



Review Article

Journal Impact factor

What would recommend to get the Impact Factor for a journal?

Karima Al-Salihi

Editor -in -chief MRVSA

mrvsa59@gmail.com

Abstract

Hundreds of electronic and non electronic journals have been established exponentially in the scientific community since the last two decades. The impact factor (IF) is only one of three standardized measures created by the Institute of Scientific Information (ISI) which can be used to measure the way a journal receives citations to its articles over time. The impact factor and other bibliometric indicators are currently utilized in most countries to evaluate institutions, scientific research, entire journals, and individual articles. Some of periodicals journal has been succeeded in developing their IF and citation reports (CR), while the others journals are still trying to develop those important indicators. This article deals with the most frequently asked questions about the impact factors and its genesis, the methods of calculating it are included. It discusses also the ways to get the IF for the journal and the effects of the impact factor on the journal and article quality and ISI journal selection criteria. Journals dealing with animal health and veterinary sciences with high impact factor are also included.

Keywords: Impact factor, citation reports, self-citation, veterinary sciences.

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Introduction

The journal impact factor (JIF) is now an important quality driver in academic publication and is commonly used to compare the quality of journals, and to assess the quality of publications from individual academics. The JIF and Journal Citation Reports (JCR) are an old issues developed since 1927 (Gross and Gross, 1927). Moreover, interest in this indicator and its derivatives has grown exponentially in the scientific community since 1995 (Eric and Vincent, 2009). JIF and JCR are indicators used to measure the way a journal receives citations to its articles over time. It is created by the Institute of Scientific Information (ISI) as one of three standardized measures. The impact factor for a journal is calculated based on a

three-year period, and can be considered to be the average number of times published papers are cited up to two years after publication. For example, the impact factor 2012 for a journal **X** would be calculated like this:

A = the number of times articles published in 2010 and 2011 were cited in indexed journals during 2012

B = the total number of “citable items” published in 2010 and 2012 (the number of articles, reviews, proceedings or notes published in 2010-2011)

Journal **X** Impact factor 2012 = A/B

And according to this equation, the impact factor 2011 will be actually published in 2012, because it could not be calculated until all of the 2011 publications had been received. Impact factor 2012 will be published in 2013.

Importantly, not all published content is considered citable. Citable items include articles, reviews, proceedings or notes, but not editorials or letters to the editor.

The h-index is another recent measurement (Hirsch, 2005), it was introduced in 2005 by Professor Jorge Hirsch. It is used to measure the productivity of an individual, group or institution. It is calculated by taking into account the balance between the number of publications and the number of citations per publication. For example, an h-index of 3 tells us that an author or group of authors have 3 publications which received 3 citations or more.

Recently most researchers and scientists have been pointed out to the impact factor. Are there really impact factor fevers? What are the reasons for growing this fever? , intensive and continuous debates have been elicited regarding the roles of the journal impact factor (Davies, 2003; Raff, et al, 2008).

In 2008, Min Zhuo (Min Zhuo, 2008), proposes the Z factor, which is a new and useful way to measure the recent academic performance. He mentioned also to the many reasons that lead to misuse the impact factor. First, the impact factor does not provide any evaluation for the quality of science in the research articles. Although the majority of papers published in high impact journals are generally novel and of highest quality, there are a few 'bad apples'. Second, the impact factor represents the mean citation rate of papers published in one journal, and it does not represent the citation of the specific article itself. And third, a paper published in a low impact factor journal may end up well cited, while conversely, a paper published in a high impact factor journal may garner very few citations.

History of the journal impact factor

Journal impact factor had been created and developed for the first time in USA due to the needs of US University and college librarians who wanted to use an objective method to select journals for their holdings. The tool was not initially developed for research evaluation,

and the approach was clearly optimized for the US context. Earlier, the methods was allowed for the identification of high impact journals in specific fields, and this subsequently raised issues of misuse in research evaluation and outright abuse in the promotion of researchers.

Despite the concept of an impact factor was first proposed in 1955 (Garfield, 1955), its ancestry can be originate much further back. Since 1873, *Shepard's Citations* was a research tool conceptually similar to the impact factor which was benefited the US legal profession. It named after its founder; the Frank Shepard Company of Colorado. Shepard's Citations was a list of American court cases and judgments, with the complete history of each being recorded in a simple code. Aside from including many law reviews and law journals, Shepard's Citations also listed some specialty publications such as the Journal of the Patent Office Society (Adair, 1955), which would later stimulate the interests of a young chemistry student named Eugene Garfield. In 1927 Gross and Gross (Gross and Gross 1927) of Pomona College in the United States (US) first suggested counting references as a means to rank the use of scientific journals (Garfield, 1996). Gross and Gross, 1927, were the first to develop this method [Allen, 1929; Mcneely and Crosno, 1930; Gross and Woodford, 1931; Henkle, 1938; Brodman, 1944; Garrfield, 1955; Raisig, 1960] when they sought to address rising problem of small colleges at a time when one "of the biggest of these had the problem of adequate library facility." Gross and Gross, 1927, elicited a question that is still highly relevant today: "What files of scientific periodicals are needed in a college library successfully to prepare the student for advanced work, taking into consideration also those materials necessary for the stimulation and intellectual development of the faculty?"

Then in 1934, S.C. Bradford (Bradford, 1934), head of the Science Museum Library in London, described how scientific articles on a given topic were being unevenly distributed across the journal literature. Back to Garfield, who was the son of a successful newspaper magazine distributor and ran a firm known as the Garfield News Company (Bensman 2007). Garfield's first inspirations came after reading a 1945 article by Vannevar Bush (Bush, 1945) where the idea of making previously collected information more accessible and recording people's information trails, was first proposed (Anonymous 2007). Garfield worked later at the Welch Medical Indexing Project at Johns Hopkins University, (Hopkin, 2005). The Welch project itself was a venture funded by the US Army Medical Library to examine systems for medical information retrieval and new methods of indexing the biomedical literature, which would later evolve into the *Index Medicus*. During working for the Welch project, Garfield became more interested in using machines to help generate indexing terms that would describe a document's contents without the need for human intervention (Garfield Library, 2007). Interest in the concept slowly accumulated and grew, and in 1953, Garfield obtained some major press coverage after organizing the first symposium on machine methods in scientific documentation at Johns Hopkins University (Broad, 1978). Later on, Garfield visited a public library in Baltimore to see Shepard's Citations for himself, confirming that it was indeed, well suited to such a role (Thomson Scientific Website. 2007) and encouraged William Adair a retired Vice President from Shepard's Citations, to write an article about Shepard's Citations, which was subsequently published in 1955 (Adair WC 1955), and in the

same year, Garfield published his landmark article in *Science* (Garfield, 1955), where it was first proposed that counting references could help measure, what he termed was, the "impact" of a particular journal

In 1961, Garfield and his colleague Irving Sher produced an experimental *Genetics Citation Index*, which would later lead to the *Science Citation Index* (SCI®). The term "impact factor" was first used in 1963, when the inaugural (1961) SCI was published by Garfield's newly formed ISI company (Garfield, 1996), although it would take some years before the SCI actually made a profit (Hopkin, 2005). In 1965, Price (Price, 1965) published his classic article on the network properties of scientific papers, and by 1967, Garfield had noted that as the field of science grew, its commitment to the handling of scientific information must also increase (Garfield, 1967). *Journal Citation Reports* (JCR®) were subsequently launched as a byproduct of the SCI, and between 1975 and 1989, appeared as a supplementary volume in the annual SCI (Garfield, 1996). Garfield's invention started with a listing of 200 journals in roughly 32 pages per issue in 1958 (Thomson Scientific Website 2007), growing to 600 journals in 1964 and 2,400 journals by 1972 (Garfield, 1972). By 1972, approximately 1 million scientists were accessing the ISI database worldwide, and by the SCI's 40th anniversary in 1998, over 8,000 titles were being listed across 35 languages (Thomson Scientific Website 2007). In 2005 it was estimated that the SCI database contained 550 million citations (Perkel, 2005), and in 2006, the JCR was including around 15 million citations from approximately one million source items per year (Garfield 2006) Table (1).

Table (1) shows the historical development of the journals impact factor.

Date	Events	Reference	Scientist or researcher
1873	Shepard's Citations is first used by the US legal profession	Adair WC (1955) Citation indexes for scientific literature? <i>Am Document</i> 6 , 31-2.	William Adair
1927	first suggested counting references as a means to rank the use of scientific journals	Gross PLK, Gross EM (1927) College libraries and chemical education. <i>Science</i> 66 , 385-9.	Gross PLK, Gross EM
1934	publishes his article on the distribution of scientific manuscripts	Bradford SC (1934) Sources of information on specific subjects. <i>Engineering</i> 137 , 85-6.	Bradford SC
1945	publishes his article on recording people's information trails	Bush V (1945) As we may think. <i>Atlantic Monthly</i> 176 , 101-8.	Bush V
1951	Eugene Garfield joins the Welch Medical Indexing Project at Johns Hopkins	Hopkin K (2005) Most highly cited. <i>The Scientist</i> 19 , 22-3. Garfield Library Website. Eugene Garfield Ph.D. Career Overview. http://www.garfield.library.upenn.edu/overvu.html . Accessed May 24, 2007.	Eugene Garfield
1955	Garfield publishes his idea for a citation index in <i>Science</i>	Garfield E (1955) Citation indexes for science; a new dimension in documentation through association of ideas. <i>Science</i> 122 , 108-11.	Eugene Garfield
1961	The SCI's precursor, the		Garfield and Irving

	Genetics Citation Index, is founded		Sher
1963	The term <i>Impact factor</i> is first used in the inaugural Science Citation Index (SCI®)	Garfield E (1996) How can impact factors be improved? <i>BMJ</i> 313 , 411–3.	Garfield E
1964	The ISI now covers at least 600 journals in its databases	Thomson Scientific Website. Thomson Scientific: Company timeline. http://scientific.thomson.com/isi/timeline . Accessed May 24, 2007. Garfield E (1972) Citation analysis as a tool in journal evaluation. <i>Science</i> 178 , 471–9.	
1965	Price publishes his article about the network properties of scientific papers	Price DJ (1965) Networks of scientific papers. <i>Science</i> 149 , 510–5.	Price DJ
1972	It is estimated that one million scientists are accessing the ISI database		
1997	The first journal is accused of manipulating its impact factor80)	Smith R (1997) Journal accused of manipulating impact factor. <i>BMJ</i> 314 , 463.	
1998	40th anniversary of the ISI, which is now covering over 8,000 titles35)	Thomson Scientific Website. Thomson Scientific: Company timeline. http://scientific.thomson.com/isi/timeline . Accessed May 24, 2007.	
1999	The concept of “topic-based” impact factors for occupational health is proposed17)	Takahashi K, Aw TC, Koh D (1999) An alternative to journal-based impact factors. <i>Occup Med (Lond)</i> 49 , 57–9.	Takahashi K, Aw TC, Koh D
2005	Approximately 550 million citations are contained in the SCI database37)	Perkel JM (2005) The future of citation analysis. <i>The Scientist</i> 19 , 24–5.	Perkel JM
2005	The Agony and the Ecstasy—The History and Meaning of the Journal Impact Factor	International Congress on Peer Review And Biomedical Publication Chicago, September 16, 2005	Eugene Garfield Chairman Emeritus, Thomson ISI

Applications of the journal impact factor

The original concept of the impact factor was used as a marketing tool for publishers, who could charge higher advertising rates and cover costs for highly cited journals. It was also intended to guide librarians on how to select journals that should be included within their catalogue, however, the applications of the impact factor rapidly expanded until it became widely regarded as a shorthand measure of a journal's quality (Harter and Nisonger, 1997). Inevitably, and recently these indicators of quality were used to criticize the quality of individual researchers output and to be widely used in academic appointments and as an evaluation tool for promotion and tenure review committees (Currie and Wheat, 2007).

The effect of the impact factor on the scientist's publication and journals operations

There can be no doubt that any applications have strengths and weaknesses. Journal impact factor has become extremely important and moved in recent years from an obscure bibliometric indicator to become the chief quantitative measure of the quality of a journal, its research papers, the researchers who wrote those papers, and even the institution they work in. This importance has, in many ways, changed the way that scientists publish and the way journals operate. The impact factor becomes a major impact on scientists. Employers and review committees faced with competing Curriculum vitae (s) may evaluate scientists on the “quality” of the journals in which they have published. Researchers building their research profile know that they will be evaluated by the impact factor of the journals in which they publish. Consequently, researchers take the impact factor of a journal into account. The impact factor also has major implications for publishers.

At the same time many conflicting opinions about impact factors were appeared, in literature. Hoeffel (Hoeffel 1998) expressed the situation succinctly, “Impact Factor is not a perfect tool to measure the quality of articles but there is nothing better and it has the advantage of already being in existence and is, therefore, a good technique for scientific evaluation. Experience has shown that in each specialty the best journals are those in which it is most difficult to have an article accepted, and these are the journals that have a high impact factor. Most of these journals existed long before the impact factor was devised. The use of impact factor as a measure of quality is widespread because it fits well with the opinion we have in each field of the best journals in our specialty.” While J.K. Vanclay 2012 mentioned that Thomson Reuters impact factor (TRIF) suffers so many weaknesses, that a major overhaul is warranted, and journal editors and other users should cease using the TRIF until Thomson Reuters has addressed these weaknesses. Urgent improvements include the adoption of a ‘like-with-like’ basis (i.e., citations to articles, divided by the count of articles only), the use of verified one-to-one links only (this would unite authors, editors and Thomson Reuters in quality control); the adoption of a more appropriate reference interval (the present two year interval is too short for many disciplines), the introduction of confidence intervals, and the rounding of reported indices to a more appropriate number of digits. Failing action by Thomson Reuters, journal editors should collaborate as they have come with committee on publication ethic (COPE) to introduce a journal certification system that acknowledges procedures to maintain quality: procedures that add value and restrict plagiarism and fraud. The future of quality science communication lies in the hands of editors.

In 2000, Amin, M. and Mabe, M (Amin and Mabe,2007) summarized that the value of the impact factor is affected by the subject area, type and size of a journal, and the “window of measurement” used. As statistical measures they fluctuate from year to year, so that great care needs to be taken in interpreting whether a journal has really “dropped (or risen)” in quality from changes in its impact factor. Use of the absolute values of impact factors, outside of the context of other journals within the same subject area, is virtually meaningless; journals ranked top in one field may be bottom in another. Extending the use of the journal impact factor from the journal to the authors of papers in the journal is highly suspect; the error margins can become so high as to make any value meaningless. Professional journal types

(such as those in medicine) frequently contain many more types of source item than the standard research journal. Errors can arise in ensuring the right types of article are counted in calculating the impact factor. Citation measures, facilitated by the richness of ISI's citation databases, can provide very useful insights into scholarly research and its communication. Impact factors, as one citation measure, are useful in establishing the influence journals have within the literature of a discipline. Nevertheless, they are not a direct measure of quality and must be used with considerable care.

Creating and increasing journal impact factor.

Hundreds electronic and non electronic journals have been established exponentially in the scientific community since the last two decades. Because of the contemporary modern fascination with impact factors and their potential effects on advertising, subscription rates and author attractiveness, it is not wondering that editors have often tried ways to create or How to Get an Impact Factor for his/ her journal, (Table 2), and in case of the existence of the impact factor they would work to increase their own journal's indicator scores. They are believed with few common ways that are seemed to be helpful in this regard (Gowrishankar and Divakar 1999). One of the most strategies which lead to create and increased the journal impact factor is the publication of a journal's entire contents such as abstract, tables, figure, full-text and conclusion online, for free. This technique has been shown that sharing detailed research data may be associated with an increased citation rate in some journals (Lawrence , 2001; Piwowar, et al 2007) .

Table (2) Shows the criteria to get an impact factor.

<p>Criteria that journal must has it to get an Impact Factor</p>
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|---|
| <ol style="list-style-type: none"> 1. Have a basic level of citation activity 2. Address a niche area with the journal 3. Be 'international' or very popular regionally 4. Conform to journal publishing norms <ul style="list-style-type: none"> - Regular publication - Peer reviewed |
|---|

There is no doubt that open access to scientific literature online provides significant advantages for the scientific community. The free online access speeds the distribution of scientific and research information via links and other kinds of communication (Lawrence , 2001) like research gate which is very popular recently. Free access helps address an important equity issue for countries that cannot afford expensive journal subscriptions, but would nevertheless benefit from the information they contain. For developing countries in particular, the internet provides many scientists' only chance of accessing literature that would otherwise be too expensive to purchase (Khan ,2001).

Despite, free access is not always elixir, as technical access to scientific information remains a serious problem for scholars in developing countries such as Africa (Keese,2001) , some countries in Asia due to computer scarcity, limited bandwidth and difficulty in accessing the internet). Indeed, the need for greater exploitation of the internet has been previously suggested by Seringhaus and Gerstein, 2007, as a future technique to help truly integrate scientific information on a global scale.

Self-citation is another way which has been used as a technique. Self-citation tends to cite of other articles previously published in the same journal. Such behavior appears to have been first reported in the late 1990s(80), although the rate at which it is attempted often varies between authors, research fields and between journals of the same special field (Miguel and Marti-Bonmati ,2002). Regardless of how regularly a particular journal or its authors may actually attempt it, blatant editorial encouragement of self-citation has generally been discouraged by the academic and scientific community (Hemmingsson, 2002; Hemmingsson, et al 2002). Publishing of review article is another technique often used for increasing the impact factor. In this strategy, a journal can choose to publish a higher proportion of literature reviews compared to original research articles, as reviews will contribute to generate a higher number of citations from other authors (Anonymous, 1998). Although review-only journals often have reasonably high impact factors, at least 40,000 review articles are published in the world each year, and not all of them will achieve high impact (Garfield , 1996); suggesting that it is not a foolproof methodology. The other way that journal may used to increase their impact factor, is choosing to focus on research topics that naturally generate a high number of citations, such as molecular biology, and eliminate research topics that do not (Anonymous, 1998). Journals may prefer to publish articles that are particularly controversial or deal with inherently controversial issues (Garfield , 1996). Controversy generates interest among readers, who may then be inclined to cite the article, regardless of its actual scientific or academic value. In this manner, it has been shown that even erroneous articles may continue to receive citations after being retracted (Budd, et al, 1998).

Currently, scientific journals exist in very competitive publishing environment; an enthusiasm with this goal may invariably become inefficient. As a fact that a publication in highly impact factor is very difficult, it should also be remembered that publication of one's research in low impact factor journals is not necessarily a disaster. Researcher must think that his useful scientific material is not only limited to the high-impact periodicals. Nakayama and colleagues (2003), in his a study regarding guidelines for evidence-based practice, found that journals with low impact factors were still frequently cited as providing important evidence. It is appeared that self-evident is the only way to improve a journal's impact factor and we do agree with Garfield's statement that he mentioned previously, "a journal impact is simply a measure of its ability to attract the best papers available" (Garfield , 1996), then it would appear that the ideal way to increase journal's impact factor is simply to attract and publish better material. The world revolution in information technology (IT) , the rapidly distribution of the internet and the domination of multiple scientific gates and links lead to increase in the impact factor of most journal as a fact that the IT open the gates for the authors to access and

cite a wider variety of references per one article. Some researchers looked recently at trends for seven major medical journals and found that most impact factors had risen over the previous 12 yr Chew and colleagues for example (Chew, et al 2007).

Impact Factors and veterinary medicine

Nowadays there are vast amounts of easily accessible information relating to animal health available to veterinarians and others veterinary professionals. As in other fields, use of the Internet and the Web has greatly expanded information, research articles and communication process among veterinary professionals. Different research fields in the veterinary medicine and animal health have always depended on the exchange and citation of several items which lead to raised variations in the impact factor of the journals in veterinary medicine. There has been an increasing level of debate regarding the overall usefulness and relevance of impact factors for veterinary medicine. Impact factors for specialist animal health and veterinary medicine journals have historically been reported by Red Jasber Limited. 178“typical” veterinary sciences journals and its impact factors have been listed since 1981. These data showed some journal revealed high impact factor reach to 17.42 .Table (3). (http://www.in-cites.com/research/2007/december_17_2007-2.html).

Table 3: Some Veterinary Sciences Journals Ranked by Impact

Rank	2006 Impact Factor	Impact 2002-06	Impact 1981-2006
1	Vaccine (3.16)	Vaccine (4.84)	Adv. Veterinary Sci. (17.42)
2	Veterinary Research (3.15)	Veterinary Research (4.57)	Animal Production (13.75)
3	Fish & Shellfish Immun. (2.73)	Veterinary Microbiology (4.01)	Vaccine (12.61)
4	Veterinary Microbiology (2.07)	Fish & Shellfish Immun. (3.98)	Am. J. Veter. Res. (12.43)
5	Med. Vet. Entomology (2.03)	Med. Vet. Entomology (3.66)	Theriogenology (11.77)
6	Medical Mycology (2.01)	Vet. Immunol. Immunop. (3.58)	Equine Veterinary J. (11.42)
7	Comp. Immunol. Microb. (2.00)	ILAR Journal (3.55)	Veterinary Radiology (10.91)
8	Vet. Immunol. Immunop. (1.99)	Theriogenology (3.40)	Vet. Immunol. Immunop. (10.86)
9	J. Medical Entomology (1.95)	J. Fish Diseases (3.39)	Veterinary Microbiology (10.85)
10	Veterinary Parasitology (1.90)	Equine Veterinary J. (3.35)	Vet. Immunol. Immunop. (10.81)

Conclusion

The Journal Impact Factor (JIF) and Journal Citation Reports (JCR) are old issues developed since 1927. The actual concept of an impact factor was first proposed by Eugene Garfield in 1955. Moreover, interest in this indicator and its derivatives has grown exponentially in the scientific community since 1995. The original concept of the impact factor was used as a marketing tool for publishers. The impact factor rapidly expanded until it became widely regarded as a shorthand measure of a journal's quality and recently is used to criticize the quality of individual researchers output and to be widely used in academic appointments and as an evaluation tool for promotion and tenure review committees . Impact factor has many supporters as well as many conflicting opinions. Publish the journal's contents online, for free Self-citation , Publish a greater proportion of review articles ,Publish "hot topics" articles, and Focus on research areas which naturally generate more citations, are different ways and techniques used to create and increased the journal impact factor. Recently there are more than 178 journals in the field of animal health and veterinary sciences showing different impact factor scores.

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