

## IMPACT FACTOR

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## ABSTRACT

The most common way of evaluating scientific work is through citation analysis. This is how the scientific achievements of authors, co-authors, institutions and states are valued. Every researcher strives to publish his results in a magazine with a good reputation. One of the basic indicators for determining the status of a scientific journal is the so-called Impact Factor – IF (a factor of influence), which is a measure of the frequency of citations of published articles in a certain period. Impact Factor is a potential indicator of the validity of an article because it is assumed that there was a strict review procedure before its publication. The true value of the article is obtained after its printing by the volume of citations from the presented results to the value of IF for the magazine in which it is printed.

The aim of this paper is to familiarize the reader with the basic databases of various scientific and research activities through which scientists connect, to clarify the notion and significance of the impact factor, which valorizes the popular scientific journals, as well as to explain precisely the more specific terms which span all spheres in the field of science.

The numerical value of the Impact Factor is calculated by the sum of quotations from the last two years divided by the number of published papers in the journal in the same period. In the same way you can calculate IF for the last five years. The study data presented in the paper is a dynamic biometric value that is constantly directed towards emphasizing the best quality in all areas of research activity in the world.

**Keywords:** IF (Impact Factor), TRIF (Thomson Reuters Impact Factor), WoS (Web of Science), JCR (Journal Citation Report).

## ФАКТОР НА ВЛИЈАНИЕ

Најчест начин на вреднување на научното творештво е преку направени цитатни анализи. Така се вреднуваат научните достигнувања на авторите, коавторите, институциите и државите. Секој истражувач се стреми своите резултати да ги објави во списание со реноме. Еден од основните показатели за одредување на статусот на научното списание е т.н. Impact Factor – IF (фактор на влијание), кој претставува мерка за фреквентноста на цитираноста на публикуваните статии во одреден период. Impact Factor-от е потенцијален показател за валоритетот на дадена статија бидејќи се претпоставува дека постоела строга рецензентска постапка до нејзиното публикување. Вистинската вредност на статијата се добива по нејзиното печатење, со обемот на цитатите од пласираните резултати преку кои таа влијае на вредноста на IF за списанието во кое е оппечатена.

Целта на овој труд е да се запознае читателот со основните бази на податоци за различни научноистражувачки дејности преку кои се поврзуваат научните работници, да се разјасни поимот и значењето на импакт

факторот со кој се валоризираат популарните научни списанија, како и прецизно да се објаснат повеќе поими кои ги пратат сите сфери во полето на науката.

Одредувањето на нумеричката вредност на Impact Factor-от се врши така што збирот на цитатите од двете последни години се дели со бројот на публикуваните трудови во списанието во истиот период. На ист начин може да се пресметува IF за последните пет години. Проучуваните податоци изнесени во трудот претставуваат динамична биометриска величина која што е постојано насочена кон потенцирање на најквалитетното од сите области на истражувачката дејност во светот.

**Клучни зборови:** IF (импакт фактор - фактор на влијание), TRIF (Thomson Reuters Impact Factor), WoS (Web of Science), JCR (Journal Citation Report).

## INTRODUCTION

Scientific work is frequently evaluated by measuring the scientific productivity achieved through citation analysis. Analyses of citations of the published scientific research results include measurements of the number and type of citations, self-citations or independent citations. Thus, the scientific achievements of authors, co-authors, institutions and states are valued. It is very important which journals the results of the research are published in, as this entails different impressions of the scientific data presented and the registration of their further citation. Therefore, often when evaluating the scientific work of the researcher (or the institution), the status of the journal in which the results are published, as well as the status of the papers in which those results are quoted, is used as an indicator.

One of the basic indicators for determining the status of a scientific journal is the so-called Impact Factor – IF. Impact Factor of the magazine is a measure of the frequency through which the citation of the published articles in a certain period is shown. This helps determine the quality of the magazine, but not the quality of a particular article or

the quality of the scientist as an individual. The impact factor can only be a potential indicator of the valority of an article, since it is assumed that there was a strict review procedure before its publication. The real value of the article is obtained after its printing, with the scope of the quotes from the results that it results in, which affects the value of the IF for the magazine in which it is printed.

IF as a scientometric indicator is only one of the indicators that contributes to the overall assessment of the scientific work of the researcher, institution, area, journal, etc. However, it is not recommended to observe it separately, instead it should be observed alongside the subject area, the length of the author's working life, scientific productivity, co-authorships, the total number and type of quotations as well as other relevant parameters.

The purpose of this paper is to process and summarize modern data to precisely determine the many terms that accompany this field, following the direction of highlighting the quality of scientific research activity on a worldwide level.

## RESULTS AND DISCUSSION

### Term of Impact Factor

The term Impact Factor (IF) means an influence factor that is incorporated into several commercial academic-based rating databases that register the quotations of journals and articles inside them (each base for itself separately). Impact factor is calculated each year for all journals that are referenced in

the respective databases and for all journals that were cited in those databases. Based on the obtained results and the set criteria, certain magazines are selected and entered into the database of new magazines, while some existing ones are excluded from it.

Impact Factor is a very important criterion

for the reputation of scientific journals. Today, the higher IF is a sure direction when choosing an adequate magazine for printing scientific work, as well as an aspiration to perfecting and modernizing a magazine. It

### Definitions

- Journal Impact Factor (JIF) for scientific journals is defined as the number obtained by dividing the total number of citations of articles (papers) published in the previous two years and cited in the current year, with the number of published papers in the previous two years [3].
- Impact Factor (IF) is a structured quotation index, a searchable collection of bibliographic data, supplemented with ab-

### Review of the meaning of Impact Factor

Impact Factor (IF) is the most common indicator for valuing magazines. When using IF, one should pay attention to the way in which it is calculated, what kind of documents are being used, what kind of articles the magazine deals with etc.

IF is also used when comparing magazines. In this case, care should be taken not to compare magazines from different scientific areas.

### Determination of Journal Impact Factor (JIF)

The determination of the numerical value of the Journal Impact Factor (JIF) is calculated by the sum of quotations from the

is often used as an expression of the relative importance of a magazine in a particular area. Chapters with a higher IF are usually considered "more important" than those whose factor is of lesser value.

stracts of scientific publications or articles in journals, keywords, references (a list of quoted papers) and quotation data, or for scientific papers which are cited by previous scientific papers [5].

- The Impact Factor (IF) or Journal Impact Factor (JIF) for scientific journals is a measure that reflects the previous annual number of citations cited in recently published scientific papers in a given journal [5].

IF is a more reliable indicator in natural and applied sciences than in social sciences. In magazines in the field of humanities, IF is not calculated because most authors do not use journals as a source of citation, and available literature crosses the boundaries of the two-year and five-year period (time for which IF is calculated).

last two years divided by the number of published papers in the journal in the same period [5], [7].

2011	2012	2013	2014	2015	2016
					

For example, the Journal Impact Factor (IF) of a given scientific journal for 2016 is de-

termined by the following formula:

**Example:** The magazine "X" indicated in

$$IF_{2016} = \frac{\text{Number of citations from 2014} + \text{number of citations from 2015 (cited in 2016)}}{\text{Number of papers in 2014} + \text{number of papers in 2015}}$$

the Web of Science (WoS) and published in 2016, from 2011 to 2015 was quoted 6014 times, of which 2182 times were quoted from works printed in 2014 and 642 times

$$IF_{2016} = \frac{2182 \text{ citations from 2014} + 642 \text{ citations from 2015 (cited in 2016)}}{191 \text{ papers in 2014} + 218 \text{ papers in 2015}} = \frac{2824}{409} = 6,904645477 \approx 6,9$$

For reputable journals from different areas, there is an information journal Journal Citation Report, where five year IF's are also calculated by the previously described method, with the use of five-year data instead of two years. The calculation of the five-year IF for the magazine "X" is done in the same way as for the two-year peri-

$$IF_{2016} = \frac{814c.(2011) + 1474 c.(2012) + 902 c.(2013) + 2182 c.(2014) + 642 c.(2015) (ct.in 2016)}{207 p.(2011) + 183 p.(2012) + 179 p.(2013) + 191 p.(2014) + 218 p.(2015)} = \frac{6014}{218} = 6,149284 \approx 6,15$$

From the analysis of the two-year and five-year IF it can be concluded that the difference between them is approximately one, which means that in the last two years, "X"

### Thomson Reuters Impact Factor

Thomson Reuters Impact Factor is a commercial metric factor, which is published annually by Thomson Reuters's scientific business through the Journal Citation Re-

### Web of Science

Web of Science (WoS) is the database of the most significant quoted indexes (database index), which covers 10-12% of the most prestigious and most well read world scientific literature, subject to very strict selection and quality control of the scientific work [13]. WoS covers the period from 1900 to the present. This database is one of Thomson Reuter's creation platforms called Web of Knowledge (WoK). Currently WoK is a ma-

were quoted from works printed in 2015 . In 2014 the magazine published 191 papers, and in 2015, 218 papers. By applying the above formula, IF for 2016 was 6.9.

od, except the calculation also adds the data for 2011, 2012 and 2013. For example, in 2016 there were 814 quotations from 2011, 1,474 quotations from 2012, and 902 quotations from 2013. In 2011, 207 papers were published, in 2012 183 were published, and in 2013 179 papers were published. The calculation will be as follows:

has seen an increase in quoting of scientific papers, which increases the reputation of the magazine.

ports (JCR). JCR provides a number of parameters and quantitative tools for ranking, grading and categorizing, as well as comparing magazines [12].

major research platform that offers great assistance in the sphere of finding, analyzing and sharing information in all scientific areas. In WoK, besides Web of Science (WoS), other bases are included, such as: Biosis Citation Index, CAB Abstracts, Conference Proceedings Citation Index, Current Contents Connect, Food Science Technology Abstracts, Global Health, Inspec, Journal Citation Reports, Medline , Zoological Record, etc.

The creator of the Web of Science's citation (index) database is Eugen Garfield. He founded the Institute of Scientific Informatics of Philadelphia, and in the 60s of the XX century strives to create a source of the latest scientific literature at an international level, which will enable easier search for the growing number of published papers. Thus, the multidisciplinary database of the Science Citation Index, which was run exclusively by magazines, emerged and is a source of scintomenetic research. The initial collection of 600 magazines produced the core of world science and represented 5-8% of all scientific publications. Today, for a growing number of world communities, WoS is the most prestigious source of publications and data on scintometric research. This is a priority for scientists precisely because of the publication of the papers in one of the magazines indexed by WoS. Since 2002, WoS (with 14 scientific journals) has been transferred to the private company Thomson Reuters, making the rules for inclusion of magazines in the database altered. The biggest changes in this sphere were made in 2007 and 2008, when WoS included a number of magazines for smaller states from the non-English region. Thus, since 2012, when 62 scientific journals were included in the database, their number is constantly growing and today covers more than 10% of the total number of world scientific journals.

The most used indexes of the WoS service are the following:

Science Citation Index Expande (SCI Ex-

panded) - denotes the field of natural sciences, medicine and technology. The data in this database date from 1900 [9].

Social Sciences Citation Index (SSCI) - covers the field of social science [10].

Arts and Humanities Citation Index (A & HCI) - indexes magazines from the field of humanities and arts. Its availability dates from 1975 [1].

The number of magazines that are entered simultaneously in the three WoS indexes is small.

WoS indexes all papers of the included journals into the database without choosing them. The bibliographic processing is done on all scientific papers, but also on various articles, such as: books, abstracts from scientific gatherings, and so on. It can make bibliometric analyzes of different characters, including the total quotation of papers by individual authors, or the papers from individual journals in a certain period of time, as well as the citation without self-cytats, the h-index (indicator of valuation of Scientific work and journal, introduced by physicist Hirsch in 2005 [4]), etc. The papers are also analyzed according to the language they are published, the year of publication, the area they belong to, and so on. In addition to the listed indexes, the WoS Service also contains the Conference Proceedings Citation Index - Science, Conference Proceedings Citation Index - Social Science & Humanities [2], and from 2015, a Book Citation Index is included which includes monographic publications by major popular publishers [11].

### Journal Citation Reports

Journal Citation Reports (JCR) is a publication that is published annually by Clarivate Analytics (followed by Thomson Reuters's intellectual property and scientific business) and informs of quotations in the scientific journals [6]. It was created in 1975 on the basis of magazine data, the number of published papers, and the quotation analysis

analyzed by Web of Science. Eugen Garfield created a special statistical database, called Journal Citation Reports (JCR), as a quantitative tool for ranking, valuing, categorizing and comparing magazines. As an indicator of the valorization of magazines, Impact Factor-IF is most often used (factor of influence).

JCR classifies scientific journals, and Median IF ranks individual journals within the scientific area to which they belong.

JCR consists of two units: The Sciences Edition (SE) and The Social Sciences Edition (SSE). Currently JCR, as a separate service, is based on quotes collected from

SCI Expanded and SSCI. For magazines in A & HCI, JCR is not calculated IF.

According to the above, Journal Citation Reports (JCR) is a reliable and relevant database for the evaluation of scientific journals and a guide to the publication of scientific results and scientific thought.

### Impact Factor Magazines from the field of agriculture

There are a huge number of magazines in which papers in the field of agronomy can be printed. The basis of selection for the researcher is primarily based on the field of scientific research, but always includes the height of Impact Factor. Web of Science abounds in magazines that satisfy these criteria, that is, there are magazines ranked

with different Impact Factor.

Table 1. shows the journals with Journal Impact Factor (JIF) in which scientific papers are published primarily in the field of agriculture (plant sciences, nutrition, botany, plant pathology, microbiology, biochemistry, etc.) [8].

Table 1. List of Scientific Magazines with Journal Impact Factor (JIF) in the field of crop production

Scientific magazines	JIF
Asian Journal of Plant Science & Research	0.92
	4.64 (5 Yr JIF)
Journal of Natural Product and Plant Resources	0.9
	4 (5 Yr JIF)
Journal of Nutrition & Food Sciences	1.49
	2.56 (5 Yr JIF)
Journal of Plant Pathology & Microbiology	1.62
	2.13 (5 Yr JIF)
Journal of Biodiversity Management & Forestry	0.781
VEGETOS: An International Journal of Plant Research	6.02
Journal of Plant Physiology & Pathology	2.396
Journal of Phylogenetics & Evolutionary Biology	1.95
Natural Products Chemistry & Research	1.7
Journal of Plant Biochemistry & Physiology	1.55
Advances in Crop Science and Technology	1.55
Medicinal & Aromatic Plants	1.42
Rice Research: Open Access	1.35
Forest Research: Open Access	1.25
American Journal of Phytomedicine and Clinical Therapeutics	1.15
Agrotechnology	1.04
Journal of Horticulture	0.72
Research & Reviews: Journal of Botanical Sciences	0.36

## CONCLUSIONS

Impact Factor (IF) is one of the modalities of evaluating scientific productivity and an indicator of the value of journals. The determination of the numerical value of the IF is done in such a way that the sum of the quotations from the last two years is divided by the number of published papers in the journal in the same period.

Thomson Reuters Impact Factor is a commercial metric factor that is published annually by Thomson Reuters's scientific business through the Journal Citation Reports (JCR) publication that provides infor-

mation on quotations in scientific journals. The Web of Science (WoS) database contains the most important cited data from the most prestigious and most well read world scientific literature, subject to a very strict review procedure of selection and quality control of the scientific work.

The data studied - the subject of this paper, represent a dynamic biometric base aimed at constantly highlighting the best quality of all areas of research activity on a global level.

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