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Research Metrics: Logic of Auditability

Keshava
Department of Library & Information Science
Tumkur University, Tumkur, India
keshtut@gmail.com

ABSTRACT

We in this paper advocated the concept Research Metrics with some descriptions relating to the units which are used to measure. We briefly described the developments in the metrics field and listed the research units. While discussing the metrics, it is important to address various ethical measures such as plagiarism, retractions, self-citations, predatory journals which have impact in metrics applications. Thus, research evaluation needs a perfect auditing system which we advocated in this paper. Any research in evaluation should consider these issues and they are expected to impact in the future assessment practices.

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1. Introduction

Research metrics are relatively recent origin, but historically the main sources for the research metrics, have been established more than 100 years ago. Bibliometrics was the first metric introduced, relying on analysing publications, books, and journals using statistical techniques. In the bibliometrics, citation analysis of one of the indicators introduced by Gross and Gross in 1927[1].In 1955, Eugene Garfield[2] suggested systematically counting and analysing the citations in the field of chemistry literature. Therefore, research metrics are quantitative tools to assess scholarly research's impact, quality, and productivity. These metrics help evaluate the research outputs, such as journal articles, books, conference papers, and other scholarly works. Hence, knowing the research metrics is essential for researchers, institutions, and funding bodies to make informed decisions regarding academic progress, funding allocation, and research impact.

2. History of Research Metrics

The history of research metrics goes way back to the 17th and 18th centuries. Henry Oldenburg, secretary of the Royal Society, started publishing a scientific journal titled "Philosophical Transactions in 1665, which laid the foundation stone

of scientific communication. During the 20th century, Alfred Lotka (1926) introduced 'Lotka's Law', which explains the frequency of publications by an author in a given discipline. It is said that Lotka Law is one of the significant contributions to quantifying scientific productivity. The establishment of the Institute for Scientific Information in 1955 by Eugene Garfield is one of the greatest contributions. He introduced the concept of 'The Science Citation Index' in 1964 to track citations between scientific articles.Later, during the 1970s, the field research metrics expanded with the development of more sophisticated bibliometric indicators. Eugene Garfield introduced the 'Impact Factor', a measure of the average number of citations to articles published in a specific journal, and it became a metric to evaluate journal quality. After that, during the 1980s and 1990s, the introduction of PubMed and Web of Science databases made collecting and analysing the citation data easier. Meanwhile, Jorge Hirsch (2005), introduced h-Index to measure the productivity and impact of research publications. In the modern era, online and offline databases and open access journals increased the accessibility of research literature. A new concept, 'Altmetrics', emerged to capture the impact of research publications. The focus on evaluation of research literature grew with more emphasis on transparency, reproducibility and responsible use of metrics. Further, scientists felt that there is a need for fair assessment practices beyond simple citation counts.

3.Types of Metrics

i) Citation Metrics: Citation metrics are calculated by the number of times a research publication is cited by other research works. For example, the h-Index measures both the research productivity and its citation impact. The I10 index indicates a number of research publications with at least ten citations.

ii) Journal metrics: Impact Factor (IF) is calculated annually by Clarivate's Journal Citation Reports, indicating the average number of citations received to the articles published in the previous two years. SCImago Journal Rank(SJR) is another journal metric that reflects the scientific influence of scholarly journals. Eigenfactor Score measures the journal's total importance to the scientific community, considering the origin of the incoming citations.

iii) Altmetrics: It tracks the frequency and context in which research publications are mentioned across social media platforms, blogs, news articles and online forums. It also indicates how many times it is downloaded or read.

iv) Author Metrics: h-Index, i10 index, and i20 index gauge the individual scientist's scientific productivity and its impact. Total Citation Count: Reveals the total number of citations received. Summarizes the total number of citations an author's works have received.

4. Research metrics: Beyond?

· **Misconduct:** Misconduct is constructed in epistemic terms of fabrication, falsification, and plagiarism. Therefore, misconduct is producing false statements within a publication. For example, submitting fake peer reviews, hacking journal databases, and establishing citation rings among authors/editors is one kind of manipulation.

· **Plagiarism:** Plagiarism is claiming other's work as our own without acknowledgement. It is an academic crime. It may be paraphrasingothers' work with a proper citation or borrowing someone's idea, images, data, formulae, text, quotations, etc., and claiming one's own.

· **Post-production:** Post-production has not only become a more collaborative effort, but it has also moved beyond the sites of traditional fraud like corporate laboratories and research institutions. The post-production publications have spread through fake journals (Jeffrey Beall and others) in the form of conference papers, peer-reviewed articles, review articles, and so on. (Brooks, 2009). These predatory journals include Universal Impact Factor, Global Impact Factor, and CiteFactor (Jalalian, 2015). The fake impact factor companies contribute to the appearance of legitimacy within the ecosystem of post-production manipulation.

· **Publication and evaluation:** In the olden days, publication means making things public by

talking to the public, delivering lectures, interacting with people, writing letters, and, more specifically, printing publications. However,in the recent past, the meaning of the term 'publication' changed to printed articles in academic journals(Cziszar, 2018). The evaluation is done by those who read the articles or listened to the lectures. Today, however, evaluations do not need to be done through reading. Evaluation is done based onthe journal's Impact Factor or the number of citations received by the publication. Therefore, at present, the meaning of publication and evaluation is substantially changed. For example, when the publication relies on the Journal Impact Factor, evaluation no longer follows the publication but takes place together with the act of publication. At present, people do not read publications, only count. The traditional locus of evaluation has become technically irrelevant to metrics regimes based on the Impact Factors, like cataloguing; they do not involve the reading of a publication's content but rather the processing of a publication's metadata (Biagioli, M and Lippman, A, 2020).

· **Predatory Journals:** In the modern era, journals have been playing the role of gatekeepers, credited with the ability to sort good science from bad through peer review. However, fake journals, also called Predatory journals, actively contribute to the post-production manipulation trend. Predatory journals have fictional editorial boards and follow the Pay-to-Play business model. The publications of these journals are not meant to be read and evaluated but rather for an entry in the curriculum vitae of an author or to include them in the annual report. These publications and journals may be virtually impact-free, but they are not outside the metric-based economy of impact.

· **Self-citations:** When the authors cite their own work in a present work, it is called self-citations. The self-citations are often built upon previous work by connecting related studies. It oftenprovides context between present and previous work so that the authors can manifest their competence and noteworthy contributions. However, unbridled self-citations can artificially increase citation metrics, such as the h-index, undoubtedly misrepresenting an author's impact in their field, which leads to an attempt to manipulate citation counts for personal benefit. Hence, gratuitous self-citations reduce the trustworthiness and integrity of the research and certainly erode the trust of the readers and peers. Therefore, only cite previous work that is directly relevant to the new research. Make sure that each self-citation adds value and context to the current study.

5. Retractions

When the published paper or publication is officially withdrawn, it is called retraction from the record because major errors or ethical breaches are found that frail the study's methods, findings and so on. The major reasons for the retraction would be false data, sampling bias, incorrect methodology adopted, plagiarism, falsification and fabrication of results, unethical treatment of subjects, salami slicing and sandwiching results etc. Retracted publications can harm the reputation of the author, and retraction can serve as a learning experience for the authors.

6. Conclusion

Before and beyond metrics begin with the origins of publication metrics, and the emergence of their derivation is pursued to both question the present and predict future postmetrics schema. Metrics are not set once and for all but are preferably introduced and modified through a never-ending process set in motion by the gamble itself. Any metrics will create the avenue for manipulations. Metrics appear to set specific targets, but those targets are inevitable to moving ones.

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