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CITATION INDEX AND IMPACT-FACTOR – CRUCIAL ATTRIBUTES OF SCIENTIFIC JOURNALS AND SCIENTIST RATING

The given article examines citation indexing as bibliographic data base and major instruments to identify bibliometric index and to evaluate scientific knowledge. The paper provides review of the foreign experience in the given sphere.

Keywords: impact-factor, citation index, cited and citers, Thomson Scientific, JCR, SCI, ISI

«The country where science and innovations are on the second place will not achieve the first place in any sphere…»
Nazarbayev N.A.

Successful realization of the major strategic objective to enter the group of fifty the most competitive countries in the world set by the Head of the state before the economy and industry of our country, is mainly defined by the presence of highly-qualified specialists whose competence meets the highest international requirements. In this regard a crucial issue of creating an effective system of training scientific and scientific-pedagogical staff of a new formation arises; the staff that are able to solve effectively tasks of any professional level in all spheres of production and scientific activity. It is quite obvious that level of the higher and postgraduate professional education system at universities in many respects is defined by the level of scientific research works carried out at these establishments. It is no accident that in recent years higher education in our country has had tendencies which make scientific achievements of higher educational institutions one of the crucial indexes of their work. Publishing results of scientific research works and achievements in leading world issues with a high citation index is one of the target objectives of Development Strategy 2011 -2012 of the Kazakh national pedagogical university named after Abay.

Major idea of the Strategy is to achieve specific results from the entrance into the world scientific and educational space. Citation index is one of the key indexes widely applied all over the world for evaluation of the works of researchers and scientific teams. Scientists' attention to the research of scientific citing is explained by the fact that it is an efficient approach to study communication in professional community, disciplinary structure of the science, mechanisms of a birth of a new knowledge. Citing provides a researcher with not exhaustive but objective indexes. The process of scientific communication is most visibly presented in *journal* publications. Periodicals are known for their efficiency in reflection of new scientific tendencies. Scientific journals are the major communication channel between scientists. Besides its informational function of notifying the scientific community on results of the carried surveys, a journal article fixes intellectual rights of scientists and reflects (by citing) his links with the works of predecessors. Therefore researchers aim to place their printed works in such scientific journals, the weight or informative value of which guarantee that wide scientific audience will get acquainted with his materials. Structure of citations and bibliometric indexes identification are based on so-called "quotation" data bases on periodicals which gather not only bibliographic data on journal publications (author, title, journal, year, volume, issue, pages) but the list of the cited literature as well. It enables to find publications *cited* in a certain article and publications *citing* this article.

Thus, a user can conduct an effective search for all bibliography on the issue of his interest. At the same time a special "superstructure" over such database, aggregating data on the whole journals, gives experts an access to bibliometric indexes of periodicals. In Western countries the most popular citation data bases are presented by a line of products of the company Thomson Scientific (former Institute for Scientific Information, ISI) – Science Citation Index, Social Sciences Citation Index and Arts & Humanities Citation Index. Aggregated journal bibliometrics is represented in a special product of Journal Citation Reports (JCR). SCI (or its Internet-version Web of Sciences – WOS) contains bibliographic descriptions of all articles from the processed research journals and reflects mainly publications on fundamental aspects of the science in leading international and national journals. JCR - citation index of journals identifies informational value of research journals. At present many have recognized that impact-factor of a journal is one of the official criteria which enable to compare the level of research works in close spheres of knowledge. Experts take into account a competitor's publications in journals covered by JCR when providing with grants and promoting for scientific awards (including the Nobel Prize). According to the definition given by specialists who prepare Journal Citation Reports (**JCR**), impact-factor **(IF)** of a certain journal is a fraction, the denominator of which is equal to the number of articles which have been published in the given journal during the given period (usually it is two years), and the numerator which is the number of references (made during the same period in various sources) on the above-mentioned articles.

As a rule, JCR publishers refer IF values calculated this way on the basis of the data for a certain period to the year directly following this period. For example, if has been calculated by the 2009-2010 period data, JCR will refer to it as the IF of 2011.

The impact-factor value range is enormous, let us examine some examples. For example, maximum value of the impact-factor in 1996 made **58.286** (journal "Clinical Research"), and an authoritative journal "Nature" had **27.074** whereas the impact-factor value of the most **ISI** processed journals for this year did not exceed **0.7,** and minimum value of this parameter was equal to **0.001.** Av-

erage value of an impact-factor presented in **JCR** journals in 1996 (their number = **4623**) made **1,288**. As for **119** Russian journals included in the number of **4623**, the average value is **0.268** at dispersion from **2.862** to **0.009.**

It means we can state that average value of the impact-factor for Russian journals is **almost 5 times lower** than the corresponding value for the whole list of **JCR** journals. Using impact-factor as criterion for evaluating the journal is based on the assumption that the journal publishing a substantial number of articles which are cited much by other researchers deserves a special attention.

Thus, it means that the higher the value of the impact-factor, the higher the scientific value and authority of the journal. Impact-factor of a journal depends on the research area, type of a journal, development rate of the given knowledge sphere, and issues it is devoted to. There are two standard approaches to evaluate the level of researchers. The first is **a citation index**, and the second – an **impact-factor**.

Citation index demonstrates how many times articles of the given author were cited in the works of other authors. As a rule, a researcher has a high citation index if his or her works were published in the journals with high impact-factor. There has been interest to evaluation of publications' citation rate for about 80 years already. The first attempt to compare research periodicals by this feature were taken in the late 20s of the last century (Gross P.L.K., Gross E.M.).

Later, and thanks to efforts of Estelle Brodman, who was studying journals on physiology, these techniques were improved (Brodman E., 1944). For many years Eugene Garfield has been an inspirer and organizer of development of this idea. Eugene Garfield is Doctor of Philosophy and founder of the present «Thomson Scientific» – part of «**Thomson**» corporation – leading world provider of information for professionals (www.thomson.com).

Eugene Garfield wrote about citation index first in the journal "Science" in 1995.

This project of a researcher and publisher with the degree of Bachelor in chemistry and Master in library sciences developed into the "Science Citation Index" (SCI) published first in 1963. The index of 1965 contained data on 3.3 million references in 196 000 publications on all exact, humanitarian and applied sciences and in 60 000 patent descriptions of the USA. **SCI** contains the list of all works which have been mentioned in any publication of the current year, and consists of two parts published as separate volumes – "Literature Citation Index" and "Citation Index". Since 1975 the organization established by Eugene Garfield has been publishing annual "Journal Citation Reports" (JCR) providing with the data on more than **7.5** thousand scientific-technical journals of more than **3.3** thousand publishers from about **60** countries. In the early 60s, Eugene Garfield and his colleagues developed a method of calculating an impact-factor so that to select journals for SCI. Need in it arose because using the number of articles or their citation frequency as criteria led to the exception of small or specialized journals. Of course, impact-factor is an important feature of research journals. It is calculated annually by the Institute of Science Information (ISI). Impact-factor of a journal is equal to the relation of references during a certain period (normally 3 years) on articles in the given journal to the number of articles published in it. **Scientific funds** apply the citation index of the project supervisor and impact-factor of journals where his works have been published as the major criteria when providing grants on research projects. Absolute number of citations of a certain edition cannot be considered objective enough for assessing the quality of publications. For instance, "The Journal of Biological Chemistry" is one of the most cited editions in the whole history of science, and it is one of the biggest. Among the large number of articles published in similar journals (several thousand a year), there can be more or less high-quality articles, and more or less interesting ones. Therefore, despite the frequent citation of all publications in total, the number of references to a certain article can be not much compared to some small, especially review, journals.

«A classical impact-factor, that is how it is understood by default, V. Pislyakov writes, is in strict determination «synchronous two-year impact-factor excluding the current year».

It is calculated by the Institute for Scientific Information® – ISI and annually published in the JCR database. SCI appear more often (at least not in scientometrics circles) when comparing levels of journals. This index enables to evaluate how many times for a certain period "an average article" of a certain journal has been cited. *Classical impact-factor* is defined as the correlation between the number of references per year to the articles of a journal, published during two previous years, and the number of these articles. Due to a wide coverage of periodicals and informational feature, impact-factor has won world recognition, fell out of purely theoretical interest and began to be used widely in publishing and scientific circles as an approach to assess scientific journals and activity of certain scientists.

Analysis of citation enables to reveal significant results and evaluate productivity of the research work. This method is applied in scientometrics. Since 1993 International Society for Scientometrics and Infometrics – ISSI has been contributing to the development of this discipline. Probably, many scientists (and not only of our higher educational institution) have asked a question: «What, exactly, impact-factor should be considered high enough?». In this regard we would like to remind here that the world system of assessment of the rating of scientists and scientific journals on the basis of citation index and impact-factor was created and developed in practice by the Institute of Scientific Information, ISI, The Thomson Corporation, USA about 44 years ago. Impact-factor (IF) is calculated as the correlation of the number of citations made in a certain year in journals included in the ISI database on the articles published in the given journal during two preceding years and the number of articles published in the given journal during this period.

Impact-factor characterizing an international rating of a scientific journal, is annually calculated for all international authoritative journals

registered in the ISI database. ISI can provide any scientist who has published at least one article in the journal of this institute database with the information on citation index, the number of articles, and their citation frequency in other international editions. Every scientist dreams of publishing his research article in such journals as "Nature" which have the highest impact-factor in the world (more than 30) as there is a belief in the scientific world that publication in the journal "Nature is almost equivalent to receiving the Nobel Prize. However, publication even in journals with IF in the range from 3.0 to 7.0 is quite a challenge as despite the significant research result presented in the article corresponding to the world standards, editorial boards of such journals are reluctant to accept articles from researchers who do not have high citation index and have not published at least ten articles in international journals with relatively low or average impact-factor. At the same time we need to state here that IF does not always provide objective reflection of the journal rating and scientific level of the articles published in it. Actually, majority of "classical" scientific Russian journals published since the Soviet times (publishing house "Nauka") with Russian and English editions have an impact-factor of about 0.2 -1.3. However, any expert, comparing articles with close IF values published in Russian and foreign editions, will inevitably come to a conclusion that scientific level of publication in Russian journals of the publishing house "Nauka" is higher than in journals of foreign editions with similar impact-factor. Therefore we can say that for us, scientists from the CIS - region, an impact-factor over 0,2 (i.e. a nonzero impact-factor) can be considered as quite high and corresponding to an international level as publication in an edition even with lower IF value is anyway taken into account when calculating a scientist's or university's rating. Certainly, a publication in journals with high impact-factor of 3.0 and over is quite a complex challenge, and every time requirements to the level of the presented articles is increasing and their reviewing is becoming more rigid. It should be noted here that for the last years there have been distinct tendencies when practically all journals, even with quite small impact-factor (about 1.0) are increasing their requirements to the level of publications. Many editorials of such journals in particular require providing photos or even video materials which will not be published but can be used as additional evidence of reliability of the experimental data received by the author. In this regard at the initial stage some scientists can publish their works in Russian journals which have Russian and English versions so that to ensure reliable and rapid growth of their rating and citation index. As we have mentioned earlier such journals can have average and even low impact-factor but by their level surpass considerably similar journals with close IF value. Publications in Russian journals are quite well cited and promote increase of the rating of authors. Having several of these articles you can hope that in the future editorials of higher impact-factor journals will be willing to accept your articles as well. And in the nearest future you will be able to publish tens of articles in "big journals" with an impact-factor of over 3, and from there it is not too far from the "greatest" journal "Nature"…

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