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**COLLNET JOURNAL
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Impact Factor in Institute for Scientific Information (ISI): Quality and Quantity of Scientific Publications

**Hamzehali Nourmohammadi
Abdolreza Noroozichakoli
Mohammad Hassanzadeh**

The article investigates the Impact Factor in Journals and its consequences for scientific considerations. The Impact Factor is a value for Journals listed in the Science Citation Index, which shows the average degree of acquaintance in the scientific community.

There is an annual increase in Impact Factor in SCI, in which the annual rate is rising as high as the Impact Factor. The Impact Factor is also determined to a considerable degree based on the availability of the cited sources.

Impact factors of Journals and prices for their relations depend only on a weak statistics from each other. Subscription of a Journal depends strongly on the citations. The IF rises with the number of copies of magazines if these already exhibit a higher IF.

1. Introduction

Impact Factor (IF) deals mainly with the article citations listed in journals and their related references. The investigation of citation patterns in journals initiated from 1920s and resulted in the establishment of the Institute for Scientific Information (ISI). IF was determined as Journal Impact Factor in ISI in 1973 and has turned into an important means for measurement of the quality of journals during the last few decades. [1,2] Interest and tendency towards this indicator has nowadays resulted in a creation number of different methods for determining IF such as Web Impact Factor (WIF). Much care and attention must be paid to various areas of IF; because it is not possible to compare, for instance, the results of IF concerning internet cites with IF in ISI due to the different citations and references used [3].

At the beginning, neither ISI nor IF were very well recognized; however, this recognition has had such a great change during the last decades that almost 931 cases were found when 'Impact Factor' was searched in WoS in July 2006. Statistics show that only 15% of the cases belonged to the year 2005 and it indicates the significant growth of IF in scientific products. At the same time, the terms *journal* OR *journals* 'impact factor' OR 'impact factors' were searched in Google and resulted in 3.46 million cases.

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Therefore, it can be concluded that this area of science has had a great significance. Scientists also attempt to publish their articles in journals with high IF. Furthermore, most of the measurement committees evaluate an article on the basis of its IF. [4]

The term Impact Factor has certainly turned into a modern term nowadays and scientists and instructors seek to have their articles cited in indexed journal in ISI or publish their articles in journals with high IF. This fact has encouraged the authors to search about this subject and present this article.

2. Objectives

The most important objective of the present research is to determine/estimate the journal impact factor available at Journal Citation Report Science Edition (JCRSE) in ISI. Therefore, following points are taken into consideration:

- Determining the growth of IF in scientific journals included in JCRSE.
- Determining the growth of IF in scientific journals with low IF included in JCRSE.
- Determining the growth rate of IF in scientific journals with high IF included in JCRSE.
- Determining IF for journals of different countries in JCRSE.
- Determining correlation between IF and the quality of journals indexed in JCRSE.

3. Methodology

The present research attempts to use the data available in JCR during 1998 and 2004 to estimate the impact factor of the indexed journals. As observed in IF formula, the data must be observed and estimated 2 years prior to the year in question. It should be stated that JCR was used to collect information about all journals available during the mentioned years. Since there was no information about journal impact factor in 1998 in JCR online, CD bank of this database was used for the purpose.

A program was written based on Delphi software which could retrieve and save all the required information automatically. This software also helped to correct the errors in symbols and numbers observed

in the information retrieved from CDs. All the annual citations and journals available in JCR were considered as a single journal in order to estimate the annual growth rate.

The same procedure was used to compare groups. AskSam, Delphi and Excel softwares were employed to extract and analyze the required data.

3.1 Estimating Impact Factor

The recorded number of citations and articles published in a journal are required to estimate journal impact factor:

The number of citations to the articles published in a journal during the two preceding years divided by the total number of articles published in that journal at the same time. Therefore:

Impact factor in 2008 =

$$\frac{\text{Journal citations in 1989 during 2006\&2007}}{\text{Total No. of articles published in 2006 \& 2007}}$$

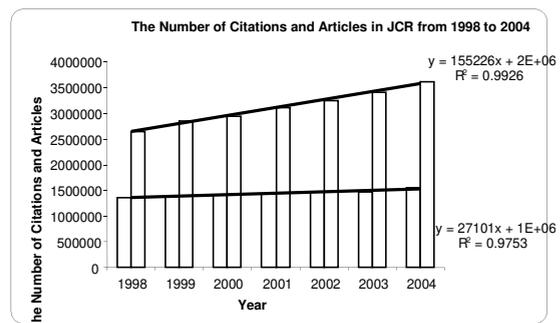
$$\text{Or: } \text{IF}(a,t) = (\text{Cit}(a,t-1) + \text{Cit}(a,t-2)) / (\text{Art}(a,t-1) + \text{Art}(a,t-2))$$

4 Results

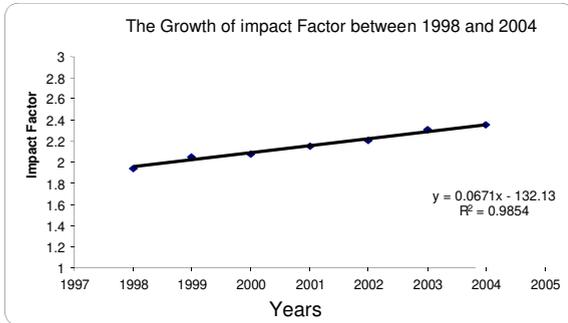
4.1 Data Analysis

One of the important points investigated in this article is determining the IF growth. The impact factor of scientific journals during various periods can be compared to each other in order to estimate the growth of this indicator. This growth is resulted from the increase in the number of citations to the articles in ISI. The growth rate of citations and articles in JCR is presented in Graph 1 and Graph 2. It can be theoretically stated that 155226 citations and 27101 articles are annually added to JCR.

Graph 1. The Number of Citations and Articles in JCR from 1998 to 2004



Graph 2. Growth Rate of JCR from 1998 to 2004



The data in Graph 2 indicates that the annual impact factor has a linear growth of 0.07. This growth is, in fact, based on the increase in the number of citations in different databases of ISI, which can be observed in Table 1.

Year	Number of articles in the 2 preceding years	Number of Citations in the 2 preceding years
1988	1.362.519	2.638.954
1999	1.383.331	2.840.509
2000	1.412.674	2.939.970
2001	1.440.738	3.098.871
2002	1.463.947	3.231.281
2003	1.477.348	3.404.212
2004	1.535.690	3.614.828

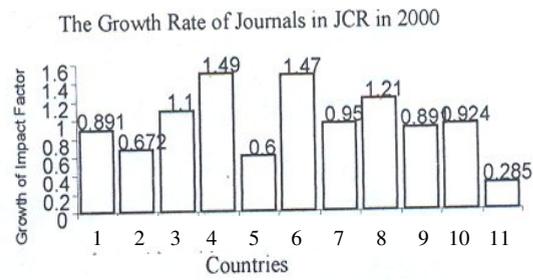
Table 1. The Number of Articles in JCRSE

Table 1 shows the number of articles and less growth in comparison with journals with high IF. Citations in ISI increased respectively 2% and 5%. In addition, the journals with low IF had less growth in comparison with journals with high IF. Distribution of annual journal impact factor in JCRSE during 1998 and 2005 is shown in Table 2.

Annual Growth	Impact Factor
0.028	0.431
0.0698	1.793
0.1558	5.96
0.2912	11.372
0.3839	26.72

4.2 Journal Impact Factor of Different Countries

We have also estimated the rate of IF of different countries regarding the number of journals available in JCR from each country. This method makes it possible to obtain some information about characteristics of these countries concerning the data available about their journals indexed in ISI. Some of these findings are presented in this part.



Graph 3. Growth in Journal IF of some Countries in JCR in 2000

The data in Graph 2 indicates that the annual impact factor has a linear growth of 0.07. This growth is, in fact, based on the increase in the number of citations in different databases of ISI, which can be observed in Table 1.

In the Graph 3, numbers 1 to 11 indicate Australia, Spain, Austria, the Netherlands, Italy, Germany, France, Switzerland, Canada, Japan and India respectively.

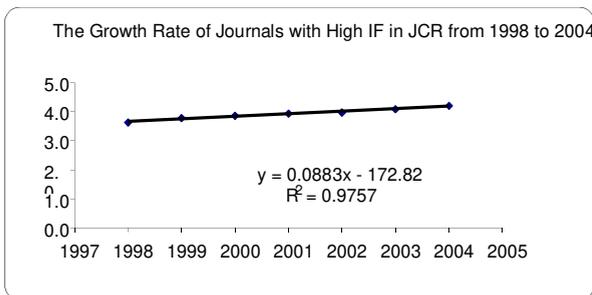
Seven years during 1998 and 2005 were considered to determine this growth and IF for the year 2000 was estimated. Germany and the Netherlands achieved the highest growth of journal IF in JCR in comparison with the other countries. The IF mentioned in Graph 3 is calculated on the basis of characteristics of all of the journals of a country indexed in JCR regardless of their topic. In the next section we compare the indexed journals according to their topics.

4.3 Growth Rate of IF in Scientific Journals with low IF in JCRSE

Some subjects enjoy a higher impact factor in JCR including General Surgery, Biology, Chemistry, Interdisciplinary Subjects, Microbiology, Haematology, Ecology, Oncology, Physiology, Psychiatry and Cellular Biology.

Their growth rate is about 0.088 while the average growth for all journals in JCR is about 0.067. Approximately 31472 citations and 2298 articles are annually added to these subjects. Graph 4 reflects the rate of growth of IF for the journals with the above-mentioned topics.

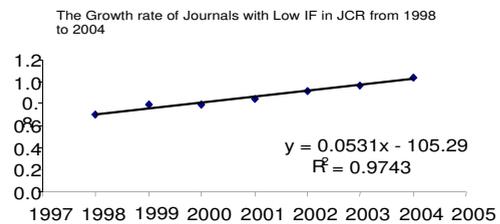
Graph 4. Growth of IF for scientific journals with high IF in JCR



4.4 Growth Rate of IF in Scientific Journal with low IF in JCRSE

Some other subjects which have a lower IF in JCR were examined in this research as well. These subjects include Research in Management, Mathematics, Entomology, Technical Mechanics, Zoology, Telecommunications, Interdisciplinary Categories, Forestry, Nutrition Sciences, Architecture, Automation and Economics of Water. The growth rate of these subjects is only 0.053 while the average growth for all journals in JCR is about 0.067. Approximately 10998 citations and 3110 articles are annually added to these subjects. In fact, the increase in the number of articles in these subjects is more than the subjects with high IF; however, the increase in the number of citations is lower. Graph 5 summarizes the growth rate of low IF journals.

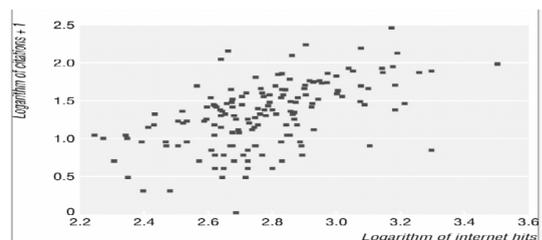
Graph 5. Growth of IF for scientific journals with Low IF in JCR



4.5 Correlation between Availability of Sources and Rate of Citations

Being observable is one of the factors which greatly influence the rate of availability of sources for the authors. According to the results, there is a (positive) correlation between the number of citations and availability of free sources. The sources available on internet are used more frequently than other sources. Pernerger [5] obtained the following results (Graph 6).

Graph 6. Correlation between Availability in Internet and Number of Citations.



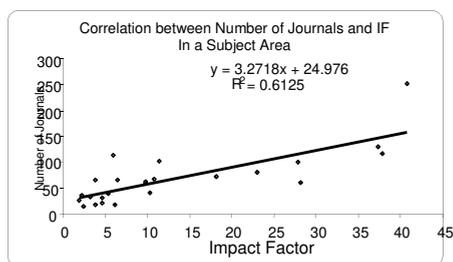
The scattering/distribution of sources indicates that the more available they are, the more likely they are to be cited.

As mentioned earlier, different factors might affect IF. which is not directly based on the quality of an article in a reliable journal. In other words, a high-quality article might be published in an unknown journal and it would also remain unknown. This fact causes these types of articles to have less chance to be cited. On the other hand, a low quality article might be published in a journal with high IF which makes the readers more interested in reading and probably citing

it. This is the reason that most authors attempt to publish their articles in journals with high IF.

One of the other points that can affect IF is the number of journals in a specific subject area. Graph 7 deals with the same subject.

Graph 7. Correlation between IF and the number of journals in a specific subject area



It can be concluded that the bigger the number of journals in a specific subject area, the higher their IF. One of the important reasons in this regard can be self-citation, i.e. articles in journals with a specific subject area refer to each other more frequently because they are dealing with the same subject area. According to Garfield [6], the contribution of self-citation is about 13 percent. Thomson Scientific (2002) also shows a 12% contribution of self-citation.

Simkin & Roychowdhury [7] tried to indicate that only 22 percent of the sources used in references are studied. They used an interesting method: they looked for the mistakes while citing. They believed that most of the scientific products are copied from the original articles. Of course, it seems to be impossible because even some of self-citations have the same mistakes or some authors might have directly communicated with the cited authors. There are even misspelling in some cases; for instance, misspelling the page numbers. Therefore, these kinds of errors should not be considered as copying. However, it can be applied for classic citations.

4.6 Quality or Quantity

Authors have always been interested in publishing their articles in the journals with high IF; therefore, there is an intense competition among authors [3]. Furthermore, it is believed that the request for publishing scientific articles in these kinds of journals

can be an indication of their high quality. Moreover, the quality of journals is higher in peer-reviewed articles and those with higher IF.

More than 100,000 journals are available in Ulrich's databank. According to Hamilton [8], the number of scientific journals has increased from 70,000 to 108590 during the last 20 years. Therefore, it would be complicated to decide which journal is scientific or undergoes review procedures. Even a scientific journal with suitable review procedures has limitations in publishing articles and cannot publish all of them. Thus, publishers should decide how many articles they can publish in their journals and publishers should decide on the number of articles which can be published in their journals. It is absolutely wrong to consider the rejection of a large number of articles as an indicator of high quality of journals; because articles in humanities and other sciences which have no clear criteria to determine their quality can be also frequently rejected. For instance, we can refer to 'Sokal Hoax' [9].

Undoubtedly, scientific papers with review procedures might contain numerous mistakes due to personal reasons and reviews published in a journal. There are many reasons to support this idea [10,11]. It is debatable to consider that all the reviewed articles have a really high quality especially, when the whole doctoral dissertation of a person does not contain more information than a brief abstract, such as Eugene Garfield's dissertation. Garfield [12] pointed out that his supervisor had believed his dissertation was too short and must have been doubled in length. However, its results were published in *Nitche* in a single page. [13].

To review an article with a complicated, recent and uncommon subject area, many problems might be aroused at first place and the subject might not be well-recognized. Of course, the author is responsible for presenting the subject area clearly, so that the reviewers comprehend it properly; because judgment is really difficult in these cases.

A highly cited article and a journal with high IF do not necessarily indicate high quality of a journal, rather it shows the interest to the science and scientific debates in that subject area.

In 1900, almost 90% of scientific articles were in English, German and French; however, nowadays the situation has changed and many countries try to publish their scientific papers in their own national languages. The number of articles in English had a significant growth, yet they had less growth in comparison with other languages.[14]

5. Discussion and Conclusion

Impact factor is considered as one of the significant indicators in scientometrics which should be applied appropriately. It has also turned into one of the most important factors for the scientific producers and authors to choose journals for publishing their articles. However, it is still open to discussion whether it is a suitable criterion to measure the quality of scientific products. Because different factors influence IF such as number of published copies, availability, extent of acquaintance, type of publication, research capability, price, time of publication, number of pages and background of journal. It is not possible to measure the quality of an article through journal impact factor or number of citations.

The following points can show why IF cannot indicate quality:

- IF is acquired from all the articles in a journal not a single article;
- IF is in fact the mean of citations to all of the articles in a journal;
- and Citations are usually related to a limited number of articles in a journal.

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- IF is acquired from all the articles in a journal not a single article;
- IF is in fact the mean of citations to all of the articles in a journal;
- Citations are usually related to a limited number of articles in a journal.

Therefore, IF cannot be considered as the suitable indicator for measuring the articles or journals, rather it should be used along with other indicators.

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