

Developing Comprehensive Indicators for Measuring Research Impact

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Abstract

The global debate on the use and misuse of journal impact factor has been raging for several decades with the majority of authors, publishers and other stakeholders clearly admitting that equating journal impact factor to research impact could be misleading. Whereas the former strictly belongs to a journal in which an article is published, the latter belongs strictly to an individual research article or book irrespective of where it is published. On both sides, book citations are poorly factored in. Attempts by universities to equate journal impact factor to research impact for the purpose of employee promotion has only compounded this confusion, making urgent the need to identify and compile a comprehensive list of the indicators that go beyond journal-level impact down to media, classroom, cultural, economic and policy impacts of research. And this is for the benefit of all researchers including those in the poorly served book-based disciplines. This paper presents a list of twenty indicators of impact covering research published in both journals and books.

Keywords: *Impact factor, Research impact, Eugene Garfield, publishing, predatory journal*

Introduction

It is common knowledge that successful publications attract attention to researchers and their affiliate institutions, just as such publications facilitate continued funding and an individual's progress in his or her field. And for researchers and institutions, finding a reliable and acceptable way of assessing the quality of journals in which such researches should be published has always been a tough job fraught with controversies. So, when Journal Impact Factor (JIF) was introduced about sixty years ago by Eugene Garfield, it appeared to address this need, but only to the extent that it provided libraries with a fairly good tool for journal selection (Baykoucheva, 2022). Since then, JIF has been extended to several other areas of decision making leading to allegations of misuse and heated debates. In response to the controversial use of JIF, Garfield warned about the "misuse in evaluating individuals" because he had observed that there is "a wide variation from article to article within a single journal".

In this issue, we take an expository look at the concept, the originally intended use of JIF, the current uses and how some of the current uses have produced only counter-productive results in institutions of learning, sometimes undermining the purpose for which journal impact factor was introduced. The worst confusion in the debate, however, has been the use of research impact and journal impact interchangeably. So, this editorial sets out with a clarification of these concepts.

Research impact or Journal Impact: Journal impact, as the name suggests, refers to how broadly a particular journal is read, discussed or cited, whereas research impact is loosely defined as how broadly scholarly research is read, discussed and used for policy, practice and learning. Ravenscroft et al (2017) defined comprehensive impact as the broad impact of scientific research upon human society (including cultural and economic impact) and the natural environment and acknowledged that comprehensive impact remains very difficult to detect, understand and measure. Though it could be argued that there are areas of overlap between research impact and journal impact, not all research impact measures listed are valid for the evaluation of journal quality or impact on the one hand. On the other hand, it should be inappropriate to equate journal impact to research impact for individual articles published in them in contradiction of the initial objective of introducing JIF—rating of journals. This paper, however, argues that any sincere and objective effort to proffer a solution should begin with an identification of impact indicators for research encompassing journal articles, books and other contents such as video, newspaper and magazine articles.

What is the Purpose for which Journal Impact Factor Was Invented?

A professional librarian, Eugene Garfield, created Journal Impact Factor about 1955 for the purpose of selecting journals for the *Science Citation Index*, SCI. On the platform of his Institute for Scientific Information (ISI) Garfield, in 1964, printed the first *Science Citation Index (SCI)*, listing citations of papers in over 2200 journals. This breakthrough enabled him eight years later to issue his first JIF as a "tool in journal evaluation." He stated clearly that his journal impact factors were designed to help scientists decide which journals to read, aid librarians in curating academic journals as well as highlight cutting-edge research for policymakers and funding bodies. At the time, it was not foreseen that some universities

would deviate from this focus and use it for the assessment of research impact and for employee promotion (Baldwin, 2017).

What are the Current Uses of Journal Impact Factor and the Shortcomings?

Beyond journal rating for the purpose of helping scientists to decide which journals to read, aiding librarians in curating academic journals and highlighting cutting-edge research for policymakers and funding bodies, many universities now extend it to scholar rating, promotion and tenure (Larivière and Sugimoto, 2019). Notwithstanding that it is computed only from citation, which is just one of the twelve criteria for assessing research impact, they use this invalid and non-representative instrument to determine whether employees would make progress or not.

Not too long ago, Philip Campbell, the editor-in-chief of *Nature*, contributed to this debate, arguing that impact factors are overused (Baldwin, 2017). If they are overused, then, they are not far from being misused. Similarly, a study published in *Emerald Journal* argued that measurement of research impact is multidimensional, that no single type of measure is a panacea, and that the use of only one measure would result in failure to assess the full range of professional role performance (Braxton; Bayer, 1986). The shortcomings are discussed as follows:

Shortcoming 1: They often disregard other evolving, more encompassing metrics such as Altmetrics that capture a researcher's work in major news sources, blogs, policy documents, Wikipedia, and social media. Details of the features of altmetrics are available at <http://www.altmetricexplorer.com/>. Purely academic metrics such as JIF aim to represent the dissemination of knowledge among scientists thereby missing out on the impact of a research publication on the wider world. But developing and using some of the other metrics listed in Table 2 would enable institutions to also evaluate wider non-academic impact of each research paper down to social media posts, press releases, news articles and political debates arising from academic work (Ravenscroft; Liakata; Clare; Duma, 2017).

Shortcoming 2: It is not fair to compare publications from different years or scientific disciplines since there is a great deal of difference in speed and frequency of citation accumulation across different fields of science without Mean Normalised Citation Score. Mean Normalised Citation Score (MNCS) is a metric designed to address this shortcoming by normalising for year of publication and scientific sub-field. But many institutions hardly consider this when using journal impact factor to assess research articles for promotion and funding for different disciplines thereby placing Social Science, Law and Humanities disciplines in a great disadvantage.

Shortcoming 3: These disciplines are globally recognised as book-based disciplines but users of JIF for promotion fail to recognise this difference, thereby serving these disciplines poorly. To investigate this, Calida Barboza, Jim Bondra, Lisabeth Chabot and Ron Gilmourwe compared the citation counts to 1,000 books submitted to the 2008 U.K. Research Assessment Exercise (RAE) from Google Books and Google Scholar with Scopus citations

across seven book-based disciplines such as archaeology; law; politics and international studies; philosophy; sociology; history; and communication, cultural, and media studies. Their findings showed clearly that these disciplines are losers when JIF is used for research impact assessment (Barboza, Bondra, Chabot and Gilmour, 2011).

Shortcoming 4: The Leiden Manifesto argues for the protection of excellence in locally relevant research such as books written within an institution for undergraduate and graduate teaching and research. The way JIF is currently used by some probably misguided institutions does not support this. There is a typical case of a textbook which has been cited in over 200 undergraduate research projects not available on the Internet. So the author may never be promoted. Even if these citations were available on the internet without being on the database of Scopus or Web of Science, they would not be captured in citation counts, implying that the research has no impact. This has to change.

Shortcoming 5: The journal impact factor usually equated to research impact in favour of an author publishing in that journal for the first time is based on citations of other articles published in that journal in the three years preceding the publication of his own article. His article has absolutely no contribution to the impact factor, yet he enjoys the elite status conferred by the JIF simply by association.

Shortcoming 6: Some academics under the pressure of “publish in impact factor journal or perish” have resorted to cheating. They take the shortest available route to publishing, resorting to plagiarism, salami slicing, add-my-name syndrome and many more. And since co-authorship of articles is not considered in any of the metrics you may have ten authors for an article actually written by one.

What are the Counter Arguments?

There is need for quality research, and it is argued that without some pressure researchers would apply less rigour. This is true. However, the pressure is misdirected when it points to publishing in certain class of journals whose quality is derived from citation-based metrics only. But it would not be perceived as misdirected pressure if emphasis is placed on indexing in directories such Scopus rather than metrics arising from citations within such indices. To achieve this, criteria covering the list of research impact measures provided in this article would be useful.

It has been argued that the 10 principles of the Leiden Manifesto written to address citation-based metrics, are now also applied to the use of altmetrics to measure academic impact, the justification being that both citation-based metrics and altmetrics measure the ‘attention’ that publications receive. That is, the number of citations, social media ‘likes’, ‘re-tweets’ etc., a development which implies that they share some of the strengths and weaknesses associated with JIF (Bornmann 2016). True as this may sound, it is obvious that enlarging the range captures all possible impacts thereby providing a measure of impact that is more inclusive and encompassing than journal impact factor ([Altmetric.com, 2022](https://www.altmetric.com/)).

Position of Leading Publishers and Regulators

Germaine at this point is the question: what is the position of leading publishers and organisations on the use of JIF and measurement of real research impact? Some leading

publishers and organisations have made interesting contributions to this debate and their views and positions are summarised in Table 1:

Table 1: Position of Leading Publishers and Organisations

SN	Publisher	Position
1	Nature Journals	The editor-in-chief of <i>Nature</i> , Philip Campbell, stated that impact factors are overused
2	Elsevier	This publisher has consistently explained that their Scopus metrics are designed to help institutions in journal selection. In a press release, Elsevier stated that the CiteScore index would improve decisions on “where to publish, which journals to subscribe to, and when to adjust a journal’s editorial strategy”, not to improve decision on staff promotion, funding or tenure (Baldwin, 2017).
3	Taylor and Francis	Journal metrics can be a useful tool for readers, as well as for authors who are deciding where to submit their next manuscript for publication... We strongly recommend that you always use a number of metrics, alongside other qualitative factors... In addition, a single article should always be assessed on its own merits and never based on the metrics of the journal it was published in. (Taylor and Francis, 2022) https://www.tandfonline.com/action/journal
4	The San Francisco Declaration on Research Assessment DORA	The San Francisco Declaration on Research Assessment published in 2013 calls on institutions to place less emphasis on publication metrics and become more inclusive of non-article outputs such as books, book chapters, newspaper articles etc. DORA insists that use of journal impact factor for promotion is flawed and should be discouraged. For the full manifesto, see: http://www.nature.com/news/bibliometrics-the-leiden-manifesto
5	Becker Medical Library, University of Washington	Assessment of research impact using traditional citation analysis alone is not a sufficient tool for assessing the impact of research findings and it is not predictive of subsequent clinical applications resulting in meaningful health outcomes (Sarli, Dubinsky and Holmes, 2010).
6	Sage Publishing	SAGE has long recognized the need to consider multiple measures of journal quality to ensure the creation of a balanced picture regarding impact. Ziyad Marar, President of Global Publishing at SAGE, stated: ‘We’ve been aware for a long time that social science is ill-served by the dominant metrics of measuring journal and article quality; and of the tendency to fetishize the JIF in particular... the increased focus on impact in recent years has exacerbated this problem. For this reason Sage

		announced the five-year Impact Factor instead (Web of Science Group, 2019).
7	The European Association of Science Editors (EASE)	Arguing that impact factor is not a reliable indicator of research quality and impact the European Association of Science Editors (EASE) in November 2007 issued an official statement recommending "that journal impact factors are used only—and cautiously—for measuring and comparing the influence of entire journals, but not for the assessment of single papers, and certainly not for the assessment of researchers or research programmes".
8	The House of Commons Science and Technology Select Committee	In reaction to this debate, The Higher Education Funding Council for England was advised by the House of Commons Science and Technology Select Committee to remind Research Assessment Exercise panels that they were obliged to assess the quality of the content of individual articles, not the reputation of the journal in which they are published.
9	German Research Foundation	In February 2010, the German Research Foundation (<u>Deutsche Forschungsgemeinschaft</u>) published new guidelines to evaluate only articles and insisted that no <u>bibliometric</u> information on researchers should be evaluated in decisions concerning funding allocations, postdoctoral qualifications, appointments, or reviewing funding proposals
10	Palgrave/Springer	Palgrave, in collaboration with Springer under Nature Portfolio, has signed up to DORA, which is concerned with reducing the focus on impact factors to concentrate on improving the methods used by funding agencies, institutions and other organisations to assess the value of research output.

Consequences of Impact Factor-Induced Pressure on Publishers

Both publishers and authors are now under intense pressure to build up impressive metrics for business and career. A preliminary interrogation of the impact of the pressure that over-emphasis on impact factor has brought to bear on publishers revealed some disturbing developments. Among them are:

1. Journals attempting to publish a larger percentage of review articles because review articles receive more citations than other types of paper.
2. Some journal editors now reset their submissions policies to receive manuscripts "by invitation only" to invite only senior researchers whose names would attract what they describe as citable papers to increase the journal impact factor.
3. Some editors now decline to publish articles such as case reports that are unlikely to be cited
4. Some journals strive to publish a large portion of their papers early in the calendar year (sometimes as preprints or early cites) so that some citations would have come in by the time impact factors would be calculated.

5. Some editors encourage or manipulate authors to cite articles in the same journal to increase the journal's impact factor.
6. There is published evidence that a certain journal published an editorial that cited all its articles from 2005 to 2006 ostensibly in a questionable protest against the scientific situation in some countries. And as expected, the large number of citations increased the journal's impact factor as planned, to the effect that the journal was not included in the 2008 and 2009 *Journal Citation Reports*.
7. Coercive citation, in which an editor forces an author to add extraneous citations to an article before the journal would accept it, is on the increase but very subtly implemented.

Impact of Impact Factor-Induced Pressure on Researchers

1. Questionable research practices (QRPs) such as 'rushing to print'
2. salami-slicing' research into multiple publications
3. Including names that didn't qualify to be authors just because they participated in acquisition of funding, general supervision of a research group or general administrative support, writing assistance, technical editing, language editing or proofreading
4. Risking and covering up conflicts of interest
5. Gift or honorary authorship to friends, deans and heads of department
6. Pseudo-authorship whereby some contract out the research to someone who would not be credited
7. Surprise authorship whereby someone sees his name in an article he did not participate in researching or writing
8. Ghost authorship—a situation where the name of the original (or deserving) author does not appear in the published version of the manuscript.
9. Granting authorship to a colleague just for departmental peace and amity
10. Taking first author credit for student work etc.
11. Failure to Support Validation of Your Research – by refusing to supply complete datasets or research material needed to facilitate validation of your results through a replication study.
12. Failure to respond to clear cases of unsuccessful validation attempts – published research that is found to be flawed should be retracted from the journal that published it.
13. Falsification of data – rather than manipulate the experiments or the data to generate preferred results, some offenders simply fabricate the entire data.
14. Plagiarism of various kinds. Enago Academy (2022), incorporating content from both the World Association of Medical Editors (WAME) and the *US Office of Research Integrity*, listed the following kinds of plagiarism:

Misappropriation of Ideas – taking the intellectual property of others, perhaps as a result of reviewing someone else's article or manuscript, or grant application and proceeding with the idea as your own.

Plagiarism – utilizing someone else's words, published work, research processes, or results without giving appropriate credit via full citation.

Self-plagiarism – recycling or re-using your own work without appropriate disclosure and/or citation. Any form of plagiarism can be avoided by using plagiarism checker tools available online.

Some claim undeserved authorship on one’s own behalf, excluding contributors, including non-contributors as authors, or submitting multi-author papers to journals without the consensus of all named authors. To move the debate towards a solution there is need for a list of impact indicators for publications of all kinds used in diverse contexts.

List of Proposed Indicators

To contribute to the discourse on how to ease the difficulty experienced by researchers affected by the misuse of JIF, a list of impact indicators is proposed in this paper to drive home the point that any indicator of use could be employed in the measurement of impact depending on the type of publication, design or research output in question. Details are presented in Table 2 showing evidence of use, justification and recommended score for each indicator:

Table 2: List of Indicators for Measuring Comprehensive Research Impact

SN	Evidence of Use	Justification	Suggested Score (on a scale of 5)
1	Number of reads	Reading an article implies learning from it	1.0
2	Number of downloads	Downloading an articles suggests that it has content that may be useful to the reader	0.5
3	Mass Media mentions	This is a clear evidence of use and impact	2.0
4	Social media mentions	This is a clear evidence of use and impact	2.0
5	Mention or Citation in a Policy	This is a clear evidence of use and impact	2.0
6	Use or Adoption for Practice	This is a clear evidence of use and impact	2.0
7	Number of copies sold	This is a clear evidence of use and impact	3-5, Depending on number
8	Number of Adaptations	This is a clear evidence of use and impact	3-5, Depending on number
9	Number of Translations	This is a clear evidence of wide acceptance and impact	3-5, Depending on number
10	Number of Adoptions by schools	This is a clear evidence of wide acceptance	3-5, Depending on number
11	Number of editions	This is a clear evidence of wide acceptance	2-4, Depending on number
12	Cultural impact	This is a clear evidence of use and impact	2.0
13	Economic impact (e.g. Job creation)	This is a clear evidence of use and impact	2.0
14	Number of citations	This is a clear evidence of use and impact	3-5,

			Depending on number
15	Number of re-tweets	This is a clear evidence of use	2.0
16	Number of likes	This is a clear evidence of use	2.0
17	How widely works are held in Libraries	This is a clear evidence of acceptance and probable impact. (https://www.worldcat.org/identities/)	1.5
18	Impact factor	This is a clear evidence of journal use and should be credited to the journal and never credited to the researcher or his research.	100% for journal ranking only
19	H-index	This is a clear indicator of article citation in a restricted context and should be credited to the researcher or his research.	1.5
20	Eigenfactor	This is a clear indicator of journal use and should be credited to the journal and never credited to the researcher or his research.	100% for journal ranking only

Conclusion: It is hoped that this would focus the debate on the development of measures for the comprehensive assessment of research impact without confusing journal impact with research impact. At the end of the day, a solution may lie in recognising all available indicators and deploying them to serve various disciplines in recognition of the peculiarities of their research activities, industry and end users of research outputs.

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