SCIENTOMETRICS

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**Scientometrics** (term introduced by Nalimov & Mulchenko, 1969) The science of measurement and analysis of science

**Bibliometrics** (term introduced by Pritchard, 1969) Application of mathematical and statistical methods to books, articles and other means of communication

**Scientometrics** published since 1978 is an international journal for all quantitative aspects of the science, communication in science and science policy

**European Summer School for Scientometrics.**
ARGUMENTS IN FAVOR OF THE USE OF SCIENTOMETRICS

- The existence in France since 2006, of an organic law on finance laws (LOLF) which requires public research organizations to measure their performance.

- Scientometrics offers indicators used in monitoring the evolution of research, in the evaluation of research organizations or research laboratories, in the writing of reports.
  
  The evaluation is done at different levels:
  - macroscopic
  - mesoscopic
  - microscopic

- Scientometrics provides tools to the national assessment institution or to organizations that fund research projects (such as the National Agency Search or ANR) working tools.
I. SCIENTOMETRIC INDICATORS

Indicators must meet three basic requirements:

- be representative of the reality they measure;
- be sensitive, able to vary when the situation changes;
- to adapt to the specificities of each scientific discipline.
Two broad categories of indicators are used: indicators and means of bibliometric indicators.

A. FUNDING INDICATORS

- Government budget credits for research and development
- Domestic spending on research and development
- National spending for research and development
B. BIBLIOMETRIC INDICATORS

1-Output indicators:

- number of articles published in scientific journals, number of books and chapters published, number of papers presented at national and international scientific events;
- number of doctoral theses defended
2-Impact indicators (based mainly on quotations from the publications)

- The "impact factor" (IF). The IF was designed by Eugene Garfield, the founder of the Institute for Scientific Information (ISI), institute that belongs now to the Thomson Reuters Corporation.
THE EIGENFACTOR

- The Eigenfactor. This indicator was developed by Jevin West, Ben Althouse, Martin Rosvall, and Carl Bergstrom at the University of Washington and Ted Bergstrom at the University of California Santa Barbara.

*Eigenfactor Score*

*Article Influence*
3-Composite Indicators

- The h-index was proposed in 2005 by Jorge Hirsch. This index is the best known and most widely used bibliometric indicator.

Its calculation is based on:
- the number of articles produced (gross productivity of the researcher) and

- the number of times these articles are cited in other publications (which reflect the quality of his production).

The h-index favors older researchers and those working on key topics.
• The **g-index** was suggested by Leo Egghe in 2006 from Anvers university (Belgium). It is a variant of **h-index**.

This index is calculated based on the distribution of citations received by a given researcher's publications: given a set of articles ranked in decreased order of the number of citations that they received, the g-index is the (unique) largest number such that the top $g$ articles received (together) at least $g^2$ citations. The factor $g$ is always higher than that of factor $h$. 
II. SOURCES OF BIBLIOMETRIC INDICATORS

- **Web of Science (WoS)**
  - in the *first component* are archived *articles* in more than 10,000 international journals. This component of WoS is divided into three bases:
    (a) *Science Citation Index* for science, technology and medicine;
    (b) *Social Science Citation Index* for the social sciences and
    (c) *Arts & Humanities Citation Index* the humanities.

- the *second component* is related to the *media* of documents archived in WoS - periodicals, proceedings - and provides their impact factor. The second component of WoS is represented by the *Journal Citation Reports (JCR)* that exists since 1975.
- **Scopus** is a database belonging to the consortium Elsevier. Scopus is available by subscription and its address is: http://www.info.scopus.com

- **Google Scholar** was launched in 2004 and admission is free. It is a multidisciplinary database. Its coverage is unknown and moving.

*Publish or Perish Software* (created by Anne-Wil Harzing, 2006) is used on the data contained in Google Scholar.

Despite the limitations of Google Scholar, the HarzingPoP is recommended by most research structures as the only adequate assessment tool for humanities.
III. EVALUATION ACTIVITY OF UNIVERSITY RESEARCH IN FRANCE

The evaluation process is carried out at different *levels*:  
- at the level of the research units of the University - research laboratories and joint research units (University / National Center for Research);  
- at the level of entire university.

These two levels, which can be described as *internal*, involve a continuous assessment (throughout the year) and periodic (annual and five-year periods).

A national organization, created in 2006 - Agency for Research and Higher Education Assessment (AERES) - provides assessment every five years universities and university research structures through experts committees. AERES make public its assessments.
In some European countries, the formula adopted at the university level is that of the self-assessment by the researchers themselves. Self-assessment may take the form of a "SWOT" analysis (Strength, Weaknesses, Opportunities and Threats).
1-Reduces the evaluation to rigid quantitative indices.

2-The existence of variations in the method of indexation of publications in the database.

3-Bibliometrics applied at the individual level, for comparison, can be dangerous. Scientometricians believe that the use of this type of index should be limited to the analysis of the research activity in aggregates (such as university, region, country).
4-A bad article can be cited often because of criticism and controversy it generates, not because of its quality, its originality.

5-The use of indices and the pressure to publish promotes salami effect or salami-slicing, parroting and has also other negative effects – the brake on risk-taking, self-citation, and self-plagiarism.

6-The calculation of IF from periods of two years is not necessarily suitable for all fields of research. In some areas, periods of five years would be preferable.
7-The **IF may also be dependent** on the periodicity of the **review**, on the number of articles per issue, the number of review texts, the language and the alphabet used, the importance of self-citations.

8-An **article published in a journal with a lowest IF** can be as **good** as an article published in a journal with a higher IF.

9-The bibliometric tools developed in physical sciences are not suited or not entirely suited to the humanities and social sciences.
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EVALUATION AND RANKING OF UNIVERSITIES

- The Academic Ranking of World Universities or Shanghai ranking
- Times Higher Education and
- Webometrics Ranking of World Universities

• The European Union is trying to realize with the project U-Multirank mapping of the institutions that attempt to give an image more accurate to university rankings.

• Summit on Global Merit Review (May 2012, near Washington)
Global Research Council

All this shows that the dynamics observed will inevitably improve, improved methods of scientometrics.
Thank you for your attention!