

How to increase the Impact Factor of a Scientific Journal?

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ABSTRACT

In this review article, the nature and uncertainties of the impact factor (IF) of scientific journals is discussed. Based on the citations of articles published in a journal during a given number of years, the impact factor has been used for purposes as different as that of evaluating the scientific journal, to helping to evaluate individual scientists, and as a tool for librarians to select journals for their collections. Many factors have been described which can influence the numerical value of the IF. Since the variability of the citation patterns in various scientific disciplines varies very much, caution is advised when using the IF for interdisciplinary comparisons or evaluations. As for the attempts to increase the IF, the opinion of the author is that the increase in quality of a scientific journal is the only true way for increasing the IF.

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INTRODUCTION

Before I come to the Impact Factor (IF), the main topic of this article, let me touch briefly on the citations, since they provide the basis for the IF. Citations, as a part of a scientific article, are a useful tool for authors since they help them to provide arguments by citing the previously published work, without having to describe it in detail. Secondly, citations help readers to find previous relevant information on a given subject. Due to the steady growth of the number of scientific articles, the number of their coauthors, and the list of references per article, it is not surprising that the number of citations is increasing even faster than the number of scientific articles.

To conclude these few sentences on citations, let me remind you that citations are often used as a measure of the importance/impact that a given article has had in the scientific community. Clearly this may be also used, with caution (see later), as a way of evaluating the quality of a given article.

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IMPACT FACTOR

There has been a long quest for a measure of quality of a scientific journal. This was important for many purposes. From a possible use for indirect evaluation of individual scientists, adding more weight to their articles published in prestigious journals, to a tool for librarians for subscribing to the most relevant journals in their collection.

It was Garfield (1955) who first mentioned the idea of the IF. His main goal was to find an indicator for selecting scientific journals to be included in his data base called Science Citation Index (SCI). Also, using citations to papers published in a journal, Raising (1960) proposed a measure of the journal quality/importance which he named 'Index of the Research Potential Realized'. In 1960, Garfield (see Garfield 1994, 1994a) standardized the IF and applied it to all the journals relevant for SCI. Vinkler gave a comprehensive description of the IF in his review on the publication of scientific journals (2000) and on the IF (2004). With time, parallel to data on the variability of the original IF, there were numerous attempts to modify it, but the original concept is still in use.

The IF of a scientific journal is a ratio between the numbers of citations received by papers published in that journal, during a given period of time. The IF published in the Journal Citation Report (Thomson Reuters, New York, USA) is calculated by dividing the number of citations received by a journal in a given year, by the number of citable texts published in the same journal during 2 previous years. This is in accord with the original Garfield's concept. A simple formula used for calculating the IF looks like this:

$$\text{IF (e.g. for 2015)} = C/P$$

C being the number of citations in 2015, and P the number of citable texts published in the same journal during 2013 and 2014. A clarification is needed for the term 'citable texts'. It is common knowledge that scientific journals may contain texts (e.g. letters, obituaries, summaries of conferences) which are rarely cited. This 'selection' of texts that can be cited is but one among the controversies associated with the IF. As we go along, we will witness a number of other controversies. So, even at this initial phase of my text, caution is advised when using a given numerical value of the IF for evaluation purposes.

To continue with possible misunderstandings of the IF, I should direct the reader to the above formula for getting the numerical value of the IF. It just may happen

that a journal with a high number of citations in a given year does not have a high IF, because the number of citable texts published in 2 previous years counts.

Also, it should be clear that a high IF of a journal does not mean that every article in it has a high citation rate. The IF is valid for the journal, not for single articles. In fact, it is quite possible that, in a high IF journal, some of the published articles have not been cited at all. Several lines of research in that matter have testified to this discrepancy between the IF of the journal and citations of individual articles published in it. In a broader picture, we do have to realize that an article published in a high IF journal may have more chance to be read than if published in a low IF journal. In other words, the IF of the journal may carry some weight in citations of articles published within the journal. Thus, so far, we have to conclude that the IF is determined by citations of individual articles, not the other way around.

When we come to citations, included in the calculation of the IF, we should be aware that there may be self-citations among them. They are defined as citation to an article in a given journal in which previous articles from the same journal were cited. Garfield (1994) has calculated that the self citations amount to about 13% of total citations. A higher number of self citations are found in journals of a small and relatively isolated branch of science. On the other hand, multidisciplinary journals have a smaller proportion of self-citations. An in-group of scientists can add substantially to the IF of a journal with their self-citations. Thus, in a more strict study of the IF, one should calculate the corrected IF, leaving out self-citations.

Since publishing and citing can vary during the years, one can try to correct that by calculating the IF for more than 2 previous years. An IF for 5 or 10 years is definitely more trustworthy than the standard one (2 years). The discrepancy between the standard IF and the one for 5 to 10 years is particularly relevant when comparisons are made between different fields of science, since there are some specific citation patterns in various fields of science. For this discussion particularly relevant are investigations of Glaenzel and Schoepflin (1995) dealing with aging of published data, using citations they receive. Based on their results, the authors proposed that 3 years be taken for calculations of the IF, as a useful compromise between fields of science with relatively quick aging (e.g. life sciences and experimental physics), as opposed to those with longer duration (e.g. some parts of physics and social sciences). Garfield himself accepted that a longer time period may be more relevant for calculating the IF in the field like Clinical Medicine.

The Journal Citation Report classifies science into about 200 categories. The prolonged number of years may be a possible practical solution, but the fact remains that some scientific journals are difficult to classify in any of the categories (e.g. interdisciplinary); many could be easily classified in several of them.

Maja Jokic (2005), in her book on bibliometric aspects of the evaluation of scientific research, has investigated the difference of the IF in various fields of science. Using the Journal Citation Report of 2003, she found that the highest IF of journals in the field of social sciences (JRC, Social Science Edition) was 11.6. Within the whole field, the IF varied from 11.6 to 1.7. Only 26.4% of all journals included had the IF over 1.0. This she compared with the JCR Science Edition, which covered about four times more journals than the Social Science Edition. The highest IF for the group of journals covered was 54.5. For the 10% of most cited journals in the group, the IF was between 54.5 and 3.0, whereas only 43.1 journals had the IF over 1.0. It is quite clear that one has to be very careful when using the IF across different fields of science. Even within the general group of Social Sciences, the variation is very large. For example, in the field of Biological Psychology, the highest IF was 10.6, as compared to the field of history having the highest IF of 0.8. This only emphasizes the caution I wrote in the above sentences. To end this paragraph on the variations in different scientific fields, I will mention Jokic's finding that, even within the fields of exact sciences, variations are significant: Biochemistry and Molecular Biology had the IF of 36.3, Biophysics 15.9, and Environment Protection only 3.9. In the field of medicine, the highest IF was in immunology (52.3), genetics and heredity had 26.5, gynecology and obstetrics had 3.7, and orthopedics only 2.9. I do hope that by mentioning these numbers I have given a message that comparison of the IF among the fields, for the purpose of evaluation, is a methodological error.

When using the IF for any comparative studies, one has to take into account all the specificities of different scientific disciplines. An important one being the pattern of citing. For example, the average number of references per published article in the field, or the half time of citing. It is known that, in Mathematics, there are fewer references and citations, often only a few. In immunology, the number of references is several folds higher, and the half life of citing is quite short. Both of these variables can influence the IF. Fast developing disciplines will have more journals and often more citation, and consequently higher the IF. There are even differences in 'popular' fields of different countries; Japan has more journals oriented to technical sciences than to fundamental fields, and that has to be accounted for, since it is known that the literature



on fundamental research is cited more often than the one in applied sciences. A very safe conclusion, taking into account all possible variables in citations, is that it is much more methodologically acceptable to compare journals within a discipline than among them. One of the ways of resolving this variability is to select journals of the same discipline and make a list of citations within the field. In doing so, one can also make a list of the IF within the discipline, and then find a place of any individual journal (IF) within that list. The general idea has been published by Schubert et al (1987). I have somewhat simplified the method for local needs (Silobrcic, 2004). In this way, one can get a reliable standing of a given individual journal within the discipline. Just in passing, a similar method can be applied for comparing individual scientists, groups of scientists, etc.

To add to the inherent variability of the IF, I should mention yet another variable: that of variable citing of various types of articles published in a journal. Notoriously, review articles are cited more than original scientific articles. Also, articles bringing new methods, particularly those with wide application, are often extensively cited. By now, I do not have to tell you that these variables can greatly influence the IF of journals in question. To be quite certain with these variables, one has to know the publication policy of the journal in question. So, for example, brief description of patients in medicine is less often cited than extensive articles. On the contrary, letters to the journal in physics and astronomy are often longer and may be cited as well as full articles.

One would not expect that even a change in the title of a journal can influence the IF, particularly if it has been done without proper information. Finally, abbreviations of various journals may be similar and may cause confusion in citations and the IF.

Another variable influencing the IF is the country of origin of a journal. This is particularly relevant when we speak of scientific journals coming from small countries. Jokic (2005) found that, from 13 such countries, three had not a single journal in the JCR. The remaining 10 had a total of 114 journals included, but only two of these had the IF higher than 1.0. She also mentioned that only about 12% of the Japanese journals registered had an IF higher than 1.0.

The IF has been used for evaluation not only of journals but also of individual scientists. This is even less advisable, on the general basis of the statistics of large numbers *vs* small numbers. A more suitable use of the IF for individual evaluation is by taking into account the IF of the journals in which individual scientists have been publishing their papers. But here a reminder is called for: the IF is not applicable for a single paper, but it is an

average of cited papers published in a given journal. In other words, even in a high IF journal, a single published paper may not be cited at all (as has been described in previous paragraphs). There is no evidence that articles published in a journal with a given IF will all be of the same quality. Seglen (1992) has shown that 90% of the citations to a journal are received by about 50% of the articles published. This is why publishing in a high IF journal does not mean that the high IF can be applied to every published article. Besides the variation in citations between the fields (which parallels the number of coauthors for that field), it is true that the total number of citations received by an article is increasing with time.

It might be useful to list the basic characteristics of the IF and citations, as Optof (1997, cited by Jokic, 2005, and translated by this author) has done:

- Impact factor is a tool for helping to determine the quality of the journals.
- Impact factor of a journal is not a tool to evaluate single papers.
- Impact factor is not a tool for evaluating the quality of an individual scientists.
- Impact factor is not a tool for evaluating quality of a group of scientists, if the group published less than 100 papers within 2 years.
- Quality of an individual scientist and/or a group of scientists can be evaluated by analyzing the citations of their papers.
- Citation analysis may not be correlated with the evaluation of reviewers.
- Citation analysis can be used a posteriori to evaluate success of a scientific policy.

The above list may be taken as a rational summary of the use and usefulness of the IF.

To add to this concluding remark, I would remind the reader that the patterns of citation in science are similarly influenced by a number of variables and as such do influence the IF, but this would require a separate and longer consideration. Here, it may be a proper place to mention a possible general outlook on the use of numerical indicators for evaluation in science (Silobrcic, 2001).

HOW TO INCREASE THE IMPACT FACTOR?

Let me now turn to the question contained in the title of this text. Given the use of the IF in the scientific community, it is not surprising that it was tempting to search for ways of increasing it. Harder (2000, cited by Jokic 2005) described attempts to intentionally increase the IF of the American Journal of Physiology: Heart and Circulatory Physiology. This is what they did: started publishing a larger number of short review articles

(I remind the reader that review articles are more often cited than original articles!); continued publishing issues with special subjects (to aim at interested groups!); Published even translations of review articles aiming at a wide medical community; published only the papers of highest quality. Also, using the transition of the journal to an electronic form, they tried to shorten the time for publishing papers. This, together with a broader and carefully selected Editorial Board, provided favorable results and the IF increased. If I was to select among the described attempts, I would definitely have to say that any measures to increase the quality of the journal are the right way to increase the IF. Here is a proper place to cite the creator of the IF. Garfield (1994, 1994a) who stated that the success of a scientific journal depends on its quality, distribution, availability and a number of competitive factors. Among these being even the price of the journal.

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