with an ISBN) and to avoid possible citations in magazines. Basically, this method is similar to previous studies for extracting different types of web citation data from the main Google search engine (Vaughan & Shaw, 2003), Google Scholar (Kousha & Thelwall, 2007a), and online syllabuses (Kousha & Thelwall, 2008), but for different purposes.

Sometimes it was necessary to omit parts of article titles to generate successful searches, especially when there were characters such as :, -, / in the titles. For instance, the phrase search of article entitled "`Modeling the information-seeking behavior of social scientists: Ellis's study revisited`" retrieved three citations from book sources. However, when the colon and subtitle (`: Ellis's study revisited`) were removed from the query the citation count increased to six. For this reason, we usually conducted several searches to maximize the citation counts. For articles with very general or common titles (e.g., Managing text digitisation), we also added extra bibliographic information to the query (e.g., first author name, journal name or both) to eliminate false matches. This problem was also reported by a previous study for Google Scholar citation counting (Kousha & Thelwall, 2008). We manually checked the Google Book Search results to guarantee that they were created for formal citation reasons, i.e., if 1) citations were observed in the reference lists or 2) in the footnotes of the books, book chapters or edited volumes. In many cases we found citations which were created for abstracting or indexing purposes such as in the printed versions of the annotated bibliographies online. These were excluded. Sometimes, one article might be cited more than once in a book, especially when a book consists of different chapters or selected papers with separated reference lists. In this case, we to locate possible citations (usually highlighted in yellow) in different sections of a book and counted all these separately.

In order to examine whether Google Book Search full-text citation retrieval mechanism works properly, we checked the references in 13 books against their hard copy counterparts, finding no mistakes in number or location of the cited articles. Some errors would inevitably be present in the Google Book Search database, but this quick test provides some reassurance that they may not be too frequent, except perhaps in older books that are more difficult to scan accurately. We found some mentions of exact article titles with the same author(s) where the cited works were published in conference proceedings instead of selected IS&LS journals. Although it is scholarly norm for many scientists to present their initial research results in conferences and then to publish similar articles in journals, we don't know of a practical method to check the extent of revisions or changes of these conference papers against the subsequent journal articles. Thus, we ignored such citations to avoid counting similar article titles published in different sources.

All ISI and Google Book Search data collection took place during about a month (November 2008) to diminish the effect of time on increasing the number of citations in both databases.

Findings

ISI vs. Google Book Search Citation Counts

Table 1 shows descriptive statistics for Google Book Search and ISI citations for IS&LS research articles. It shows that the 1923 journal articles published in 51 IS&LS ISI-indexed journals attracted about a third (31%) as many Google Book Search citations as ISI citations. Although the number, mean and median of ISI citations to journal articles are significantly higher than Google Book Search citations, the results indicate that the number of Google Book Search citations are sufficiently numerous to help monitor the impact of IS&LS research. Table 1 also shows that the distribution of both Google Book Search and ISI citations are highly skewed.

Table 1. Descriptive statistics for Google Book Search (GBS) and ISI Citation counts

	GBS Citations	ISI Citations
Mean	1.42	4.57
Median	0	1
Standard deviation	3.46	12.44
Skewness	11.18	17.11
Minimum	0	0
Maximum	85	389
Total	2,745	8,793
Relative citations (%)	0.31 (31%)	3.20 (320%)

Journal-level citation analysis

Table 2 reports the number, mean and median of Google Book Search and ISI citations at the journal level. It shows that, except for two journals, the number and the mean of ISI citations is higher than that for Google Book Search citations. Surprisingly, we found more citations from Google Book Search than from the ISI for both *Information Research-An International Electronic Journal* and *Online*. Table 2 also shows that of 51 IS&LS journals, the median Google Book Search citations is higher than 1 for 27 (53%) journal titles. Perhaps for of the majority of the studied IS&LS journals Google Book Search citations were sufficiently useful for research evaluation and impact assessment. Note that we used median instead of mean here, since in most cases the distribution of Google Book Search and ISI citations was found to be highly skewed and mean is not an appropriate indicator for measuring the central tendency of citation counts. Most notably, *MIS Quarterly* with a median of 10 and *Annual Review of Information Science and Technology* with a median of 8 have the highest Google Book Search citation impact among 51 IS&LS journals in 2003.

If Google Book Search citations are to be applied for impact factor measures then it is interesting to compare citations from Google Book Search and ISI for each journal as the unit of data analysis. A strong correlation would suggest the use of Google Book Search citation as an alternative source of journal citation impact, especially in some social science and humanities in which books have a great role in research communication. Hence, we performed correlation test between the mean citations of ISI and Google Book Searches for the 51 journals. There was a highly significant correlation between the mean of ISI citations and the mean of Google Book Search citations ($r=0.720^{**}$, $p=0.000$, $n=51$). Thus, it seems that IS&LS journals having higher mean ISI citations also have higher mean Google Book Search citations. Note that the Spearman correlation test was preformed instead of Pearson because the frequency distributions of both Google Book Search and ISI citations were highly skewed.

Table 2. Descriptive statistics for Google Book Search and ISI citations for 51 IS&LS journals

Journal	Articles	GBS* Citation	GBS Citations mean	GBS Citations median	ISI Citations	ISI Citations mean	ISI citations median	ISI citations / GBS	GBS citation / ISI
MIS Quarterly	15	223	14.86	10	892	59.46	35	4	0.25
ARIST 11		88	8	8	214	19.45	10	2.43	0.41
Information Society	30	179	5.96	5.5	208	6.93	4	1.16	0.86
J. of Management Information Systems	32	179	5.59	3	294	9.18	4.5	1.64	0.61
Information S ystems Research 14		63	4.5	5	260	18.57	17	4.13	0.24
J. of The American Medical Informatics Association	54	230	4.25	3	1041	19.27	11.5	4.53	0.22
Information Systems J.	15	50	3.33	3	104	6.93	6	2.08	0.48
Information & Management	71	224	3.15	2	746	10.5	6	3.33	0.3
Telecommunications Policy	31	95	3.06	3	123	3.96	1	1.29	0.77
Information Pro cessing & Management 41		102	2.55	2	346	2.55	2	3.39	0.29
J. of The Americ an Society For Info rmation Science And Technology	92	225	2.44	2	968	10.52	6	4.3	0.23
J. of Documentation	27	64	2.37	1	227	8.4	6	3.55	0.28
J. of I nformation Technology 16		38	2.37	2	106	6.62	6	2.79	0.36
Social Science Compute r Review 33		76	2.3	1	159	4.81	4	2.09	0.48
Government Information Quarterly 24		46	1.91	1	135	5.62	2	2.93	0.34
College & Research Libraries 27		50	1.85	1	113	4.18	3	2.26	0.44
J. of Health Communication 43		75	1.74	1	273	6.34	6	3.64	0.27
Information T echnology and Libraries	27	47	1.74	1	62	2.29	2	1.32	0.76
Portal-Libraries and The Academy 45		71	1.57	1	111	2.46	1	1.56	0.64
Information Re search-An International Electronic J.	18	27	1.50	1	22	1.2	0	0.81	1.23
Library Quarterly	13	19	1.43	1	74	5.69	5	3.89	0.26
International J. of Information Management	36	48	1.33	1	163	4.52	3.5	3.4	0.29
Library & I nformation Science Research	18	22	1.22	1	102	5.66	4	4.64	0.22
Social Science I nformation Sur Les Sciences Sociales	17 17		1.00	0	37	2.17	0	2.18	0.46
Library Trends	45	43	0.95	0	95	2.11	1	2.21	0.45
Aslib Proceedings	34	32	0.94	1	98	2.88	2	3.06	0.33
Reference & User Services Quarterly 27		24	0.88	0	28	1.03	0	1.17	0.86
J. of Academic Librarianship 35		31	0.88	1	96	2.74	2	3.1	0.32
J. of Librarianship And Information Science	15	13	0.86	0	46	3.06	2	3.54	0.28
Knowledge Organization	12	10	0.83	0.5	62	5.16	4	6.2	0.16
Research Evaluation	19	15	0.78	0	57	3	1	3.8	0.26
Scientometrics 72		56	0.77	0	540	7.5	4.5	9.64	0.1
Online Information Review	37	28	0.75	1	93	2.51	1	3.32	0.3
J. of Information Science	41	29	0.70	0	148	3.6	3	5.1	0.2
Program-Electronic Librar y and Information Systems	20	12	0.60	0	25	1.25	0	2.08	0.48
J. of The Medi cal Librar y Association 43		24	0.55	0	227	5.27	2	9.46	0.11
Electronic Library	37	20	0.54	0	51	1.37	1	2.55	0.39
Online 41		21	0.51	0	11	0.26	0	0.52	1.91
Library Collections Acquisitions & Technical Services 35		15	0.42	0	58	1.65	1	3.87	0.26

Library Resources & Technical Services	14	5	0.35	0	21	1.5	1.5	4.2	0.24
Library J.	139	39	0.28	0	49	0.35	0	1.26	0.8
J. of Scholarly Publishing	14	4	0.28	0	17	1.21	1	4.25	0.24
Law Library J.	29	7	0.24	0	26	0.89	0	3.71	0.27
J. of Information Ethics	13	3	0.23	0	5	38	0	1.67	0.6
Libri 27		5	0.18	0	30	1.11	0	6	0.17
Scientist 265		40	0.15	0	77	0.29	0	1.93	0.52
Canadian J. of Information And Library Science	20	2	0.10	0	20	1	0	10	0.1
Econtent 71		7	0.09	0	8	0.11	0	1.14	0.88
Interlending & Document Supply 27		2	0.07	0	63	2.33	2	31.5	0.03
Restaurator 20		0	0.00	0	53	2.65	2.5	N/A	0
Zeitschrift Fu r Bibliothekswesen Und Bibliographie 21		0	0.00	0	9	0.42	0	N/A	0
Total	**1,923**	**2,745**	**1.42**		**8,793**	**4.57**		**3.20**	**0.31**

*GBS= Google Book Search

** Journals were ranked based upon the Google Book Search citations mean

Analysis of top book cited articles

Table 3 lists the top 20 book-cited articles in the ISI IS&LS category from 2003. It shows that the most cited articles by books could also attract high ISI citations. A Spearman correlation test between Google Book Search and ISI-cites for all 1923 IS&LS articles showed a significant relationship between two types of citation data (r=0.635**, p=0.000, n=1923). The result showed that highly book-cited articles also received higher citations from journal articles indexed in ISI. There were no cases of highly book-cited articles that had received no ISI citations but several cases where the number of book citations was significantly higher than 31% of the ISI citations (i.e., higher than the expected value). The most extreme case is influential information scientist Clifford Lynch's article on institutional repositories, which had a moderate impact according to the ISI statistics, but a high impact according to book citations.

Table 3. Top 20 Google Book Search cited articles in ISI IS&LS category. Bold values indicate relatively high GBS citations.

Authors	Title	Journal	GBS cites	ISI cites
Venkatesh, et al.	User acceptan ce of informa tion technolog y: Toward a unified view	MIS Quarterly	85	389
DeLone, W; McLean, E	The D eLone an d McLean m odel of informa tion systems success: a ten-year update	J. of Mana gement Information Systems	58	107
Benbasat, I; Zmud, R	The identit y crisis w ithin the is d iscipline: Defining and communicating the discipline's core properties	MIS Quarterly	26	90
Lamb, R; Kling, R	Reconceptualizing users as social actors in information systems research	MIS Quarterly	24	43
van Dijk, J; Hacker , K	The digital divide as a complex and d ynamic phenomenon Information	Society	22	34
Lynch, CA	Institutional repositories: Essential infrastructure for scholarship in the digital age	Portal-Libraries and The Academy	**21**	**6**
Borner K., Chen C., Boyack K.	Visualizing knowledge domains	ARIST	20	69
Gibbs, J; Krae mer, KL; Dedrick, J	Environment an d polic y factors shaping global e - commerce diffusion: A cross-country comparison	Information Society	**20**	**21**
Bates, et al.,	A proposal for electronic medical records in U S primary care	JAMIA	20	67
Downie J.S.	Music information retrieval	ARIST	**18**	**17**
Liederman, EM; Morefield, CS	Web messaging: A ne w t ool for patient-physician communication JAMIA		18	43
Briggs, et al.,	Collaboration engineering with ThinkLets to pursue sustained success with group support systems	J. of Manage ment Information Systems	17	25
Peleg, M;	Comparing computer-interpretable guideline	JAMIA	17	82

	models: A case-study approach			
Kling, R; McKim, G; King, A	A bit more to it: Scholarly communication forums as socio-technical interaction networks	JASIST	**17**	**19**
Bates, D. and et al.	Ten commandments for effective clinical decision support: Making the practice of evidence-based medicine a reality	JAMIA	16	99
Teo, HH; Wei, KK; Benbasat, I	Predicting intention to adopt interorganizational linkages: An institutional perspective MIS	Quarterly	16	62
Griffith, TL; Sawyer, JE; Neale, MA	Virtualness and knowledge in teams: Managing the love triangle of organizations, individuals, and information technology	MIS Quarterly	15	57
van der Heijden, H	Factors influencing the usage of websites: the case of a generic portal in The Netherlands	Information & Management 14		43
Lee, H	The growth of broadband and electronic commerce in South Korea: Contributing factors	Information Society	13	21
Ash, JS; Stavri, PZ; Kuperman, GJ	A consensus statement on considerations for a successful CPOE implementation	JAMIA	13	53

JASIST= Journal of the American Society for Information Science and Technology
ARIST= Annual Review of Information Science and Technology
JAMIA= Journal of the American Medical Informatics Association

Note that some journals in the Table 3 are loosely related to library and information science research and they are more related to information systems (e.g., *MIS Quarterly, Information Systems Research, J. of Management Information Systems*) and medical informatics (*J.of the American Medical Informatics Association, J. of the Medical Library Association*). They are included within IS&LS category because of the ISI's classification practices. Hence, Table 4 is restricted to the top 20 book-cited articles in the library and information science journals to assess how library and information science research is cited in books.

Table 4. Top 20 Google Book Search cited articles from library and information science journals

authors	article	Journal	GBS cites	ISI cites
van Dijk, J; Hacker, K	The digital divide as a complex and dynamic phenomenon	Information Society	22	34
Lynch, CA	Institutional repositories: Essential infrastructure for scholarship in the digital age	Portal-Libraries and The Academy	**21**	**6**
Borner K., Chen C., Boyack K.W.	Visualizing knowledge domains	ARIST	20	69
Gibbs, J; Kraemer, KL; Dedrick, J	Environment and policy factors shaping global e-commerce diffusion: A cross-country comparison	Information Society	**20**	**21**
Downie J.S.	Music information retrieval	ARIST	**18**	**17**
Kling, R; McKim, G; King, A	A bit more to it: Scholarly communication forums as socio-technical interaction networks	JASIST	**17**	**19**
Lee, H	The growth of broadband and electronic commerce in South Korea: Contributing factors	Information Society	13	21
Jaeger, PT; Thompson, KM	E-government around the world: Lessons, challenges and future directions	Government Info. Quarterly	12	23
Borlund, P	The concept of relevance in IR	JASIST	10	51
Davis, PM	Effect of the web on undergraduate citation behavior: Guiding student scholarship in a networked age	Portal-Libraries and The Academy	10	26
Capurro R., Hjorland B.	The concept of information	ARIST	9	25
Vakkari P.	Task-based information searching	ARIST	9	46
Blair, DC	Information retrieval and the philosophy of language	ARIST	**9**	**9**
Jaeger, PT	The endless wire: E-government as global phenomenon	Government Info. Quarterly	9	13
Bailey, P; Craswell, N; Hawking, D	Engineering a multi-purpose test collection for Web retrieval experiments	Information Processing & Management	9	30
Shank, JD; Dewald, NH	Establishing our presence in courseware: Adding library services to the virtual classroom	Information Technology and Libraries	**9**	**7**
Gilchrist, A	Thesauri, taxonomies and ontologies - an etymological note	J. of Documentation	9	12
Weber, L; Loumakis, A; Bergman, J	Who participates and why? An analysis of citizens on the Internet and the mass public	Social Science Computer Review	9	25

Kling, R; Callahan, E	Electronic journals, the Internet, and scholarly communication	ARIST	8	18
Shill, HB; Tonner, S	Creating a better place: Physical improvements in academic libraries, 1995-2002	College & Research Libraries	**8**	**7**

Results from Table 4 confirm that the articles most cited by book sources also are highly cited by the ISI. However, Table 5 shows that there are some highly ISI-cited articles that received relatively few book citations from Google Book Search. For instance, the first highly book-cited LIS papers in Table 4, are in the 9th ranking place in Table 5 and the second highly book cited papers (with 21 citations from books) could only attract six citations from ISI.

Table 5. The top 20 ISI cited articles from library and information science journals

authors	Article	Journal	GBS citation	ISI citation
Borner K., Chen C., Boyack K.W.	Visualizing knowledge domains	ARIST	20	69
Ahlgren, P; Jarneving, B; Rousseau, R	Requirements for a cocitation similarity measure, with special reference to Pearson's correlation coefficient	JASIST	4	63
Vaughan, L; Thelwall, M	Scholarly use of the Web: What are the key inducers of links to journal Web sites?	JASIST	**2**	**52**
Borlund, P	The concept of relevance in IR	JASIST	10	51
Vakkari P.	Task-based information searching	ARIST	9	46
White, HD	Pathfinder networks and author cocitation analysis: A remapping of paradigmatic information scientists	JASIST	6	44
Aksnes, DW	A macro study of self-citation	Scientometrics	**2**	**38**
Vaughan, L.; Debora, S	Bibliographic and Web citations: What is the difference	JASIST	**2**	**37**
van Dijk, J; Hacker, K	The digital divide as a complex and dynamic phenomenon	Information Society	22	34
White, HD	Author cocitation analysis and Pearson's r	JASIST	**2**	**34**
Foster, A; Ford, N	Serendipity and information seeking: an empirical study	Journal of Documentation	8	32
Wang, PL; Berry, MW; Yang, YH	Mining longitudinal web queries: Trends and patterns	JASIST	6	32
Heimeriks, G; Horlesberger, M; Van den Besselaar, P	Mapping communication and collaboration in heterogeneous research networks	Scientometrics	**2**	**31**
Bailey, P; Craswell, N; Hawking, D	Engineering a multi-purpose test collection for Web retrieval experiments	Information Processing & Management	9	30
Talja, S; Maula, H	Reasons for the use and non-use of electronic journals and databases - A domain analytic study in four scholarly disciplines	Journal of Documentation	5	30
Thelwall, M; Tang, R; Price, L	Linguistic patterns of academic Web use in Western Europe	Scientometrics	3	30
Glanzel, W; Schubert, A	A new classification scheme of science fields and subfields designed for scientometric evaluation purposes	Scientometrics	**0**	**29**
Gupta, MP; Jana, D	E-government evaluation: A framework and case study	Government Information Quarterly	**2**	**27**
Davis, PM	Effect of the web on undergraduate citation behavior: Guiding student scholarship in a networked age	Portal-Libraries and the Academy	10	26
Thelwall, M; Harries, G	The connection between the research of a university and counts of links to its web pages	JASIST	5	26

Conclusions and discussion

In answer to the first research question, we found that Google Book Search citations are valuable for impact assessment of the published academic research articles in library and information science. The proportion of Google Book Search citations per ISI citation was one third (31%) of ISI citations, suggesting that Google Book Search citations are numerous enough to be used to supplement ISI citations and for research evaluation.

In answer to the second question we found relatively strong relationships between Google Book Search citations and ISI citations, suggesting that Google Book Search is an applicable

new bibliometric tool for citation counting and impact assessment in IS&LS. An important conclusion of the current study is that in disciplines in which books also play significant role in scholarly communication (e.g., many social science and humanities disciplines) Google Book Search can be used for monitoring research evaluation. Hence, our study suggests that in disciplines with research communication highly dependent on books, Google Book Search could be a possible replacement for the ISI citation databases.

Limitations: One limitation is that the time period needed to attract book citation may be longer than that to attract journal article citations, although this has not been clearly proven. If true, the consequent delay in producing results would be a disadvantage for practical citation counting exercises. Second, there may be disciplinary differences in the extent of Google Book coverage. For instance, in many science disciplines Google Book Search citations might be rare enough to be ignored in research evaluation. Therefore, future studies should examine how disciplinary differences may influence Google Book citations in science and the social sciences.

In this study we manually checked the Google Book Search results to guarantee that they were created for citation reasons (i.e., in the reference lists or in the footnotes of the books). Consequently, our method cannot be used for the automatic impact assessment of the research because the results had to be checked individually and so it lacks the advantage of using automatic searches. Regarding Garfield's (1996) "Book Citation Index", it therefore seems that there is still scope for the development of an automatic 'Book-Impact Factor' tool using Google Book data (with permission) to add to existing ISI/Thomson Reuters citation data.

References

Broadus, R. (1971). The literature of the social sciences: a survey of citation studies. *International Social Science Journal* , 23, 236–43.

Butler, L. & Visser, M. (2006). Extending citation analysis to non-source items. *Scientometrics*, 66, 327–343.

Chung, Y. (1995). Characteristics of references in international classification systems literature. *Library Quarterly*, 65, 200–215.

Clemens, E., Powell, W., McIlwaine, K. &Okamoto, D. (1995). Careers in Print: Books, Journals, and Scholarly Reputations. *American Journal of Sociology*, 101, 433–494.

Cronin, B., Snyder, H., Rosenbaum, H., Martinson, A., & Callahan, E. (1998). Invoked on the web. *Journal of the American Society for Information Science*, 49, 1319–1328.

Cronin, B., Snyder, H. & Atkins, H. (1997). Comparative citation rankings of authors in monographic and journal literature: A study of sociology. *Journal of Documentation*, 53, 263–273.

Earle, P. & Vickery, B. (1969). Social science literature use in the U.K. as indicated by citations. *Journal of Documentation*, 25, 123–41.

Frandsen, T. & Nicolaisen, J. (2008). Intradisciplinary Differences in Database Coverage and the Consequences for Bibliometric Research. *Journal of the American Society for Information Science and Technology*, 59, 1570–1581.

Garfield, E. (1996). Citation Indexes for Retrieval and Research Evaluation, Consensus Conference on the Theory and Practice of Research Assessment, Capri.

Glänzel, W. (1996). A bibliometric approach to social sciences. National research performances in six selected social science areas, 1990–1992. *Scientometrics*, 35, 291−307

Glänzel, W., & Schoepflin, U. (1999). A bibliometric study of reference literature in the sciences and the social sciences. *Information Processing & Management*, 35, 31−44.

Hicks, D. (1999). The difficulty of achieving full coverage of international social science literature and the bibliometric consequences. *Scientometrics*, 44, 193−215.

Hicks, D. (2004). The four literatures of social science. In H. Moed (Ed.), *Handbook of quantitative science and technology research* (pp. 476–496). Dordrecht, The Netherlands: Kluwer.

Hood, W. & Wilson, C. (2003). Informetric studies using databases: opportunities and challenges. *Scientometrics*, 58, 587–608.

Huang, M. & Chang, Y. (2008). Characteristics of research output in social sciences and humanities: from a research evaluation perspective. *Journal of the American Society for Information Science and Technology*, 59, 1819–1828.

Ingwersen, P. (2000). The international visibility and citation impact of Scandinavian research articles in selected social science fields: The decline of a myth. *Scientometrics*, 49, 39−61.

Jacsó, P. (2004). Citation-enhanced indexing/abstracting databases. *Online Information Review*, 28, 235–238.

Kousha, K. & Thelwall, M. (2006). Motivations for URL citations to open access library and information science articles. *Scientometrics*, 68, 501–517.

Kousha, K. & Thelwall, M. (2007a). Google Scholar citations and Google Web/URL citations: A multi-discipline exploratory analysis. *Journal of the American Society for Information Science and Technology*, 58, 1055–1065.

Kousha, K. & Thelwall, M. (2007b). How is science cited on the web? A classification of Google unique web citations. *Journal of the American Society for Information Science and Technology*, 58, 1631–1644.

Kousha, K. & Thelwall, M. (2007c). The Web impact of open access social science research. *Library and information Science Research*, 29, 495–507.

Kousha, K. & Thelwall. M. (2008). Assessing the Impact of Research on Teaching: An Automatic Analysis of Online Syllabuses in Science and Social Sciences. *Journal of the American Society of Information Science and Technology*, 59, 2060–2069.

Krampen, G., Becker, R., Wahner, U. & Montada, L. (2007). On the validity of citation counting in science evaluation: Content analyses of references and citations in psychological publications. *Scientometrics*, 71, 191–202.

Lindholm-Romantschuk, Y. & Warner, J. (1996). The role of monographs in scholarly communication: An empirical study of philosophy, sociology and economics. *Journal of Documentation*, 52(4), 389–404.

Moed, H. (2005). *Citation analysis in research evaluation*. New York: Springer.

Nederhof, A. (2006). Bibliometric monitoring of research performance in the social sciences and the humanities: A review. *Scientometrics*, 66, 81−100.

Nederhof, A. & van Raan, A. (1993). A bibliometrics analysis of six economics research groups: A comparison with peer review. *Research Policy*, 22, 353–368.

Nederhof, A. (1989). Books and chapters are not to be neglected in measuring research productivity. *American Psychologist*, 44, 734–735.

Porta, M., Fernandez, E. & Puigdomènech, E. (2006). Book citations: influence of epidemiologic thought in the academic communit. *Rev Saúde Pública*, 40, 50–56.

Robinson, W. & Poston, P. (2004). Literature use by U.S. economists published in 1999: An exploratory study. *Behavioral and Social Science Libraries*, 22, 53–65.

Roth, D. (2005). The emergence of competitors to the Science Citation Index and the Web of Science. *Current Science*, 89, 1531–1536.

Small, H. & Crane, D. (1979). Specialties and disciplines in science and social science: An examination of their structure using citation indexes. *Scientometrics*, 1, 445–461.

Tang, R. (2008). Citation characteristics and intellectual acceptance of scholarly monographs. *College & Research Libraries*, 69, 356–369.

Thompson, J. (2002).The death of the scholarly monograph in the humanities? Citation patterns in literary scholarship. *Libri*, 52, 121–136.

Van Leeuwen, T. (2006). The application of bibliometric analyses in the evaluation of social science research: Who benefits from it, and why it is still feasible. *Scientometrics*, 66, 133−154.

Vaughan, L. & Shaw, D. (2003). Bibliographic and Web citations: What is the difference? *Journal of the American Society for Information Science and Technology*, 54, 1313–1324.

Vaughan, L. & Shaw, D. (2005). Web citation data for impact assessment: A comparison of four science disciplines. *Journal of the American Society for Information Science and Technology*, 56, 1075–1087.

Yates, S. & Chapman, K. (2005). An examination of the use of monographs in the communication journal literature. *Scientometrics*, 66, 81–100.