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Modified CiteScore metric for reducing the effect of self-citations

Hilary I. Okagbue*[1], Sheila A. Bishop[2], Pelumi E. Oguntunde[3], Patience I. Adamu[4], Abiodun A. Opanuga[5], Elvir M. Akhmetshin[6]
[1,2,3,4,5]Department of Mathematics, Covenant University, Ota, Nigeria
[6]Department of Economics and Management, Kazan Federal University, Russia Federation
*Corresponding author, e-mail: hilary.okagbue@covenantuniversity.edu.ng

Abstract

Elsevier B.V. launched a scholarly metric called CiteScore (CS) on December 8, 2016. Up till then, the journal impact factor (JIF) owned by Clarivate Analytics (Thomson Reuters) was the only trusted metric for journal evaluation. As noted by Teixeira da Silva & Memon (2017), CS offers some observed advantages over JIF. The potentials of CiteScore as a viable metric are still emerging. The paper briefly introduces a variant of the CiteScore that can be used in quantifying the impact of researchers and their institutions. The ultimate aim is to reduce the numerical effect of self-citations (SC) in academic publishing. The reduction is designed to discourage SC but not diminishing it. The reasons for the adopted methodology are discussed extensively. The proposed modified CiteScore metric is simple, transparent and constructed to ensure integrity in academic publication. The result showed that the proposed modified CiteScore is a better option than the traditional CiteScore and hence, can be applied in impact determination, the ranking of authors and their institutions, and evaluation of scientists for a grant award. The approach used in this paper is entirely new in two ways; first, a metric similar to journal ranking is proposed for ranking authors and their institutions and secondly, disproportionate scores are awarded to different sources of citations to reduce perceived dishonesty in academic publications. In conclusion, this research is one of very few to report the effect of SC on CiteScore. Hitherto, the effect of SC has always been on the journal impact factor (IF).

Keywords: *CiteScore, clarivate analytics, impact factor, Scopus, self-citation*

1. Introduction

CiteScore and journal impact factor (JIF) is a viable metric that can provide trusted evaluations. Teixeira Da Silva [1] lamented that the JIF does not truly reflect the prestige, impact, and relevance of researchers and scholarly journals. The author noted that the detailed JIF is subscription-based and some of the analysis is shrouded in secrecy. The weaknesses of the JIF were also echoed in [2] as issues bothering on reliability and accuracy were added to the growing list of discontent with JIF among scholars.

A careful look at the Web of Science showed that most indexed journals with impact factors are from Europe and North America. Even the introduction of the Emerging Sources Citation Index (ESCI) has not struck the balance between the east and west. However, Scopus Elsevier is almost represented in every part of the world. CiteScore has some unique features such as the following:

- 3-year publication window.
- Consistent numerator versus denominator.
- Document indexation not limited to articles and reviews.
- Data sources not limited to journals only.
- Larger coverage than JIF.
- The analysis is free (see SciVal).
- Updated monthly.
- Not influenced by editorial policies.

See the following for detailed explanations: [3-9].

Atayero et al. [10], presented data that compared the situation of open access and subscription-based journals. The perceived impact of journals has been classified into quartiles for impact and reliability analysis [11]. The authors affirmed that CS is a viable alternative to

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the JIF. Recently, Okagbue et al. [12-14] investigated the editorial board composition and CS of Hindawi and Dove journals indexed in Scopus and PubMed. Besides, the CS metric seems to be very efficient in the impact analysis of journals within the same subject field [15]. The issue of whether CS is more transparent or better than all the existing metrics will continue to be a source of scholarly debate [8, 16].

This paper proposes a modified version of CS that is designed to measure the impact of researchers (authors) and their institutions (mainly universities). This will serve as a viable alternative to citation counts, h-index, 10 h-index, Euclidean index, and others. The motivation behind this paper is to find a robust and flexible CS metric that discourages multiple self-citations and to reduce the effects of inflated citations from conference papers, books, and book chapters. This approach is entirely new in two ways; first, a metric similar to journal ranking is proposed for ranking authors and their institutions and secondly, disproportionate scores are awarded to different sources of citations based on impact. This is a departure from the current situation where the CS can be manipulated by target self-citations.

2. Research Method

2.1. CiteScore

CiteScore is a measure of the mean or average citations received per document published in a serial. It is one of the three main indices used by *Scopus* to rank publication sources of indexed scholarly outputs or outlets. In this source ranking method, higher values indicate high impact, relevance and prestige. The methodology for calculating the CiteScore metrics is presented in (1) and Figure 1 respectively. CiteScore for year *N* (CiteScore *N*) sums the citations received in year *N* to documents published in years *N-1, N-2, and N-3*, and divides this by the number of documents published in the three consecutive years *N-1, N-2, and N-3.*

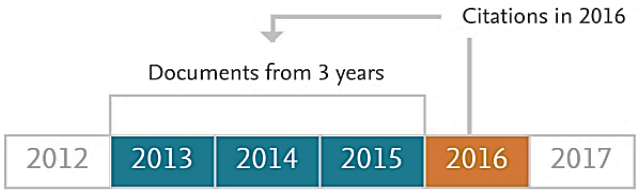

Figure 1. CiteScore computation as published by Elsevier, B.V. and implemented in the Scopus database

$$CiteScore\ N = \frac{Citation\ Count\ in\ N}{Documents\ (N-3)-(N-1)};\ CiteScore\ 2016 = \frac{Citation\ Count\ in\ 2016}{Documents\ 2013-2015} \quad (1)$$

According to *Scopus*, the 3-year CiteScore time window was chosen as the best fit for all subject areas. Research shows that a 3-year publication window is long enough to capture the citation peak of the majority of disciplines. According to Scopus, 2-year is too short and 5-year is too long.

2.2. Proposed Modified CiteScore

The same equation of CiteScore is used. Hitherto, all citations for the documents are awarded one (1) point. The authors proposed six (6) different scenarios of which the values of citations are to be allocated and that is provided in Table 1. The application is given in the next section.

Table 1. The Proposed Points for the Sources of Citations

Acronym	Scenario	Proposed point
A	Self-citation from journal	0.25
B	Self-citation from books or book chapters	0.15
C	Self-citation from conference papers	0.20
D	Citation from journal	1.00
E	Citation from books or book chapters	0.30
F	Citation from conference papers	0.50

2.3. A Case for the Proposed Modified CiteScore

The number of citations an academic work receives is often used as a measure of its relevance, prestige, reputation, impact and largely, its quality. Researchers and academicians are viewed as being successful when they are visible in the academic society. Visibility implies the number of peer-reviewed impactful publications and citations [17].

Web of Science (journal impact factor) and Scopus (CiteScore) are the leading metrics for quantifying the effect of citation as it relates to the impact, relevance, and prestige of a journal. A citation can be self-citation (SC) or citation from others. Self-citation is when the author(s) cite(s) their peer-reviewed articles in their manuscript submitted for evaluation and consequently publication. Interestingly, there seems to be a misunderstanding on the issue of self-citation [18], which had generated many arguments on the effect of self-citation on journal impact and authors' prestige. The voice of the opponents of SC appears to be louder than the proponents.

2.3.1. Opponent of Self-citation

Many cases of abuse or a perceived aberration of the citation practices have been reported in a calculated attempt to increase the relevance and impact of someone's paper through coercive citation which, can manifest as author self-citation (ASC), inter-citation, induced citation, and citation cartels. The pressure of career progression and academic promotions can also be viewed as a contributing factor. Coercive self-citations can be regarded as a form of academic dishonesty that genuinely undermines the process of effective journal evaluation such as the use of impact factors and CiteScore [19]. This is viewed as unethical, especially when the SC is excessive [20] and the perceived impact and prestige of the journal may not be the true picture of the journal, which can be termed 'deceptive' [21].

Publishing outlets are not spared of the aberrations as some journals insist on the authors citing any related articles of the journal to increase the perceived impact of the journals. The practice is known as journal self-citation (JSC) [22-27]. The abuse of SC, according to Contreras et al. [28], is one of the difficulties often encountered by authors in submitting papers for possible publication

According to the researchers, the consequence is the erosion of the impact and reputation of the journals. JSC and ASC have been found to be correlated with journal impact factor (JIT) for ($R = 0.300$, sig. $= 0.032$; $R = 0.397$, sig. $= 0.004$, respectively), although the author, Ghane [29], considered only journals indexed in the Persian Citation Index. In the same vein, SC was also found by Torabian et al. [30] to be significantly related to JIT for open access medical journals and the same was observed for ecology journals [31]. A positive correlation between SC and JIT was also reported in the study of Urology and Nephrology Journals [32]. Readers are also referred to Hartley [33].

2.3.2. Proponent of Self-citation

Some motivations for the use of SC have been reported [34]. The promotion of the author's thorough and inspiring work is the leading reason while SC is promoted, especially the last authors of journal articles [35] and authors from different cultural backgrounds [36]. Also, reputation building has been cited as one of the reasons for SC as claimed by [37].

Hellsten et al. [38] asserted that SC helps in the emergence and birth of new research areas as authors that introduce new topics seem to use SC more often. They also stated that SC can be used to track an evolving research trend over time. Contrary to the popular perception that SC has a high impact on the Hirsch index, Huang and Lin [39], showed that that was not the case in the field of environmental engineering, thereby disputing the incredibility attached to SC. Credibility and strengthening the author's knowledge claims were the key submissions from Hyland [40] on the continual use of SC. Gálvez [41] wrote that SC can be used to drive knowledge diffusion in academic publishing. The knowledge diffusion can come in the form of the provision of background information which will help researchers understand the target area of the research [42]. SC can be seen as a way of promoting innovative work and patents [43]. Surprisingly, it has been reported that SC does not affect the total number of citations for marine and freshwater biology journal articles [44]. This can be viewed as an isolated case and the reasons for such a conclusion may be the nature of that research field or some unexplained variables.

2.3.3. A Way Forward

The arguments for and against are often restricted to the region, country, journal, experience of the authors [45] or subject area and general statement cannot be made based on the particular nature of peer-reviewed information about SC. Listening to both sides of the argument, it is imperative to propose this methodology as a calculated attempt to moderate the impact of self-citation. This is done by allocating smaller values to self-citation in the calculation of CiteScore. This is done to maintain the use as claimed by the proponents and to reduce its adverse effects as claimed by the opponents of SC. The reasons for using the CiteScore instead of the JIF have been discussed in the introduction section. Also, the effect of SC on CiteScore has not been reported to be the best of the knowledge of the authors. It has always been SC and JIT. Finally, [46, 47] suggested some legal ways to increase citation to discourage self-citation; examples are open access publishing, utilization of social networks, academic linkages, open access repositories, and data sharing.

3. Results and Analysis

The modified CS is computed using (1) and Table 1 simultaneously. The application is done using an example. Example: A researcher from an institution with a total publication of 50 from 2013 to 2015. The publications are as follows: 30 journal articles, 18 conference papers and 2 book chapters of which all are indexed in Scopus. The 261 citations of the 50 publications in 2016 are presented in Table 2 using the acronyms of Table 1 to represent the sources of the citations. The modified CS is thereby computed using (1), Tables 1 and 2, and presented in Table 3.

Table 2. The Distribution of Citation Across the Journal, Book or Book Chapters and Conference Papers

Source	Number	A	B	C	D	E	F	Total
Journal	30	100	0	0	20	1	14	135
Book or book chapters	2	0	8	0	2	1	4	15
Conference papers	18	0	0	84	8	1	28	121
Total (sum)	50	100	8	84	30	3	46	271

Table 3. Computation of the Citation using the Proposed Methodology

Source of Citation	Computation	Sum per Citation source
A	100 x 0.25	25.0
B	8 x 0.15	1.2
C	84 x 0.20	16.8
D	30 x 1.00	30.0
E	3 x 0.30	0.9
F	46 x 0.50	23.0
Total		96.9

The modified CS for the researcher is computed using Table 3 and is given as:

$$\text{Modified CiteScore } (2016) = \frac{96.9}{50} = 1.938$$

this CS computed using (1) is given as:

$$\text{CiteScore } (2016) = \frac{271}{50} = 5.42$$

the modified CS was able to reduce the effects of self-citations, which were not captured by the CS.

4. Conclusion

The research findings can summarize as follows: 1) a modified CiteScore (MCS) metric has been proposed; 2) the MCS can be used to rank researchers and their institutions and evaluation of researchers by grant-awarding bodies; 3) the MCS provides an alternative to impact factor, h-index, and 10 h-index. Euclidean index and so on; 4) the MCS is transparent, easy to compute and interpret and award points to citations based on their sources; 5) the MCS can withstand the undue effects of self-citations from journals, conference papers and books or book chapters. Furthermore, it is difficult to manipulate; 6) the MCS can be implemented by Scopus and updated monthly just like the normal CS.

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There is absence of conflict of interest among the authors. The paper was sponsored by Covenant University, Ota, Nigeria.

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