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Mini Review

SP-index: The measure of the scientific production of researchers

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ABSTRACT

Ability to assess how solidly one is participating in their research arena is a metric that is of interest to many persons in academia. Such assessment is not easily defined, and differences exist in terms of which metric is the most accurate. In reality, no single production metric exists that is easy to determine and acceptable by the entire scientific community. Here we propose the *SP*-index to quantify the scientific production of researchers, representing the product of the annual citation number by the accumulated impact factors of the journals whereby the papers appeared, divided by the annual number of published papers. This article discusses such a productivity measure and lends support for the development of unified citation metrics for use by all participating in science research or teaching.

1. Introduction

How does anyone in science research or teaching express the strength of their efforts to an administrator, a client, a constituent in the state that he serves, a student, or even to a member of his laboratory? Is it through research and teaching grants received, papers published, and awards won? Sure. However, the real strength on one's contributions may very well be in how others in science receive the published work. A whole host of publication metrics have been developed to document acceptability of one's published efforts. Indexes such as the h-index [1] [strength of published core], e-index [2] and a-index [3] have been defined and are popular metrics to show research productivity. However, use of these indexes has their strengths and weaknesses [1–10]. Moreover, if papers are published in a variety of journals not serviced by major citation databases, such as Web of Science and Scopus, then obtaining citation values to (eventually) calculate the metrics are difficult [4,5]. Also, time and constant repetition are needed in order to accurately assess an individual's citation numbers [4,5], which either leaves the accuracy of such evaluation to be less than correct or haphazard at best.

Information regarding impact factor [11,12], a scientometrics parameter created by Garfield [13], importance of citation analysis [4,5,12] and methods to calculate citation metrics [4,5] have been presented previously. Moreover, new metric measures are continually being introduced due to the simple facts that scientific disagreements exist in which citation metric to use for specific applications, as well as the evolving thought(s) that other "exposure" variables should be considered in determining individual program strength/impact [11,13–15] provides sufficient ammunition for the teaching/research community to explore other measures of individual impact/strength. One alternative is to use the *SP*-index as a standard bibliometric measure of individual scientific contribution.

2. Results

2.1. Definitions of SP-index

The *SP*-index incorporates paper numbers (per year), impact factors of the journals in which the papers appeared, as well as the citation number (at any point in time) for the published papers. Here we define *SP*-index as below.

$$SP = \sum cit \sum IF/N$$

where *cit* is the annual number of citations received by the published papers; *IF* denotes the accumulated impact factors of the journals where the papers have been published and *N* is the number of published papers per year. A practical application of the *SP*-index for a hypothetical researcher is summarized in Table 1.

3. Discussion

Citation metrics are a big deal in academia. Whether proceeding from one academic rank to another, or being evaluated for an award at the National level, these indices may help in solidifying one's packet. Alternatively, poor citation data may result in termination, being turned-down for an award, or being the end-result of

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Table 1
The *SP*-index applied to a three-year period of a hypothetical researcher.

Year	Total number of published papers (N)	Total number of citations received by the published papers (cit)	Total impact factors of the journals where the papers have been published (IF)	*SP*-index $SP = \sum cit \sum IF/N$
2011	9	31	18	62
2010	6	42	12	84
2009	13	64	26	128

a budget cut. Citation numbers are not necessarily correlated to journal in which one publishes, even though impact factor of a journal in which the paper appears is considered by many to be as important as citations received.

A number of citation metrics exist and new ones are being devised and introduced weekly. Strength of journal published in, number of citations received, and total number of papers published appear to be major determinates that are "plugged into" generation of the different citation metrics. The rub exists, however, in that audience/discipline-driven publications might only been seen/appreciated by a few individuals. Consequently, there potentially exists academics that are well-received by their peers, but whom are not considered very productive – depending on the citation metric used for their evaluation. Moreover, citation analysis of all types requires some effort to obtain citation numbers per paper [4,5], such citation searches need to be conducted on a periodic basis [4,5] and maintenance of such needs to be somewhat of a priority. This is compounded by the simple observation that there exists competing citation search engines, servicing different subsets of journals, and who are building loyalty for their product and could care less as to whether their citation results are consistent to those obtained from other search engines/motors.

Compounding all of this is the increasing tone from administrators, at specific institutions, who are still preaching that academics should publish their contributions in (only) high impact journals. Numerous publications exists to suggest, and it seems to be common knowledge, that some of the high impact journals are such due to flaws in their composition, number of review papers contained within them, and selective authors allowed to publish within the journals. High impact journals mean little if papers within them receive few citations. Alternatively, one might publish in a low impact journal, but if the paper is seen by huge numbers of individuals that might use/cite the paper, the paper would receive the attention it deserved – but would inherently be down-played due to the lower impact factor of the journal. Compounding this are the observations that not all journals report citations in an expedient manner, some journals only cite the first author of multi-authored papers, and those participating in teaching efforts (alone) are at much of a disadvantage since few teaching/advising/learning journals exist which possess impact factors.

Herein, we propose an index [the *SP*-index], which may be used to incorporate important citation metrics into one efficient number. Table 1 summarizes the productivity of one researcher over the course of a three year period. Differences existed in the numbers of papers published per year, total citations received (per year) and cumulative impact factor of journals published within. These three citation variables have been combined to form one useable index. Results suggest that during 2010 (for example) that while only publishing six papers the *SP*-index was (at 84) mid way between the productivity index (62) of 2011 and (128) that of 2009. The productivity of this academic was highest during 2009 and lowest during 2011, even though more papers were published in 2011 than 2010. This type of (final) number of productivity does not preclude the indexes of scientometrics that evaluate journals [the impact factor], and those that evaluate the researcher [the *h*-index]. Instead, it is necessary to emphasize that our *SP*-index differs from previous indexes. *SP*-index considers, joint and simultaneously, the impact factor of the Journal in which the paper was published and the number of citations (impact) that the same paper received.

The *SP*-index is easily calculated by any researcher, from the information available in the citation search databases such as the Web of Science, Scopus or Google Scholar. Over time, it is likely that these databases will devise applications to calculate the *SP*-index and make it available to the scientific community. Alternatively, such analysis like the simple one presented here means little if no one else analyzes their published productivity variables in a similar manner or if (like other citation metrics) little agreement is obtained for use of such measures in a universal mode.

Conflict of Interest

No conflicts of interest to declare.

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