

Countries

Typical areas of analysis include international benchmarking and analyses of individual countries, the number of publications and their development, citation impact, the proportion of the number of publications to research years or research funding (input-output analyses), publication collaboration and the distribution of publishing activities by sector within a country.

It can be difficult to identify research trends when only examining a single country. In fact, comparisons between several countries may be more informative. In addition, a temporal comparison gives a more complete and reliable picture of a country's development.

How are countries analysed?

Examples of perspectives that can be used when examining countries' publishing activities include:

- **Citation impact** ([Chapter Citation impact indicators](#))
- **Number of publications and their development** ([Chapter Productivity indicators](#))

A country's fractionalised publication count represents the country's contribution to co-publications. In the calculation of fractionalised publication numbers, international co-publications are fractionalised equally between the participating countries and the sum of the shares per country is 1.0. It is also possible to fractionalise by the number of authors, for example.

In the calculation of full publication counts, international co-publications are included at full weighting in the number of publications for each country. Calculated in this way, the number of publications indicates the number of publications each country has participated in.

A comparison of publication volumes between countries should be carried out by using fractionalised publication volumes. Examining the trend in the number of publications provides a broader perspective than a single year or four-year period.

- **Distribution of publishing activities within a country**

The number of publications or citation impact can be further broken down within a country, by, for example, field of science, sector (universities, research institutions, companies – public and private sectors), language, research funder or participating organisation. The number of publications can also be examined from a perspective such as open access publishing or collaboration (e.g. the proportion of open-access publications or publications produced in collaboration with companies).

- **Proportion of the number of publications to research years or research funding (input-output analyses)**

Interesting, new insights can be gained by analysing the number of publications in relation to research years or research funding, for example.

- **Publication collaboration between countries**

When examining publication collaboration, international co-publications (at least one author from outside the country under review), national co-publications (at least two organisations from the country under review) and publications produced within a country's research organisations are distinguished. Bilateral collaboration means that, in addition to the organisations in the country under review, an author or authors from exactly one other country have been involved in the production of the publication. Typically, international publications have a higher citation impact than publications produced nationally or within a research organisation. However, it should be noted that the importance of internationalisation varies between fields of science and countries. It is more important in Finland than, for example, in the United States. You can read more about the accumulation of citations in publications and the role of internationality in citation numbers in the [Citations](#) and [Differences between fields of science](#) chapters of this guide.

- **International benchmarking and analyses of individual countries**

Countries can be compared, for example, based on the number of publications (by field of science) or the number of citations received by publications. A country can be compared with other countries or groups of countries (e.g. EU, OECD). When choosing the countries to compare, it is worth considering factors such as the comparability and scale of a country's R&D system. It can be difficult to identify research trends when only examining a single country. In fact, comparisons between several countries may be more informative. A longer time period usually gives a more complete picture of a country's development.

Tools for examining countries include:

- **Reports for science policy purposes**, e.g. reports by national research funders and in Finland, [the State of scientific research in Finland reports](#) carried out by the Academy of Finland.



Responsible analysis of countries

Interpreting bibliometric indicators at macro level when examining countries is not straightforward and requires a critical approach. Country-specific reviews may be based on different indicators, the results of which may be contradictory. This also allows for a purposeful choice of indicators.

There are many ways to calculate a simple indicator such as the number of publications produced by a country. There are at least three methods for calculating the number of international co-publications. Publications can be fractionalised by country according to the number of authors from each country (fractionalised publication count), or they can be counted directly in each country's publications (full publication count). The third method is to count publications only for the country represented by the first author. The full publication count represents the number of publications in which a country or organisation has participated. The fractionalised publication count shows the contribution of a country or group of countries to co-publications. A comparison of publication volumes between countries should be carried out by using fractionalised publication volumes.

The State of scientific research in Finland statistics cover research funding, staff and scientific publishing. The focus is on research sectors, individual research organisations and discipline groups, but Finland is also compared with key benchmarking countries when it comes to research funding and scientific publishing. Countries comparable to Finland in size and research system in Europe are the Netherlands, Belgium, Ireland, Austria, Norway, Sweden, Switzerland and Denmark. Of the major traditional science nations, the United Kingdom, France, Germany and the United States are involved. China is included in the analyses to represent large, emerging science nations.

- **Vipunen bibliometric reports** - [the reports based on the Web of Science database](#) and [the reports based on the Scopus database](#)

The Vipunen bibliometric reports provide an overview of the number of publications, scientific citation impact and publication cooperation by field of science in Finland and various reference countries. For Finland, analyses are also presented by publication cooperation between national research organisations and by the cooperation countries of Finland.

- **Research.fi visuals** ([Figures on science and research – Research.fi](#))

The Figures on science and research section contains visualised information on Finnish research funding, human resources, publishing activities and scientific citation impact. The section also includes international comparisons of Finland with EU and OECD countries, for example.

The data is based on the Finnish National Agency for Education's Education Statistics Finland service Vipunen, the statistics of Statistics Finland and the data of the Finnish Immigration Service. International comparisons are carried out using OECD's statistics and the European Union's CORDIS service. The Publication activity and scientific impact section also includes data from Clarivate Analytics' Web of Science publication database.

- **Other possible sources for international comparison** include research funders: Nordic funders, [German Research Foundation DFG](#) – Deutsche Forschungsgemeinschaft or [the US NSF](#) – National Science Foundation and [National Science Board's Science and Engineering Indicators](#) | [NCSES](#) | [NSF](#).

International operators such as OECD ([OECD iLibrary \(oecd-ilibrary.org\)](#)), EU ([EUROSTAT Publications - Science, technology and innovation - Eurostat \(europa.eu\)](#)) and the European Commission [Statistics | European Commission \(europa.eu\)](#)), NordForsk and the Nordic Council of Ministers ([Nordic Statistics database](#)) publish statistics and reports on RDI activities.

The ETER database ([European Tertiary Education Register \(eter-project.com\)](#)) provides statistical information on higher education institutions in Europe. The publicly available [Scimago Journal & Country Rank \(scimagojr.com\)](#) portal is based on the information contained in the Scopus database.

- **Analytical products by private companies**
 - [Dimensions](#)
 - [InCites](#)
 - [Essential Science Indicators](#)
 - [SciVal](#)

When examining countries, it should also be noted that the citation indicators provide one approach to examining scientific impact but do not give an overall picture of the level of research on their own. Publications in the humanities and several social sciences, in particular, are under-represented in international citation databases. Counting indexed publications in these databases alone does not reflect the true extent of publishing activities in the country under review. In the evaluation of scientific quality, peer review is a key method.

It can be difficult to identify research trends when only examining a single country. In fact, comparisons between several countries may be more informative. When choosing the countries to compare, it is worth considering factors such as the comparability and scale of a country's RDI system. Responsible evaluation also takes into account the extent of the country's international collaboration and its potential impact on the analysis of publication productivity or citation impact.

When carrying out citation-based analyses, it is important to remember that citations accumulate slowly for articles.