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The Use of Fi-Index Tool to Assess Per-manuscript Self-citations

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Abstract

Bibliometric parameters are now increasingly used in the evaluation of scientific research and researchers/authors. Over the years, different indices have been taken into consideration with the aim of "quantifying" different authors. A new index was recently defined, the Fi-index, with the aim of evaluate how much the h-index of a given author is influenced by his self-citations. The purpose of this work is to apply the Fi-index, not to the entire career of the author, as normally happens, but to the single paper in course of publication, so as to verify or certify that a specific manuscript does not affect the h-index or citations from the single author or authors. Fi-index tool score measure the impact of a paper on author career and it is obtained by a simple calculation that could be made with an online tool (www.fident.eu/fidentresearch/fiindextool). The use of fi-index tool could be useful as a guarantee parameter on a specific manuscript, obviously provided that a particular author could have a scientific research trend. It is hoped that this index will be used on a large scale for scientific publications affected by bibliometric parameters.

Keywords Publications · H-index · Fi-index · Bibliometrics · Self-citation

Introduction

It is useless to reiterate how the bibliometric parameters have become important for all the researchers of the scientific sub-sectors subjected to this type of evaluation [1]. A parameter used all over the world is the H-index, which examines the number

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of manuscripts published by a given author and the number of citations [2, 3]. Obviously, it does not take into account the career length of a particular author and does not take into account all those strategies implemented to increase the value of the h-index, with positive implications in the event of a public competition or evaluation by a commission. Precisely for this reason, different indexes of bibliometric evaluation have been introduced over the years which can in some way normalize the parameter. The main disadvantage of the old bibliometric indicators, such as the total number of articles or the number of citations, is that the first measure does not appreciate the quality of scientific publications [4], and the second is disproportionately affected by groups that have few publications. And yet a large number of citations [5, 6]. The h-index aims to simultaneously measure the quality and quantity of scientific production. It is not very difficult to understand that the h-index can lead to confusion regarding the importance of a scientist because, being limited by the number of total publications, a short-career scientist is at a clear disadvantage and the importance of his early work is not considered in the right measure. For example, if we have a researcher with 5 publications A, B, C, D and E with 10, 8, 5, 4 and 3 citations respectively, the index is equal to 4 because the 4th publication has 4 citations and the 5th has only 3. On the other hand, if the same publications have 25, 8, 5, 3 and 3 citations, then the index is 3 (i.e., the 3rd position) because the fourth article n there are only 3 citations. In addition, the index is not influenced by the highly successful article.

A recent index introduced has precisely the function of understanding how much an author has influenced his h-index with self-citations, this parameter is the fi-index, by its author [7].

The purpose of this manuscript is to introduce a tool, useful, not to evaluate the positive self-influence on one's career by a researcher/author, but to evaluate this value per-manuscript. The ultimate function should be to evaluate the quality of the reference list with regard to self-citations, and to obtain a value for the individual author that can be included in the text to guarantee the work done and the citations inserted.

Materials and Methods

How to Use Fi-Index Tool

This tool is derived directly from the Fi-index [7]. Its use is very simple and basically evaluate how an author modifies or influences his h-index with a single publication where he is present among the authors. This tool offers the possibility of giving a guarantee regarding the reference list of given manuscript, above all it guarantees on the work of the individual author. Its calculation derives completely from the Fi-index.

Fi-index formula:

$$hindex - \left[\frac{(100 - \%selfcit)}{100} * hindex\right]$$

Once the Fi-index of a particular author or multiple authors has been obtained, it is necessary to move on to the analysis of the reference list or bibliography of a specific manuscript (in course of publication or submission). In the bibliography all citations belonging to that particular author must be identified and their weight on the h-index must be considered.

It is easy to observe from Table 1, how the presence of 3 self-citations in a given manuscript increases both the number of total citations of a given author and the number of self-citations obviously by 3. In the event that one of these self-citations is in a useful position to modify the h-index, obviously this will be taken into account when the Fi-index is recalculated (Table 2).

In Table 3 could be observed e an example of the above in Table 2.

Table 1 This table shows an example of a manuscript published with 3 self-citations without h-index improvement

	Total citations	Total self-citations	H-index
Before publication	1800	540	20
After publication	1803	543	20

These values must be examined before and after publication (or presumed) of a given manuscript

Table 2 This table shows an example of a manuscript published with 3 self-citations with h-index increase

	Total citations	Total self-citations	H-index
Before publication	1800	540	20
After publication	1803	543	21

These values must be examined before and after publication (or presumed) of a given manuscript

Table 3 I In this case, the fi-index calculation with the parameters used in Table 1, before and after the presumed publication of the manuscript, could be analyzed

	Value or score before publication and indexing	Value or score after manuscript supposed publication and indexing
Hirsch-index	20	20
Citations number	1800	1803
Citations number without self-citation	1300	1300
Citations value k	18	18,03
% self citations	27,77,777,778	27,8,979,479
Fi-index	5,555,555,556	5,57,958,957

Obviously, this step is at the base of the fi-index tool's calculation

Once these results have been considered, below we find the formula for calculating the Fi-index tool:

$$Fiindex - \text{Fiindex after publication}$$

"Fi-index after publication" means the results of fi-index analysis considering the manuscript as published and indexed with their references. The results can be seen in the subsequent sections of the manuscript.

When Do I have to Perform My Calculation?

The use of the fi-index tool must be carried out before the publication of the manuscript in order to be able to report the result in one of the different sections of the latter, depending on the guidelines of the journal or the type of manuscript. The result is recommended to be indicated in the Materials and Methods section or Results section (or both with method description and results later) with an entry similar to this:

> This manuscript has been checked with Fi-index tool and obtained a score of nn.nn in date dd/mm/yy according to…

With nn.nn we mean a number with two decimal digits. It is also advisable to mention the source (with a reference) of the Fi-index tool and the Fi-index for a quick check by reviewers or editors who are not aware of them.

A date could be added to this wording, or furthermore, this could be inserted in a subparagraph named "Fi-index tool" as appears in this manuscript (Results Section). "According to" means according to a specific information source as in the paragraph 2.3.

The score can be reported on the manuscript with the wording expressed above up to the last revision stages of the latter, in order to be sure that the value is updated. It can therefore be calculated at any time during drafting, the important thing is that it is updated and correct.

Furthermore, a table with Fi-index tool scoring detail for each author could be added in the manuscript, as shown in "Fi-index tool" subparagraph (Table 4).

Table 4 Fi-index tool score for author detail table

Author name	Fi-index tool score
Fiorillo L.	0.11
Cicciù M.	0

What Information Sources Do I have to Use?

The sources of information that can be used are different, depending on the disciplinary scientific research sector. The important thing is that the calculation is carried out using citations and h-indexes from the same source, in order to avoid errors.

Single Author Paper

In the event that a given manuscript is single-authored, obviously the calculation is simple and must be carried out on the single author, so you can take for example a situation with the one seen in Tables 2 and 3.

Multiple Author Paper

In the event that a given manuscript is conducted by several authors and co-authors, different conditions may arise:

- First Author
  Only the use of the Fi-index tool is taken into consideration for the first author of the manuscript, this obviously will not consider the score of all authors and that all references can influence it. It is a good index, simplistic and quick to carry out.
- First, co-authors, corresponding and Last author
  Only the use of the Fi-index tool is taken into consideration for the first author, the corresponding, the second name and the last name. Obviously, if the corresponding overlaps one of the 3, it is considered only once. Once the score has been calculated with the fi-index tool of the 3 or 4 authors individually, it is necessary to perform a mathematical average of the latter values. The result will be the final score, the value can always fluctuate from 0 to a positive numerical value. This value is the right compromise, it does not take into consideration all the authors but in the worst-case scenario it foresees the calculation between only 4 authors.
- All authors
  In this last case, we consider the use of the fi-index tool for each individual author and co-author present in the manuscript, once the results are obtained, a mathematical average is made between them. The resulting value is the score of the final fi-index tool. This value is the most reliable and complete, but obviously it takes much longer, especially if the authors are many (six or more).

Online Tool

This tool, available online and free of charge, can easily be used to calculate the fi-index and to use the fi-index tool: www.fident.eu/fidentresearch/fiindextool.

Results

It is concluded that the Fi-index tool gives a result of 0,240,340,174 in the example taken in question from Tables 2 and 3. Only the first two decimal digits could be considered. The result therefore shows a positive parameter, which obviously indicates the presence of self-citations in the manuscript. The accepted parameters can be positive, negative or 0. If the parameter is positive, obviously the author is autolisting his works in the reference list with or without influence on the h-index. If the parameter is 0, it means that there are no self-citations in that particular job, a desirable result, almost always [8]. Obviously, only by considering the manuscript of an external author, in which there is no co-author, can a negative value of the Fi-index tool be obtained.

For completeness, the fi-index tool was also used in the case of the data as in Table 2. In this case, also given the variation of the h-index, the value obtained is much higher (3.03), which should already make us suspect inherence of a given citation inserted (Fig. 1) [9].

Fi-Index Tool

This manuscript has been checked for all authors with fi-index Tool [7] with a score of 0.11 for the first author and 0,058 for all authors in date 27/06/2022 according to Scopus® (Table 4).

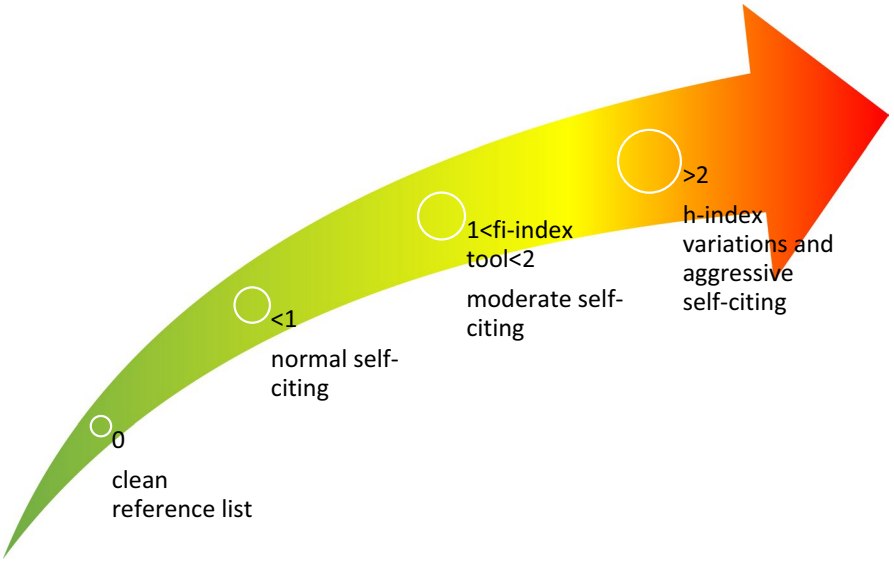

Fig. 1 This figure shows the trend of the fi-index based on the score obtained

Discussion

Bibliometric analysis aims to evaluate scientific production with the use of quantitative, potentially objective indicators. Its main tools are citational analysis and impact factor measurement.

Citation analysis is a method of evaluating a scientific publication, by counting how many times it is cited in the scientific journals. According to this model, the more citations a publication gets, the better its quality [10, 11]. Unfortunately, as already said previously, many authors can be underestimated using some bibliometric parameters, while other authors end up the opposite. Some authors who, for example, present one or two highly cited articles (Table 5), should be evaluated with different indices than the h-index, to avoid obtaining a low value (h-index of 5, as in Table 4). For this reason, different bibliometric indices have been introduced over the years [12].

Many scientific search engines now allow to remove the self-citations automatically using a filter, in this way could be obtained both a total of "clean" citations, and an updated h-index without the self-citations.

Obviously the fi-index comes to our aid precisely in these situations, and allows us to understand how much these self-citations have been piloted. It is obvious that the exchange citation with other external authors (past co-authors or not) is not taken into consideration, and that the peer review self-citing phenomenon is not taken into consideration [13]. Unfortunately, these phenomena are still out of control and cannot be measured given the "blinded" nature of peer review processes [14]. For this, one can only rely on the competence of the Editors and the prestige of the scientific journals [15].

We need to make some clarifications about the fi-index tool. In recent years, science and research have increasingly tended to specialize. It is indisputable that if a researcher specializes in a certain topic or science field, or is even an innovator in the latter, the discoverer, or is part of the only Institution/laboratory/University that deals with a certain topic, then the presence of self-citations it is justifiable [16]. This author in the treatment of his topic will necessarily have to cite some articles present in the literature, and in the event that he was the only one present, or belonging to the only study group, surely, he cannot be blamed for it [17]. I give an example on this, but I think the concept are quite clear:

In this article, the fi-index citation score is not 0, precisely because there is a self-citation regarding the fi-index.

Table 5 Example of authors with only few highly cited papers

Manuscript n	Citations
#1	359
#2	343
#3	311
#4	10
#5	5

There are obviously limitations to the use of this tool: In the case of a single author, it is very simple to use as we have seen above, but in the case of multiple authors or many authors, it becomes a long and complex calculation, with the need to consult more times the sources of scientific information. If you choose to evaluate the score only for some authors, those in key positions, then the index will lose its reliability anyway as it is no longer a correct parameter, and the error is not known. Furthermore, in the event that an author repeatedly cites another author of his group of studies in an unjustified manner, without citing himself, the value obtained by the fi-index tool would always be 0.

Conclusion

The use of the fi-index score shows how simple it is to be able to limit the self-citing phenomenon through a parameter and above all to know an author or to guess the reliability of the reference list. It is hoped that this parameter can be used for the evaluation of authors and manuscripts in order to standardize them even in the presence of a public competition or ministerial evaluations.

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