



*Opinion*

## Comments on the article “Relative h-index to compare the scientific performance of researchers” by L.A.S. Dias

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**ABSTRACT.** The relative h-index, proposed by L.A.S. Dias, is not useful to compare the scientific performance of researchers. This is shown by examples. More adequate alternatives include the g-index and the R-index.

**Key words:** Hirsch index; h-index; Relative h-index; g-index; R-index

### INTRODUCTION

A landmark paper by Jorge Hirsch (2005) introduced the Hirsch-index (or h-index) as follows. Order the papers of an author in decreasing order of number of received citations. Then, this author has an h-index  $h$  if the rank  $h$  is the highest such that all papers on ranks 1, ...,  $h$  have received at least  $h$  citations. The h-index has attracted considerable attention in the scientific community [not only in the areas of science evaluation and informetrics, see e.g., the paper Dias (2012) under discussion here] and is even “produced” in databases such as Web of Science and Scopus.

There are many advantages and disadvantages of the h-index [see the review by Egghe (2010)], which we do not discuss in this short communication. Only the following two disadvantages of the h-index (relevant to this paper) are discussed.

i) Once a paper is in the h-core (i.e., the set of the h papers with the highest number of citations), it does not matter how many citations this paper actually received. An example makes this clear. Suppose we have an author with 5 papers each with 5 citations. Then,  $h = 5$  for this author. Suppose now we have another author with 5 papers each with, say, 100 citations. Then, also this author has h-index  $h = 5$ . This is a clear disadvantage of the h-index: no matter how many citations these 5 papers receive (above 5), the h-index remains  $h = 5$ .

ii) The h-index is invariant if we add papers with a number of citations less than or equal to h. Again an example. Suppose again that we have an author with 5 papers each having 5 citations. The h-index of this author is  $h = 5$ . Suppose now that we have another author with 100 papers each having 5 citations. Then this author still has h-index equal to  $h = 5$ .

Solutions to problem (i) are well-known: use for example the g-index (Egghe, 2006) or the R-index (Jin et al., 2007) instead of the h-index. We do not explore this further here, since it is not the topic of this short communication.

In the next section we study the proposed solution of Dias (2012) in relation to problem (ii).

### ***Relative h-index***

Dias (2012) proposes the “relative h-index” to tackle problem (ii): divide the h-index ( $h$ ) of an author by his/her total number of papers published by this author ( $N$ ):

$$\text{Relative h-index} = h/N \quad (\text{Index 1})$$

In Dias (2012), the example is given of author A with 10 papers, each cited (at least - these two words do not make sense in this paper and would be better deleted, otherwise we can have a higher h-index) 5 times, so  $h = 5$  for this author. Take then author B with 20 papers each with 5 citations [I assume 5; this was not specified in Dias (2012)]; so, also for author B,  $h = 5$ . But, as indicated in Dias (2012), the relative h-index of author A is  $5/10 = 0.5$  and of author B  $5/20 = 0.25$ .

I do not understand how this could be a good property. Author B gets half the credit (impact) of author A, even though author B has published twice as many papers with the same number of citations each as author A. This does not appear correct. Index 1 appears worse than the h-index itself; author B has twice as many papers as author A (and all papers have 5 citations) but their h-indices are equal and the relative h-index of B is only half of that of A. Maybe the philosophy of Dias is that the more papers one publishes, the more papers he should have with a higher number of citations: this is a necessary requirement for his relative h-index to increase.

Even if we follow this line of reasoning, we can see that the relative h-index is still not a good impact measure. Take the following example. Let author A have 5 papers each with 5 citations. Here  $h = 5$  and the relative h-index is 1. Then, take author B with 10 papers with a number of citations: 100, 100, 100, 100, 100, 5, 5, 5, 5, 5. Again  $h = 5$  (not a good measure of impact), but the relative h-index is even lower than that of author A:  $5/10 = 0.5$ .

I can find no reasonable argument that allows me to conclude that author B has had

less impact than author A. Yet the relative h-index indicates this. This makes it clear that the relative h-index is not able to compare (in an acceptable way) the scientific performance of researchers, as proposed by Dias (2012).

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## Editor's observation

The author of the original article chose not to publish a response to these comments.