

Bibliometrics: An overview

By Dr Michael Latham and Stuart Bentley

Introduction

Research support is an expanding area of activity for libraries in the HE sector. At the University of Hull, the recent reorganisation of Library and Learning Innovation involved a redistribution of expertise to meet the changing needs of the University, its staff and students. As part of this, a new Research Services Team was created to meet the needs of the research community and so contribute to a key strategic aim of increasing the quantity and quality of research outputs.

Research support at the University of Hull

The Research Services Team supports the University research community in its broadest sense, meeting the needs of faculty staff and student researchers. Specific areas of support include Open Access (OA) publishing, Research Data Management (RDM), copyright, research resource discovery, and bibliometrics. Support is provided by different modes of delivery, including face to face teaching and advocacy, online learning tools and support guides, and other promotional initiatives.

Impact factors

Impact factors measure how quickly and how often articles in a specific journal are cited by authors of other articles, allowing a comparison of how heavy an impact that journal has within a particular discipline.

The ability to assess the impact of research publications is a growing area of importance for researchers, in terms of securing funding, career development and research output dissemination strategies. Bibliometrics provides a quantitative analysis of the influence of research. It looks at the citation counts for articles to see how they have impacted on the research landscape and with the introduction of altmetrics looks at how the influence of the article can be measured. It stands alongside qualitative measures of excellence such as peer review. Available metrics can be differentiated as to what is being measured in terms of impact:

Authors and Institutions

Citation counts, publication counts, h-index

Articles

Citation counts, Facebook/Twitter mentions

Journals

Journal impact factor, SCImago journal rank, Eigenfactor

Subjects

Highly-cited papers, hot papers, journal impact factor

It is worth noting that citation measures are most developed for research in the sciences and social sciences. The arts and humanities, due to disciplinary differences, have less tools available for such analysis. It is also difficult to compare impact factors of journals in different discipline areas as citation practices vary between disciplines.

Bibliometrics have the following limitations:

- Not established for all disciplines
- Citation practices vary from one discipline to another
- High number of citations does NOT imply high value
- Potential manipulation, e.g. “group” citing, splitting research between multiple articles
- Coverage of sources other than journal articles can be poor

The following points should be born in mind when trying to raise a research profile:

- Use a consistent form of your name wherever possible
- Use an author ID system, e.g. ResearcherID, ORCID
- Ensure you include your institutional affiliation
- Promote your research via appropriate social media
- Use self-citation in a responsible way

There are a number of different tools available to collect bibliometrics, many commercial and some free to use. The free to use resources tend to be available on an individual registration basis, so can be recommended to researchers with the proviso that they will need to register themselves.

Web of Science

Web of Science is a platform provided by Thomson Reuters and includes a number of different databases and services which can help track bibliometrics. Two major products in the field of bibliometrics are only available through Web of Science: Journal Citation Reports and Essential Science Indicators. These products have strong functionality for analysing bibliometrics - see below for more details.

Web of Science is multi-disciplinary but its bibliometric tools only cover titles in the sciences and social sciences. Also not all journal titles take part in JCR and ESI.

You can also get a quick snapshot from Web of Science itself, although you need to restrict your search to the Web of Science Core Collection. When the results are displayed, you will quickly see those papers which are identified in ESI as either Highly Cited Papers or Hot Papers. And if you click on the journal name, you will see a pop-up window which gives the 2-year and 5-year impact factors for the journal, as well as its ranking in the subject categories to which it has been assigned.

Journal Citation Reports compiles cited references to articles to measure the impact factor and citation rates at journal and category levels. It covers 10,800 journals in the sciences and social sciences from over 2,550 publishers in 232 disciplines from 83 countries. This breaks down to over 8,400 journals in the Sciences and over 3,000 journals in the Social Sciences edition.

An impact factor of 1.0 shows that on average the articles in the journal published one or two years ago have been cited once. It is also possible to include a 5 year impact factor and to look back at the impact factors for a number of years to see whether the journal's impact is increasing or waning.

Data in JCR is updated on an annual basis, meaning that in a given year, data for a previous year is added to the product.

Essential Science Indicators (access via Web of Science) ranks scientists, institutions, countries and journals in 22 specific fields across 12 million articles from 12,000 journal titles. It includes baselines which allow researchers to analyse the benchmarks by which research impact is assessed. The authors of papers are matched to institutions and the institutions normalised. Information in Essential Science Indicators is updated more frequently than JCR.

ESI identifies Top Papers which consist of two categories:

Highly Cited Papers – These are chosen from 10 years of data and measure citation on the basis of the field the paper was published in and when it was published.

Hot Papers – These are papers from the past two years that show an unusually high rate of citation in the current period.

Scopus

Scopus is a citation database provided by Elsevier. It features metrics that allow researchers to assess journals, articles and authors which are gathered at <http://www.journalmetrics.com>. The assessment is based only on journals featured within Elsevier's database.

The major tool for this is Compare Journals, which compares up to 10 journals on IPP, Impact per Publication, and SNIP, Source Normalised Impact per Publication.

Scopus data is also surfaced in Scimago which has a journal rank indicator, and CWTS - see below for more details. Alternatively, you can get a quick snapshot for a particular journal by clicking on the journal name in the list of results of a search. You will be presented with the SCImago journal rank, IPP and SNIP for the journal in question.

The Compare journals function in Scopus allows you to compare up to 10 journals and view various metrics in either graphical or tabular format.

The SCImago Journal & Country Rank includes indicators for journals and countries using the Scopus database.

CWTS journal indicators is a source of free access to bibliometrics for scientific journals, and has been calculated by the Centre for Science and Technology Studies (CWTS) at Leiden University using the Scopus database to provide indicators for over 20,000 journals. The two main indicators available are:

RIP (Raw impact per publication) - equivalent to Scopus's IPP (Impact Per Publication) - average number of citations per publication.

SNIP (Source normalized impact per publication) - average number of citations per publication, corrected for differences in citation practices between fields.

Google Scholar

An alternative and free source of metrics is Google Scholar. To use the citation analysis option in Google Scholar, you will need the Publish or Perish software, which is available for free download at <http://www.harzing.com/pop.htm>. Publish or Perish interrogates Google Scholar for raw citation details which are then analysed for the following:

- Total number of papers and total number of citations
- Average citations per paper, citations per author, papers per author, and citations per year
- Hirsch's h-index and related parameters
- Egghe's g-index
- The contemporary h-index
- Three variations of individual h-indices
- The average annual increase in the individual h-index
- The age-weighted citation rate
- An analysis of the number of authors per paper.

Altmetrics

A recent development in the area of bibliometrics is altmetrics. Altmetrics measure impact in a different way. They take into account the rise of social media in the raising of research profiles through the analysis of activity in online tools and environments. As such they can be helpful in discovering where research has affected policy or been discussed in the media and therefore assessing the social impact of research.

- Altmetric.com provide a free tool for gathering altmetrics on specific papers at <http://www.altmetric.com/researchers.php>.
- Altmetrics.org have a directory of altmetric apps at <http://altmetrics.org/tools/> and their manifesto regarding altmetrics is at <http://altmetrics.org/manifesto/>.
- Altmetrics are also being incorporated into databases and you can find altmetric data in Scopus and in Cinahl Complete, and in some journal platforms like Taylor and Francis.
- Cinahl Complete features information on social media mentions for some articles. Where this information is available, the Plum Print icon will show and you can click on this to get further details.
- For some articles in Scopus, you will see additional citation information provided by Altmetric - this appears when you display the full reference for the article you are interested in.

Do it yourself

It is also possible, with a bit of work, to create your own bibliometrics. However, it requires a lot of time, powerful computers and a good mathematical brain. We don't do this at the University of Hull but there are organisations with their own bibliometricians.

Navigating the bibliometrics landscape

As can be seen above there are a number of applications of bibliometrics and tools for their collection within the HE sector and beyond. Uses can range from benchmarking the quality of research in a department or institution, to helping researchers further their career.

It is important to recognise that if you use the commercial tools, they are calculated slightly differently in each tool and usually only on the basis of journals that feature in their respective databases. Therefore it is possible to come up with different scores for the same journal, article or author, depending on the source used. If you have access to multiple tools, you will need to decide which result you will use or if you will try to use the results from each tool to come to a normalised score.

It is also important to remember that bibliometrics are open to criticism as primarily a quantitative measurement of quality and should be considered alongside other qualitative measures to get a round picture of the actual quality of a resource. Altmetrics, a rapidly developing area, are a possible source of such data and are likely to have greater importance as they mature.

It is a rapidly changing landscape and one to keep an eye on. As such you might want to join LIS-BIBLIOMETRICS on JiscMail for all the current news.

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Glossary

Eigenfactor : A rating of the impact of a scientific journal by measuring the number of citations to a particular journal. Within JCR, eigenfactor scores for all journals sum to 100. Developed by Carl Bergstrom and Jevin West at the University of Washington and available at <http://www.eigenfactor.org>.

G-index : Suggested by Leo Egghe, this is an index for quantifying scientific productivity of an author. An author's articles are ranked in decreasing order of the number of citations received and the g-index is the unique largest number such that the top g articles received together at least g^2 citations.

H-index : Suggested by Jorge E. Hirsch, this is an index for quantifying scientific productivity of an author. A scholar with an index of h has published h papers which have each been cited h times.

ORCID : ORCID ID is a persistent digital identifier that uniquely identifies a particular researcher and can be linked to other identifiers. Researchers can register for free at <http://orcid.org>, though many institutions are implementing ORCID on an organisational level.

ResearcherID : ResearcherID is Thomson Reuters' unique identifier scheme which is ORCID compliant and integrates with Web of Science. Researchers can register for free at <http://www.researcherid.com>.

SCImago : a research group from the Consejo Superior de Investigaciones Cientificas, University of Granada, Extremadura, Carlos III (Madrid) and Alcala de Henares who have produced a Journal and Country Rank portal at <http://www.scimagojr.com>.