
Research Support

Tools for science and research evaluation Scientometry

Scientometry deals with measuring quality and quantity in science. It also seeks and determines appropriate methods and metrics for measurements. "By its very nature, it monitors and evaluates communication in science, because all measurements are derived from interactions between individual elements of scientometry, citations form this basic interaction." With the arrival of databases, new forms of bibliometric research such as citation mapping began to develop.

Scientometry analyses scientific outputs based on scientific communication. Citation analysis is the basic method.

Citation analysis is a mathematical-statistical method, a basic research method in bibliometry and scientometry, which measures the relationships between authors, documents and scientific documents on the basis of bibliographic citations and references.

- It is an evaluation of the quality and relevance of scientific publications.
- It examines information sources, the frequency of citations, which citations appear together, which authors cite each other, or which sources are repeated in a given field.
- It is a basic method of scientometry and bibliometry.
- It uses data from citation index databases from the ISI Web of Science and the Scopus database.
- Citation analyses are used today mainly in the field of science evaluation.
- The results of citation analyses are directly dependent on the source of the data, its excerpt, the quality of the records and their metadata.
- When interpreting the results of citation analyses, it is always necessary to take into account the possibilities and limits of the methods and sources used.

Citation and publication analysis

Publication analysis is the basis of citation analysis. The two are inter-related. For a complete idea of the state of science in a given area, the publication itself of articles, books, etc. is first analysed. From the results of the citation analysis it is possible to observe: the performance of science, professional quality, influence and impact. The results depend on the data source, the excerpt (taking extracts/footnotes), or the metadata.

Initial hypotheses of the citation analysis:

- Source A, which cites source B, is semantically (regarding its meaning) related to this source
- According to the number of citations of the source, its significance can be assessed (the more citations, the more significant the source)

Publication analysis:

- Mathematical-statistical method dealing with the frequency of production of the publication and its measurement. The following is the most frequently studied: geographical and scientific area, time period, type of scientific literature and others.

Citation index

The citation index is a tool of citation analysis. It is about monitoring and recording the number of citations, according to other sources it can be any information source that uses a citation to refer to another document. The analysis of citation index can determine the future development of scientific disciplines.

Web of Science

- The Web of Science database contains easy-to-use tools for basic scientometric analyses
- It is an online version of the well-known Science Citation Index databases. It includes both citation monitoring of scientific articles and regularly updated bibliographic data (including abstracts) on articles from more than 21,000 leading worldwide scientific and professional journals from all fields of science with more than 60 years of retrospection.
- It contains Science Citation Index Expanded, Social Science Citation Index and Arts, Humanities Citation Index, Conference Proceedings Citation Index and Emerging Sources Citation Index
- ISI indexes from each issue of the journal all its essential elements: own articles, book reviews, databases, hardware, software, bibliographies, editorial materials, discussions, letters from readers, corrections, additions, chronologies and more.

Scopus

- Scopus is the largest citation and abstract database of peer-reviewed literature: scientific journals, books, and anthologies. It provides a comprehensive overview of the results of world research in the field of science, technology, medicine, social sciences and arts or humanities.
- It is equipped with intelligent tools for monitoring, analysis and visualization of research.

Basic concepts of citation analysis

Impact Factor:

Impact Factor (IF) is a measurement of the quality of scientific journals. It is defined as the ratio of the number of citations that were recorded in the evaluated year for all the articles published in a given journal in the previous two years, to the total number of all these articles.

Calculation:

- Each year, the impact factor for the previous two years is assigned to the periodical. Therefore, the impact factor for the year 2015 will use data from the years 2013 and 2014. The whole equation looks like this:
- $A / B = \text{impact factor of a given journal in 2015}$
- A = how many times articles from a given journal published in 2013-2014 were cited by other journals in 2015
- B = how many articles in total were published in it in the period 2013-2014 (correction articles, comments, etc. are not counted)

Article Influence Score (AIS):

- Indicator of a journal rating in JCR
- Used in governmental evaluations of science since 2017

SJR - SCImago Journal Rank:

- Indicator of a journal rating in Scopus
- Also used in governmental evaluations since 2017.

Journal ranking:

- Quartiles and deciles of the journal according to IF, AIS and SJR, i.e. the order of the journal in the given field according to an indicator.

Other methods of citation measurement:

The impact factor alone is not the only way to measure the value of an article or journal. For example, PageRank, Immediacy Index or Cited Half-life are also used.

H-index:

The H-index is a tool of scientometry. It is numerical data indicating the impact of a scientist's work on his/her field of activity. The number h is the number of works of a scientist with the number of citations greater than or equal to h. The total time of scientific activity is evaluated.

The H-index is given by the number h , which is the number of works that have been cited at least h times. The total number of works is N . Therefore $(N - h)$ works have less than h citations. The scientist with an index of 50 published 50 works, each of which was cited at least 50 times (There will, therefore, be at least $50 \times 50 = 2500$ citations).

The H-index assumes that a good scientist publishes sufficiently and is sufficiently cited. It also assumes that the work, which is cited many times, is of good quality – in this regard Hirsch is critical of the impact factor (it tells how many times the articles were cited - mostly during the year), which does not take into account the quality of each article separately and, therefore, the qualities of their authors.