The Reliability of Total Citation Rankings

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In short, citation analysis has become a small cottage industry today. The legitimacy of its use for a variety of purposes has been established. In fact, that legitimacy has extended to the point where many suspect uses of citations are accepted without significant skepticism. Rarely, if ever, are these counts, which compare one individual with another, accompanied by a set of caveats, about the limits of such individual comparisons or the bases on which the comparisons are being made (Jonathan R. Cole). (Cole, J. R. A Short History of the Use of Citations as a Measure of the Impact of Scientific and Scholarly Work, Chapter 14. In *The Web of Knowledge*; Cronin, B., Atkins, H. B., Eds.; ASIS Monograph Series, 2000; p 281.)

The editorial in the January 10, 2002, issue of Nature and a following paper in its February 14, 2002 issue are both timely and important. Scientometrics, the quantitative study of the working mechanism of basic research has become a self-standing field of science studies.[1,2] Unfortunately many sloppy uses of its already known and established rules are endangering its healthy expansion and applications.

Perhaps it is worthwhile to mention here a recent paper entitled "Impact factors: Use and Abuse"[3] which clears up many misinterpretations related to impact factors. Some of the mistakes in calculating impact factors were revealed already long ago.[4]

A good example of the questionable aspects of total citation rankings is a computer list, in effect a citation world ranking compiled in 1998 based on the Science Citation Index (SCI) of the Institute for Scientific Information (ISI), Philadelphia. In the list 10 858 chemists worldwide were ranked according to the total number of citations they received between January 1981 and June 1997. The list is headed by A. Bax, with 21 655, and is closed by M. Tsuchia, with 500 citations. In the list, the number of journal articles published in the given period by the scientists on the list are also indicated, with the average citation rate of those articles. The list was purchased from the ISI (Philadelphia) by French chemists, and they published it on the Internet at http://pcb4122.univ-lemans.fr.chimie /chimistes.html and since then as "a ghost it roams over Europe", moreover, about the whole world—paraphrazing here a famous basic author, now somewhat out of fashion (Marx).

The introduction to the list reports quite laconically about the methodology, the aspects, and criteria of selection (it can be supposed that by publications articles, reviews, notes, and letters are meant).

The following arguments are given as a proof that, although the presence of a scientist on the list undoubtedly supposes a research activity worthy to mention, rough numerical data based on total citations counts are by no means suitable for the comparison of the performance of individual scientists for decision makers, arbitrators, or committees.

According to basic scientometric knowledge, the publication and citation practices of the various science fields (e.g. chemistry, physics, biomedicine, etc.) are rather different. The same is true for scientific subfields as well, and, therefore, the comparison of the total publication activity and citation rate of e.g., a physical with that of a colloidal chemist based on the number of citations is a nonsense.[5]

Numerous methods of reliable scientometric evaluations are available depending on the size of the population of publications and citations used.[6] Different methods have to be employed for the evaluation of countries, geopolitical regions scientific fields, subfields having large scientist populations, and of universities, faculties, research institutes, research groups, and individuals producing different population sizes of papers and/or citations. Because of the relatively smaller and in most of the cases statistically nonsignificant populations of their articles and citations, the comparative evaluation of individuals would require a very special care and methodology. In addition, we must know the following about the abovementioned list:

1. The number of citations it mentions does not differentiate between foreign and self-citations. In the case of a scientist publishing in a homogeneous science field, where in all his/her publications—with good reason—the author cites a certain number of his/her previous articles, self-citations can amount even to 15 to 25% of his/her total citation rate.

2. On the list, it is impossible to differentiate between homonyms. Therefore, we can reasonably suppose that a certain family name and a single letter representing the first name can hide many and mean not only one single scientist. For the partial proof of the above-mentioned, we have extracted the most productive authors of the list. The rank of authors with the highest publication rate is as follows:It can perhaps be supposed, although nonchalantly, that the name Struchov, Y. T. belongs to one individual only, who was able to publish continuously an average of 97 journal articles per year during 17 years, but the following 9 Japanese names on the list, most probably include many Japanese

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Table 20

author's name	no. of publications 1981−1997	no. of citations 1981−1997
Struchov, Y. T.	1651	6941
Tanaka, K.	1202	9820
Suzuki, T.	1098	9450
Tanaka, M.	1009	8067
Tanaka, T.	982	8074
Takahashi, K.	954	9961
Yamamoto, Y.	890	10007
Ito, Y.	890	9718
Tanaka, H.	880	8469

authors having the same family name and first name initial.

Chemists who publish in chemistry journals not processed by the ISI in the SCI database (the number of which can supposed to be many), but are cited in journals processed by the SCI, are not included in the list.

The division of sciences into science fields is today very manifold. Interdisciplinarity can produce a significant overlapping between chemistry and physics, biology, medical sciences, material sciences, etc., respectively. The list seems not to include chemists who have published (also) on interdisciplinary topics having also a chemical character.

Based on the above-mentioned, the data on that list are with high probability numerically questionable. Consequently, the ranking is also mistaken.

This is why we do not recommend that list (and similar lists) to be used in any decision making process of evaluation of the performance of chemists or scientists working in any science field.

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