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Downsides of Impact Factor as a Valid Criterion of Quality Publications

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ABSTRACT

The aim of this paper is to examine the validity of impact factor as a metric for evaluation of scientific output of researchers, laboratories, departments and their institutions. The opinion that Impact Factor (IF) is an index that expresses the quality and scientific value of a given researcher/author; departments and their institutions is examined against the critical view point in clinical medicine. Sociological and statistical factors are also considered. Attempt is also made to elucidate on what citation exactly should count for quality in determination of values of IF. Citation frequency as a measure of journal's importance to its end users is considered to be a plausible theory in clinical medicine. Sociological and statistical factors are also seen to have effects on values of IF across subject areas. It is also found out that a count of citations to error in calculation of IF value does not reflect a true value of quality. Appropriate count that reflects quality should be used to compute IF values. Many previous critiques have developed to undermine the use of IF as a metric for evaluation of scientific output of researchers/authors. This article forms the first attempt to identify that all citations to an article do not necessarily count for quality. In this context, the article is original and of great potentials.

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Introduction

Bibliographic indicators have traditionally referred to abstracting and indexing services for scholarly literatures. Examples of these indicators include: Citation Index, Impact Factor (IF), H-Index etc. The importance of bibliometrics has led to the emergence of many bibliographic database sources such as: CiteBase; CiteSeerX ; Google Scholar; Web of Knowledge; Elsevier Scopus; former Windows Live Academic (now available with extra features as Microsoft Academic Search) etc. These services focused on collecting the citation information and making them searchable (Trawick and McEntyre, 2013). Bibliographic indicators provide descriptive and organized collection of references to published literature to allow the user to easily establish which later documents cite which earlier documents. This may be general in scope or cover a specific subject area.

While bibliometrics were originally designed for information retrieval, they are now increasingly used in a number of academic endeavours based on the enumeration and statistical analysis of scientific output in the form of articles, publications, citation and other more complex indicator (Okubo, 1997). It has become the most commonly used metric for evaluation of scientific output of researchers, laboratories, departments and their institutions, scientific specialisation and performance of countries (Okubo, 1997; Thorston-Krell, 2012; Daniel, 2013). These indicators are now used in deciding where an author will choose to submit an article for publication (Daniel, 2013; University of Alberta Library Guides, 2012). The use of these indicators by Editors and Reviewers in deciding acceptability of a submitted article is also gaining prominence. Actually, Editors prefer to accept manuscripts that contain considerable citation to articles in their journals because this will enhance the IF rating of the journal. In this context, IF is used as a political instrument instead of being a measure of

quality. Libraries/Librarians also use them to make decisions about collection development (University of Alberta Library Guides, 2012; Saha et al. 2003). In US and UK, promotion and grants receptions are based on impact ratings, as well as how many times an institution has been cited in publications (Saha et al. 2003; Seglen, 1997; Lowy, 1997).

The considerable opinion among scholars is that IF is an index that express the quality and scientific value of a given researcher/author; departments and their institutions, scientific specialisation and performance of countries; however now there is increasing critical view to this standpoint. Many critiques have emerged to this effect.

In this present paper, IF is examined against the critical view point in clinical medicine. Sociological and statistical factors are also considered. Attempt is also made to elucidate on what citation exactly should count for quality in calculation of IF.

Critical View Points in Clinical Medicine

The IF is a measure of the frequency with which an article has been cited in a particular year or period. There is Journal IF, Aggregate IF, Median IF, and Author IF. Journal IF is the average number of citations to those papers that were published during the two preceding years (University of Alberta Library Guides, 2012). For example, if A equals the number of times articles published in 2006 and 2007 were cited by indexed journals during 2008; and B is the total number of "citable items" published in 2006 and 2007. ("Citable items" are usually articles, reviews, proceedings, or notes; not editorials or Letters-to-the-Editor.), then the 2008 impact factor of the journal would be calculated as the ratio A/B. The use of impact factor as an index of journal quality relies on the theory that citation frequency accurately measures a journal's importance to its end users. This theory is plausible for journals whose audiences are primarily researchers, most of whom write manuscripts for publication. By citing articles from a given journal in their own

manuscripts, researchers are in essence casting votes for that journal (Saha et al., 2003). Impact factor serves as a tally of those votes (Saha et al., 2003). Saha et al., (2003) believe that a journal's impact within clinical medicine depends largely on its importance to practitioners, most of whom never write manuscripts for publication and thus never have a chance to "vote." Citation frequency may therefore better reflect the importance of clinical journals to researchers than practitioners. The opinions of both practitioners and researchers are relevant in judging the importance of clinical journals, the validity of impact factor as a measure of journal quality in clinical medicine is uncertain (Saha et al., 2003). Journal impact factor has its limitations. There should be further evaluation of whether and how impact factor measures journal quality before it is widely adopted as a quantitative marker of journal quality (Saha et al., 2003).

Sociological and Statistical Critical View Points

Amin and Mabe, (2007) identified that the value of the IF is affected by sociological and statistical factors. Sociological factors include the subject area of the journal, the type of journal (letters, full papers, reviews), and the average number of authors per paper (which is related to subject area). Statistical factors include the size of the journal and the size of the citation measurement window (Garfield, 2008). It was shown that the absolute value of the mean IF exhibits significant variation according to subject field. In general, fundamental and pure subject areas have higher average IF than specialized or applied ones. The variation is so significant that the top journal in one field may have an IF lower than the bottom journal in another area. The phenomenon of collaboration between authorship has also been identified as source of variation in IF evaluation. The average number of authors on a publication depends on the subject area. In social sciences, there is the average of about two authors per paper while there are over four in fundamental life sciences (Amin and Mabe, 2007). Due to the tendency for authors to refer to their own work, there is a strong and significant correlation between the average number of authors per paper and the average IF for a subject area. As the IF is an average value, it also shows variation due to statistical effects (Garfield, 1998). These relate to the number of items being averaged, that is the size of the journal in terms of articles published per annum. It is obviously inadequate to employ them in determination of quality of all types of journals in all subject areas, and even comparing the same type of journal in the same subject category (Lee et al., 2002; Amin and Mabe, 2007).

Citations to Errors

IF is a measure reflecting the average number of citation which is expressed as a ratio. A clear and unambiguous definitions of the items counted to evaluate this ratio are essential (Amin and Mabe, 2007). Generally, the published IFs are calculated by a count of the number of citations to all parts of the journal and the number of papers. But what citation exactly should count for quality? Actually, a definition of quality should connote high degree of approval because it is free of errors. The believe that citation to an article signify quality is borne out of the opinion that citation of an article establishes its approval. This opinion, in the general, is not true. It should be pointed out that not all citations to an article actually count for quality. Sometimes articles are cited to point out errors that should be corrected. For example, Adedayo, (2010a, 2010b, 2010c,) and Adedayo (2011) cited DeGarmo et al., (1999) and MIT, (2002) to identify error that have caused serious industrial conflicts. Powell, (2009) has also cited: Di Pietro (1994); Hsu (1994); Yilbas (1996); Kaplan (1996); Chen (1997); Abdulhadi

(1997); Breaban (2006); Ermolaev (2006); Li (2007); Sobih (2007) all to point out errors. Citations to articles for the purpose of indicating errors which may have significant consequences do not imply the articles are quality.

What Citations in Which Part of the Article should Count for Quality?

For most articles that are reports of empirical studies, the main features of the papers can easily be recognized to include: The Abstract, Introduction/Literature Review, Methodology/Materials and Methods, Results/ Results and Discussions; and Conclusion. Review and other articles forms can have highly varied features as the author may be inspired. As a general rule, for most journal publications, Abstracts and Conclusions do not contain citations to articles.

Introduction/Literature Review sections of an article are written to establish knowledge pertinent to the research subject. Identification of gaps, arguments and opposing views in the literature is made (Emerald, 2012). The background knowledge is used to provide justification for further research efforts along the identified area. Justifications for research are borne out of established facts of limitations of status quo knowledge. A limited knowledge should not be adjudged as quality. Essentially, the citations to an article made in the Introduction/Literature Review sections may imply the importance of the article; however, importance does not necessarily connote quality. When citations are made in the Methodology/Materials and Methods section of articles, it is probably because there is an adoption or correlation of methodology/materials in the cited article. This gesture signifies approval and should count for quality.

In discussing results, the attempt is to present the results in a broader context of other works on the subject so that they could be interpreted with minimum speculation. Actually, in science and particularly in engineering analysis, observations of nature are explained using equations, variables and functional relationships based on other established facts in related subjects. The essence is to be able to make generalizations and possibly very accurate predictions beyond the range confirmed by experience, experiment and practice. Citations made in this section of the article are used to support/correlate an argument or to establish the result. This shows approval of the idea presented in the cited article and should be counted for quality.

Distinction between Importance and Quality

Importance describes a situations of wide spread influence. It shows a general circumstance that is vital, crucial, essential and significant. Quality is a measure of excellence. It implies a state of being free from defects, deficiencies and significant variations. While a situation may be important because it is quality, however, quality is not necessarily a precondition for importance.

DeGarmo et al., (1999) reported that the product of oxidation of steel during oxy-fuel gas cutting is Fe_3O_4 . This statement is not quality information because FeO is the essential product of oxidation of steel when steel is cut by oxy-fuel gas method. Citation of DeGarmo et al., (1999) should not be regarded to count for its quality; however its citation is important because it has potential of grave consequences as reported by Adedayo, (2010a, 2010b, 2010c,) and Adedayo (2011).

Conclusion

A critique of the opinion that IF is an express indication of the quality and scientific value of a given researcher/author; departments and their institutions has been made. The theory that citation frequency accurately measures a journal's

importance to its end users is seen to be a plausible theory in clinical medicine. Sociological and statistical factors also affect IF values. These factors can significantly affect the values of IF across subject areas. IF is calculated by a count of the number of citations to all parts of the journal and the number of papers. Counts of citations to error are also counted and these do not reflect a true value of quality. IF possesses potentials to be a valid criterion, however only appropriate citations counts should be used in calculating the values of IF.

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