

The Impact of Citation Counts— A UK Perspective

Number 37

September 12, 1988

Recently, the British Association for the Advancement of Science (BAAS) held its annual meeting. On September 6, a special half-day conference considered the use of citations as performance indicators. Viewpoints both for and against were expressed. This Mason Conference was brought about, in part, by the decision earlier this year by the University Grants Committee, one of two major government funding bodies for UK academic research, to use citation data, inter alia, to help assess research performance.

The following reprint was originally published July 15, 1988, in the *Times Higher Education Supplement (THES)* (London). I

was invited to write this piece as a result of the heightened interest in the topic in the UK. Indeed, an earlier BAAS meeting had considered the topic, as did a Ciba Foundation conference on evaluation research. Although this article was written for a British audience, I believe the issues addressed have a general significance.

* * * * *

My thanks to Elizabeth Fuseler-McDowell and Peter Pesavento for their help in the preparation of this essay.

©1988 ISI

This article originally appeared in the *Times High. Educ. Suppl.* 15 July 1988. p. 12.

The use of citations by the University Grants Committee [UGC] has caused widespread disquiet among scientists and librarians who are asked to compile the relevant data.

The *THES* asked Gene Garfield, originator of the *Science Citation Index*® and president of the Institute for Scientific Information®, to explain the strengths and weaknesses of the technique for assessing research performance in individual departments.

The impact of citation counts

The UGC's use of citation data to evaluate university departments in the United Kingdom is a sensitive issue, and, because it involves the use of data generated by my company, I am concerned about how such data are handled by the UGC investigators. Citation analysis, even when performed by trained information specialists, is a subtle undertaking. In the hands of the unskilled, there is a real possibility of its misuse.¹ In any assess-

ment, citation analysis ought to provide only one indicator among many others, both analytic and human. Invidious comparisons supported by inaccurate or incomplete data help no one. But this is no less true for subjective decision-making based on limited memory and "old boy networks".

The *Science Citation Index*® (*SCI*®) is, foremost, a tool for information retrieval. In addition,

for 25 years now, the *SCI* has proven its worth in tracking research and its application. Anyone who thinks that the *SCI*—and its companion publications, the *Social Sciences Citation Index*[®] and the *Arts & Humanities Citation Index*[™]—exist merely to provide citation counts should test how useful these indexes can be in helping them search the literature. Among other things, they are now a major tool for historians and sociologists of contemporary science.

I suggested in 1955 that the creation of the *SCI* would eventually lead to many by-products.² In fact, it has become an enormous and constantly growing database which provides statistical indicators and specific identifications of intellectual connections among scientists and publications.

The *Citation Index* itself lists cited papers, books, theses and other publications under the first author's name. It should be stressed, however, that the source (author) index cross-references all authors. The main entry indicates the first nine authors of each item. Using a complete bibliography of works produced or published by members of a university department, it is possible to assemble data showing what material has been cited, by whom, and how often. But this is only the first step in citation analysis. A limited attempt has been made to interpret these data—for example, to try to determine why these items are cited, and why others are not.³

If citation data are to be used as part of a process of discrimination and selection, it is essential to establish the methodology and the terms of reference and comparison.¹ As a start, because of the need to compare like with like, it is important to take account of variations between subject areas. The literature varies consistently not only between, but also within, fields, in characteristics which affect the potential for being cited—such as the size, time lag and degree of integration of new knowledge, and the age of the literature.⁴ These and other factors may influence how quickly a paper will be cited; how long it will take the citation rate to peak, and whether it will continue being cited or be subject to what Robert K. Merton has called “obliteration by incorporation” (in which the substance of a researcher's work becomes so absorbed in the common understanding prevalent in its field that explicit citation is no longer thought necessary).⁵

For example, key papers in physical chemistry, maths and astronomy may not start to accumulate citations until several years after publication. Work in biochemistry or immunology may be cit-

ed more rapidly and over a longer period. The role of the journal literature itself in the communication and progress of research can differ from one discipline to another.

Contrary to general mythology, citation analysis is extremely sensitive, and rapid changes in scientists' citation practices within a field can be perceived in a short time. This underlines the need to study not only citation levels, but also trends. Citation potential depends on a range of variables, and it is vital to take heed of—if not compensate for—disparities.

In my 1955 *Science* paper, I suggested that citations would provide a measure of impact of authors.² However, to short-cut the time lag in estimating the impact of individual papers, an approximation is made by using the overall “impact factor” of the journal in which the paper is published. Since then a great deal of work has been done using these data to rank the influence and impact of journals.

While a journal's impact does not indicate the distribution of the citations it has received, it does reflect the average citation frequency of recently published articles. The fact that a paper has been published in a high-impact journal indicates careful peer review even for controversial ideas.

Other aspects to consider include the amount and nature of self-citation; the chronological distribution of the citations; whether citations are concentrated around a few papers or dispersed among many; the extent to which citations are cross-disciplinary, or international and, of course, the *Citation Index*'s coverage of the field or country.

However, a frequent misconception is that if a paper is published in a journal not covered by the *SCI* then citations of that paper will not be found in the *SCI*. How journals are selected for the *SCI* and other indexes is a topic too vast to be discussed here. The important point is that, within each field covered, journals are chosen according to their standing in the international research community of that field. Each author writing in those journals is free to cite whatever papers he or she has found useful and relevant to the research being described, regardless of whether the journals which published the cited material are indexed in the *SCI* or not.

Undoubtedly, there are some “local” topics which do not have international impact, and discussion may be confined to a particular group or sub-specialty. If an article presenting major new research findings appears in a journal not covered

by the *SCI*, it rarely takes long before those findings are picked up, discussed and cited in higher impact journals which *are* indexed in the *SCI*.

A thorough assessment also requires asking why citations have been given. Referring to the passages in the papers which cite the research being reviewed helps to reveal why it is being quoted. Citation context analysis helps determine which aspect of the research was actually mentioned and what are the concepts which other publishing scientists recognize and associate with the department's researchers. If properly carried out, this interpretative work provides a rich store of information unavailable both to those who merely compute raw citation counts, and to those who rely solely on a select group of subject experts to assess the work of their peers.⁶

Given the varied nature of citations, it is only natural for critics and proponents alike to ask what, after all, is being measured? The only responsible claim we can make for the use of citation data in evaluating a department's research is that the data provide an objective measure of the utility or impact of that department's work—bearing in mind the changing interests of the research community, and the visibility of the department and its individual members. Citations say nothing directly about the nature of the work; nothing about the reason for its utility or impact; nothing about its intrinsic value. But it is not unreasonable to make the assumption that, for a department to have an impact (as measured by citations), it is necessary for other researchers to form some opinion about the quality of that department's work. It is therefore valid to use citation data as an in-

dicator—and a quantifiable and consistent one—of the wider community's assessment of the usefulness of a department's work.⁷

The fact that a department's work is of interest to, and has an impact on, the research community will therefore normally be reflected in that department's citation record. But careful judgement may be required to ascertain the reasons why publications are relatively or completely uncited. The citation life of much work is limited. One group's papers, or those of an individual researcher, may be superseded by those of another group or individual. Complex social and other factors determine which paper is adopted to represent a particular set of ideas in preference to other publications. Further, delayed recognition of papers reporting significant research is not uncommon: perhaps the work has not yet been related to current research concerns, or some methodological breakthrough is needed before the work can be fully exploited.⁷

Superficial and indiscriminate citation studies often deserve the suspicion which they arouse. But if the UGC—and individual departments reviewing their own performance—are prepared to invest a reasonable amount of interpretative effort in the process, they are likely to find that citation analyses have a significant contribution to make to defining the more systematic approach to evaluation which is so urgently needed.

ISI® is very sensitive to the possible misuse of its data and takes every opportunity to present a balanced view of the "correct" interpretation and use of citation analysis.

REFERENCES

1. Garfield E. Uses and misuses of citation frequency. *Essays of an information scientist: ghostwriting and other essays*. Philadelphia: ISI Press, 1986. Vol. 8. p. 403-9.
2. ———. Citation indexes for science. *Science* 122:108-11, 1955.
3. ———. *Citation indexing—its theory and application in science, technology, and humanities*. Philadelphia: ISI Press, 1979. 274 p.
4. ———. Highly cited articles. 37. Biomedical articles published in the 1940s. *Essays of an information scientist*. Philadelphia: ISI Press, 1980. Vol. 3. p. 76-83.
5. Merton R K. *On the shoulders of giants: a Shandean postscript*. New York: Harcourt Brace Jovanovich, 1965. p. 218-9.
6. Zuckerman H & Merton R K. Patterns of evaluation in science: institutionalism, structure and functions of the referee system. *Minerva* 9:66-100, 1971.
7. Garfield E. How to use citation analysis for faculty evaluations, and when is it relevant? Part 2. *Essays of an information scientist*. Philadelphia: ISI Press, 1984. Vol. 6. p. 363-72.