

Citation Analysis of the *Decision Sciences Journal*

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Citation analysis, one basis for evaluating journals, provides a variety of functions. According to Starbuck and Mezas, “[C]itation rates measure visibility. . . . Journals with larger circulations tend to receive more citations. American journals tend to get more citations than foreign ones, especially ones in foreign languages” (Starbuck & Mezas, 1997).

[One] may distinguish three application areas of citation analysis: the evaluation of scientists, publications, and scientific institutions; the investigation of hypotheses concerning the history and sociology of science and technology; and the study of the performance characteristics of the information search and retrieval procedures. (Peritz, 1992)

Peritz also suggests that merely counting the number of citations is not enough. He says that the average number of citations needs to be compared with other papers dealing with like subjects or with other journals. Additional areas which he identified as pertinent in citation analysis were such classifications as material type and date of publication.

One of the easiest methods of citation analysis is the citation count; that is,

determining how many citations have been received by a given document or set of documents over a period of time This measure allows one to compare the impact of journals which publish different numbers of articles. (Smith, 1981)

Peritz has noted that “citations can be viewed as legitimate objects of research, and, in fact, citation analysis has often proven itself to be a meaningful research tool” (Peritz, 1992).

Information for citation analysis can be obtained from a manual count or from electronic data sources. The Institute for Scientific Information (ISI) publishes an elec-

tronic database, the *Journal Citation Reports (JCR)*, which provides a systematic and objective means of determining the relative importance of science and social sciences journals within their subject categories (Journal Citation Reports, 1999).

Statement of the Problem

There is a need for evaluation of research publications for many reasons. First, writers need to know which journals are hard-science, research-based journals and which are soft-science, non-research-based journals when writing for and submitting to journals for publication. Second, merit evaluations of faculty necessitate a knowledge of quality of publications, and the question ultimately arises regarding how to evaluate when journals may not be equal in quality. Third, faculty, when writing articles for publication, need guidance regarding citation of other research. For these reasons, a citation analysis was conducted of the 1996 and 1997 *Decision Sciences* journals to determine:

1. What is the average number of bibliographic citations per article?
2. What is the recency of the citation? Within the last five years of the publication date of the article?
3. What is the author self-citation rate?
4. What percentage of citations listed in the articles are from books, journals, or other publications?
5. What is the average number of pages per article?
6. What is the incidence of citations to the journal in which the article is published (journal self-citations)?
7. What are the genders of the primary and secondary authors?

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8. How often are authors in other journals citing the articles from this journal?

Methodology

A manual count and an electronic search were conducted of articles published in *Decision Sciences* in 1996-97. In the manual count, only full-length articles were considered. News items, brief notes, letters, responses, and book reviews were not considered for citation analysis. A data collection form was designed for recording all information relative to the research questions (Williams, Triche, & Ross, 1994). This instrument was field tested using selected individuals who provided feedback relative to the practicality, usability, and validity of the form. Information provided was then used in the final design of the instrument.

An electronic search was conducted using *Journal Citation Reports* to determine total citations, impact factor, immediacy index, and the cited half-life of the articles in *Decision Sciences*.

Analysis of Data

Sixty-three *Decision Sciences* articles (2,620 citations) were evaluated by a manual count. Table 1 summarizes the results. The first

column of Table 1 indicates the criteria used for measurement. Column 2 shows averages—the numbers and percentages selected from the research of others that were used as benchmarks for comparison. Discussion of this related research follows Table 1. Column 3 presents the data for the *Decision Sciences* Journal.

Number of Citations Per Article

Price states that the average number of bibliographic citations listed in articles classified as hard-science, research-based is 22 (Price, 1970). However, MacRoberts and MacRoberts point out that many of the hard-science, research-based disciplines' average citation rate varies significantly (MacRoberts & MacRoberts, 1989). For example, the citation rate averages range from a low of 5 to 6 in engineering, mathematical, and technology-oriented disciplines; 8 to 10 in biology and psychology; 12 to 15 in chemistry, clinical medicine, earth science, physics and space science; and the average is around 20 in the biomedical field.

Starbuck and Mezas state that citation rates incorporate systematic biases arising from the bibliographic practices in different fields (Starbuck & Mezas, 1997); that is, articles in applied psychology or management cite around 23 references on the av-

erage. Articles in educational or social psychology cite around 29 references each, and in the general psychology category around 35 references each.

For this study, the Price average of 22 bibliographical citations per article was used as a benchmark (Price, 1970). As shown in Table 1, the average number of citations per article for *Decision Sciences* is 42.

Recency of Citations

For hard-science, researched-based disciplines, Price's Index indicates that, on the average, 43% of the cited research is derived from research from within the last five years of the publication date of the article (Price, 1970). The last five-year measurement was used in this study. For the *Decision Sciences* study, 22% of the citations were derived from research from within the last five years (Table 1).

Author Self-Citation

Garfield and Sher found that authors working in research-based disciplines tend to cite themselves on the average of 20% of the time (Garfield & Sher, 1963). However, MacRoberts and MacRoberts claim approximately 10% to 30% of all the citations listed fall into the category of author self-citation. Additionally, MacRoberts and MacRoberts conclude that:

very few articles do not include any self-citations, that the distribution of the number of self-citations per article has a wide range and that authors are inclined to cite their own work more abundantly than the work of any single author. (MacRoberts & MacRoberts, 1989)

The Garfield and Sher 20% author self-citation rate was applied in this study. In the *Decision Sciences* data shown in Table 1, 4% of the total number of citations were author self-citations. However, 65% of the authors quoted themselves at least once in each article.

Citations from Journals, Books, or Other Publications

Leong's citation analysis of the *Journal of Consumer Research* revealed that 53% of the articles' citations were to academic journals and 31% were to books (Leong, 1989). The remainder of the percentages was to other types of publications. He concluded that

Criteria	Benchmarks	<i>Decision Sciences</i> Data
Average Number of Citations	22	42
Citations < 5 years	43%	22%
Author Self-Citation	20%	4%
At Least One Author Self-Citation	No criteria established	65%
Citation to Journals	54%	71%
Citations to Books	34%	28.6%
Citations to Other Publications	12%	.4%
Average Pages per Article	14	24
Journal Self-Citation	20%	5%
At Least One Journal Self-Citation	No criteria established	79%
Gender		
Primary Authors—Male 65%; Female 8%; Unknown 27%		
Secondary Authors—Male 90%; Female 10%		

Table 1: Citation analysis criteria, benchmarks, and results of manual count, *Decision Sciences*, 1996-97.

there seemed to be a trend away from citing from books. That conclusion was consistent with findings by other researchers that, in general, the use of the book has "shown a general decline in its importance as a communication vehicle in most fields, particularly the natural sciences . . . although much less so in the humanities" (Leong, 1989; Holsapple, Johnson, Manakyan, & Tanner, 1993). In their study, Holsapple et al., discovered that for the years 1987-1991 (while examining 27,543 citations from business computing research journals) 54% of the citations were to journal articles, 34% were book citations, and 12% were citations to other publications (Holsapple et al., 1993).

The Holsapple et al., data was used as a benchmark in this study. The data for *Decision Sciences* is 71% from journals; 28.6% from books; and .4% from other sources.

Average Number of Pages

Garfield and Sher studied average page lengths for scientific journals (Garfield & Sher, 1963). They found that for scientific literature, the average page length was 5.4 pages per article. In a study of library science literature, Cline found slightly different averages for that discipline (Cline, 1978). Her citation analysis of College and Research Libraries and Special Libraries disclosed an average of 5.62 pages per article for College and Research Libraries and 4.14 pages per article for Special Libraries. However, when Cline analyzed the averages by decade, she found that the average page lengths were increasing. In the period 1970-1974, the College and Research Libraries had increased to an average of 7.66 pages per article, and Special Libraries had grown to an average of 5.27 pages per article. Dimond and Simonson, in a study of three education journals, found that averages among theory, research-based education journals ranged from 12 pages in 1960s, 15 pages in the 1970s, and 14 pages by the mid-1980s (Dimond & Simonson, 1984).

For the purposes of this research, the Dimond and Simonson average page length of 14 was used. Table 1 shows that the *Decision Sciences* average was 24 pages.

Journal Self-Citation

Garfield and Sher noted that, on the average for scientific literature journals, the self-citation rates had an average of approximately 20% (Garfield & Sher, 1963). Cline noted that by the mid-seventies, the journal self-citation rate for a portion of library science literature had risen to 35% (Cline, 1978).

This research study used the Garfield and Sher 20% as the average for journal self-citation. For *Decision Sciences* the journal self-citation was 5%; however, 79% of the authors quoted *Decision Sciences* at least once.

Gender

Buttlar analyzed 16 library and information science periodicals and compared her findings with Olsgaards and Olsgaards' 10-year study in which female authorship rose from an average of 21.2% to 41.3% (Buttlar, 1991). In Buttlar's study, it rose to an average of 52.17%. Buttlar found that female authorship percentages varied from publication to publication but noted that in 9 of the 16 titles studied, women had greater than a 50% publication rate, with a high being 69.34%. In general, it can be noted that, on the average, women have steadily increased their role as research disseminators and in some disciplines are beginning to be the predominate authors.

Gender studies are not usually a part of citation analysis, but gender was studied here as a point of interest. In the *Decision Sciences* analysis, 65% of the primary authors were male; 8% were female; and 27% were unknown (unable to determine by name). Secondary authors were 90% male and 10% female.

Citations by Authors in the Same and Other Disciplines

A primary way of determining the value of the work in a discipline is by studying the impact of that discipline on other fields. An impact factor is the average number of citations received in one year by the articles that appeared during the two previous years. *Journal Citation Reports* (JCR), Social Science Edition, was used to ascertain the extent to which articles published

in *Decision Sciences* are being cited (Journal Citation Reports, 1997).

The *Journal Citations Reports* database shows that in 1997 *Decision Sciences* was cited in related journals 894 times. This report is published annually and provides valuable information on citation activity. The report on 1998 data will be published in the fall of 1999.

Information from the *Journal Citation Reports* includes the following data fields with sort and filter options:

1. *Total Cites* indicates the total number of times that each journal as been cited in a given year.
2. *Impact Factor* measures the frequency with which the average article in a journal has been cited in a particular year. The impact factor helps evaluate a journal's relative importance, especially when compared to others in the same field. The impact factor is calculated by dividing the number of current citations to articles published in the two previous years by the total number of articles published in the two previous years; for example, the formula for the impact factor for a journal published in 1997 is calculated as follows:

Cites in 1997 to articles published in	1995 = 23
	1996 = 25
	1995 + 1996 = 48

Number of articles published in	1995 = 30
	1996 = 32
	1995 + 1996 = 62

Calculation:
Cites to recent articles / Number of recent articles = $48/62 = 0.774$ Impact Factor

3. *Immediacy Index* is a measure of how quickly the average article in a specific journal is cited.

Cites in 1997 to articles published in 1997 = 10
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Number of articles published in 1997 = 32

Calculation:
Cites to current articles / Number of current articles = $10/32 = .312$ Immediacy Index

4. *Cited Half-Life* reflects the ongoing use of a particular journal. It is the number of publication years from the current year, which accounts for 50% of current citations received. This figure helps evaluate the age of the majority of cited articles published in a journal. Only those journals cited 100 times or more time have a cited half-life published in *Journal Citation Reports*. The cited half-life for a historical article would be expected to be greater than that for an article on technology that is constantly changing.

Journal Citation Reports, Social Science Edition was used for the years 1994 to 1997 to compare total cites, impact factor, immediacy index, and cited half-life, listing journals in the category of "Management" (*Journal Citation Reports*, 1997). Most of the journals on the list are listed in *Cabell's Directory of Publishing Opportunities in Management and Marketing* (Cabell & English, 1997-98). The number of journals on the list varied each year. The 1997 report listed 59 journals; 1996, 48 journals; 1995, 38 journals; and 1994, 36 journals. See Table 2.

Information obtained from *Journal Citation Reports* shows that *Decision Sciences* is well represented in the area of total cites and is improving its impact factor and immediacy index.

As Table 2 shows, in 1997 *Decision Sciences* had 894 total cites and ranked 11th out of a total of 59 journals. In 1996, *Decision Sciences* ranked 12th with 927 total cites; in 1995 it ranked 13th with 737; and in 1994, it ranked 12th with 753 total cites. The rank for total cites has improved from 1994 to 1997.

The impact factor for *Decision Sciences* in 1997 was .586 for a ranking of 27th out of 59 journals; in 1996, .430 for a ranking of 29th out of 48 journals; in 1995, .500 for a ranking of 23rd out of 38 journals; and in 1994, .459 for a ranking of 24th out of 36 journals. The rank for impact factor has improved continuously from 1994-1997.

The immediacy index for *Decision Sciences* in 1997 was .000 because there were no citations in 1997 to articles published in the journal in 1997. In 1996, the immediacy index was .176 for a ranking of 9th. In 1995, it ranked 20th with .083. In 1994, the immediacy index was .028 for a ranking of 31st. The immediacy index has improved from 1994 to 1997.

The 1997 cited half-life for *Decision Sciences* was 8.6 for a rank of 10th. In 1996 the cited half-life was 8.2 for a rank of 11th. In 1995 the cited half-life was 7.9 for a rank of 10th. In 1994 the cited half-life was 7.4 for a rank of 12th. The higher rank in 1997 indicates that *Decision Sciences* is being used for longer periods of time than it had been previously.

Journal Citation Reports also publishes information showing which journals are citing articles in a specific journal; that is, *Decision Sciences*.

These reports provide valuable information to faculty who are judged for their publishing record, to administrators who must do the evaluating, and to the journals that are listed in the databases. This means of evaluation should be used along with other methods, such as peer review. Pitfalls that all should be aware of are citation biases, such as language barriers, criticism of an article instead of agreement, courtesy citations, and readership size for different areas of study. Also, these databases are electronic, but errors could be made at the data-entry level, causing information to be incorrect. All whose livelihood is involved with citation analysis should check as much as possible to ensure that data is correct. Journal editors, especially, should be aware of how and where data about their authors and articles appear and should monitor the information.

Conclusions

The results of the manual count reveal that *Decision Sciences* exceeded the criteria of number of citations, number of citations to journal, and average pages. It falls short on citations less than five years from date of publication, author self-citations, and journal self-citations. It was shown, however, that a majority of the authors were quoting themselves and the journal at least once. Citations of less than five years from the date of publication were lower than the criterion of 43%, with *Decision Sciences* having 22%. This seems to be the one shortcoming of greatest importance. Authors should be using more recent references. This, of course, is dependent on the topic of the article. Regarding gender analysis, men far outnumber women in publishing

	1997	1996	1995	1994
Number of Journals on JCR Report	59	48	38	36
Data for <i>Decision Sciences</i>				
Total Cites	894	927	737	753
Rank for Total Cites (Rank/Total)	11/59	12/48	13/38	12/36
Impact Factor	.586	.430	.500	.459
Rank for Impact Factor (Rank/Total)	27/59	29/48	23/38	24/36
Immediacy Index	.000	.176	.083	.028
Rank for Immediacy Index (Rank/Total)	.000	9/48	20/38	31/36
Cited Half-Life	8.6	8.2	7.9	7.4
Rank for Cited Half-Life (Rank/Total)	10/59	11/48	10/38	12/36

Table 2: Summary of Decision Sciences Data: Journal Citation Reports, Social Science Edition 1994-1997.

in this journal, contrary to the research that shows women gaining in publication rates. From these results, it can be said that this journal is moving toward being hard-science, research-based with a few areas where attention is needed.

Information obtained from *Journal Citation Reports* shows that *Decision Sciences* is well represented in the area of total cites and is improving its impact factor and immediacy index. Its cited half-life shows that the journal is being used for a longer time in recent years.

It is not recommended that *Journal Citation Reports* users depend solely on citation data in their journal evaluations. Citation data are not meant to replace informed peer review. Additionally, careful attention should be paid to the many conditions that can influence citation rates, such as language, journal history and format, publication schedule, and subject specialty. This caution is supported by Eugene Garfield, the founder of the Institute for Scientific Information, who says,

Using journal impact factors as a surrogate for actual citation counts is to be avoided. We all know that there is considerable variation within a particular journal. However, this does not mean that the impact factor of the journal in which a person has published is irrelevant. Certainly there is some prestige accorded a scientist who manages to have his papers accepted in high impact journal. (Garfield, 1998)

In conclusion, citation analysis is an important factor in the evaluation of journals, articles, and authors. Careful monitoring of databases by all who are affected by them, along with other means of evaluation, should ensure more valid results.

References

Buttler, L. (1991). Analyzing the library periodical literature: Content and authorship. *College and Research Libraries*, 52(1), 38-52.

Cabell, D., & English, D. (1997-98). *Cabell's Directory of Publishing Opportunities in Management and Marketing*. Beaumont, Texas: Cabell's Publishing Co.

Cline, G. S. (1978). *A bibliometric study of two selected journals in library science, 1994-1974*. Ph.D. dissertation. School of Library Science, University of Southern California, Los Angeles, California.

Dimond, P., & Simonson, M. R. (1984). Publications of the profession: AVCR/ECTJ, AVI/II, JID. Paper presented at the annual meeting of the association for Educational Communications and Technology. Dallas, Texas: ERIC.

Garfield, E. (1998). Comment by Eugene Garfield on Heinz Hauffe's article, Is Citation Analysis a Tool for Evaluation of Scientific Contributions? Online: <http://info.uibk.ac.at/sci-org/voeb/vhau9402.html>, 4-5.

Garfield, E., & Sher, I. H. (1963). New factors in the evaluation of scientific literature through citation indexing. *American Documentation*, 18(July), 195-201.

Holsapple, C. W., Johnson, L. E., Manakyan, H., & Tanner, J. (1993). A citation analysis of business computing research journals. *Information & Management*, 25(5), 231-244.

Journal Citation Reports Database on CD-ROM. (1997). Social Science Edition.

Journal Citation Reports: Institute for Scientific Information. (1999). Online: <http://alerting.isinet.com/prodserv/citation/jcr.html>

Leong, S. M. (1989). A citation analysis of the Journal of Consumer Research. *Journal of Consumer Research*, 15(March), 492-497.

MacRoberts, M. H., & MacRoberts, B. R. (1989). Problems of citation analysis: A critical review. *Journal of the American Society of Information Science*, 40(5), 342-349.

Peritz, B. C. (1992). On the objectives of citation analysis: Problems of theory and method. *Journal of the American Society for Information Science*, 43(6), 448-451.

Price, D. J. (1970). Citation measures of hard science, soft science, technology, and nonscience. In *Communication Among Scientists and Engineers*. Lexington, Massachusetts: D. C. Heath, 3-22.

Smith, G. (1981). Citation analysis. *Library Trends*, 30(Summer), 83-106.

Starbuck, B., & Mezas, J. (1997). Journal impact ratings. Online: <http://cmit.unomaha.edu/tip/TIPAPR96/starbuck.htm>

Williams, A., Triche, C., & Ross, D. (1994). Evolution, directionality, and scientific status: A bibliometric study of *Journal of Business Communication* (1963-1993). Unpublished manuscript. ■

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