SDG indicator metadata

(Harmonized metadata template - format version 1.1)

0. Indicator information (SDG_INDICATOR_INFO)

0.a. Goal (SDG_GOAL)

Goal 9: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation

0.b. Target (SDG_TARGET)

Target 9.5: Enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, in particular developing countries, including, by 2030, encouraging innovation and substantially increasing the number of research and development workers per 1 million people and public and private research and development spending

0.c. Indicator (SDG_INDICATOR)

Indicator 9.5.2: Researchers (in full-time equivalent) per million inhabitants

0.d. Series (SDG_SERIES_DESCR)

Applies to all series

0.e. Metadata update (META_LAST_UPDATE)

2023-03-31

0.f. Related indicators (SDG_RELATED_INDICATORS)

Linkages with goals and targets: 9.b, 12.a, 17.6, 17.7, 17.8

Linkages with indicators: Not applicable

0.g. International organisations(s) responsible for global monitoring (SDG_CUSTODIAN_AGENCIES)

UNESCO Institute for Statistics (UIS)

1. Data reporter (CONTACT)

1.a. Organisation (CONTACT_ORGANISATION)

UNESCO Institute for Statistics (UIS)

2. Definition, concepts, and classifications (IND_DEF_CON_CLASS)

2.a. Definition and concepts (STAT_CONC_DEF)

Definitions:

The researchers (in full-time equivalent - FTE) per million inhabitants is a direct measure of the number of research and experimental development (R&D) workers per 1 million people.

Concepts:

The Organisation for Economic Co-operation and Development (OECD) Frascati Manual (OECD, 2015) provides the relevant definitions for research and experimental development (R&D), gross domestic expenditure on research and experimental development (R&D) and researchers. Although an

Organisation for Economic Co-operation and Development (OECD) manual, the application is global. During the 6th revision of the Frascati Manual, developing country issues were mainstreamed in the core of the Manual. The 7th edition was released in October 2015.

The following definitions, taken from the 2015 edition of the Frascati Manual are relevant for computing the indicator.

Research and experimental development (R&D) comprise creative and systematic work undertaken in order to increase the stock of knowledge – including knowledge of humankind, culture and society – and to devise new applications of available knowledge.

Researchers are professionals engaged in the conception or creation of new knowledge. They conduct research and improve or develop concepts, theories, models, techniques instrumentation, software or operational methods.

The Full-time equivalent (FTE) of research and experimental development (R&D) personnel is defined as the ratio of working hours actually spent on research and experimental development (R&D) during a specific reference period (usually a calendar year) divided by the total number of hours conventionally worked in the same period by an individual or by a group.

2.b. Unit of measure (UNIT_MEASURE)

Per million population

2.c. Classifications (CLASS_SYSTEM)

The main methodological guide, which provides international standard guidelines for measuring research and experimental development (R&D) is the Organisation for Economic Co-operation and Development (OECD) Frascati Manual (Frascati Manual 2015: Guidelines for Collecting and Reporting Data on Research and Experimental Development: http://www.oecdilibrary.org/science-and-technology/frascati-manual-2015_9789264239012-en).

In addition to the above, the following international classifications are used to facilitate the research and experimental development (R&D) data compilation process and the presentation of research and experimental development (R&D) statistics by various disaggregation:
International Standard Industrial Classification of All Economic Activities
(ISIC), Rev. 4, United Nations (2008):
https://unstats.un.org/unsd/publication/seriesm/seriesm_4rev4e.pdf.
International Standard Classification of Education (ISCED) 2011, UNESCO-UIS (2012):
www.uis.unesco.org/Education/Documents/isced-2011-en.pdf.
International Standard Classification of Occupations (ISCO), International Labour Organization (2012):
www.ilo.org/public/english/bureau/stat/isco/isco08/index.htm.

3. Data source type and data collection method (SRC_TYPE_COLL_METHOD)

3.a. Data sources (SOURCE_TYPE)

Data are collected through national research and experimental development (R&D) surveys, either by the national statistical office or a line ministry (such as the Ministry for Science and Technology).

3.b. Data collection method (COLL_METHOD)

The UNESCO Institute for Statistics (UIS) sends out a questionnaire every year to collect research and experimental development (R&D) data from all countries (around 125 countries), which are not covered by the data collections of the other partner organizations such as the Organisation for Economic Co-operation and Development (OECD), Eurostat (Statistical Office of the European Union) and the Network on Science and Technology Indicators – Ibero-American and Inter-American (RICYT). In agreement with these three organisations, their data (which were collected from their member states/associated member states – around 65 countries-) are directly obtained from the respective databases (in the case of the Organisation for Economic Co-operation and Development - OECD and Statistical Office of the European Union - Eurostat) or received from the partner (in the case of the Network on Science and Technology Indicators – Ibero-American and Inter-American - RICYT). There is also collaboration in Africa with the African Science, Technology and Innovation (STI) Indicators Initiative (ASTII) of the African Union Development Agency-NEPAD (AUDA-NEPAD).

For the countries to which the UNESCO Institute for Statistics (UIS) sends a questionnaire, the process is the following:

(i) A questionnaire is sent to focal points in countries, generally within the Ministry of Science and Technology or the national statistical office.
(ii) The UNESCO Institute for Statistics (UIS) processes the questionnaires, communicating with the countries in case of questions, calculates indicators and releases the data and indicators on its website.
(iii) Countries are requested to complete the questionnaire using the standard international classifications, therefore adjustments are generally not needed.

The other agencies have similar procedures.

3.c. Data collection calendar (FREQ_COLL)

The UNESCO Institute for Statistics (UIS) sends out the questionnaire in June every year. The Organisation for Economic Co-operation and Development (OECD) and the Statistical Office of the European Union (Eurostat) collect data twice per year. The Network on Science and Technology Indicators – Ibero-American and Inter-American (RICYT) collects data once per year.

3.d. Data release calendar (REL_CAL_POLICY)

March and October every year

3.e. Data providers (DATA_SOURCE)

Data are collected through national research and experimental development (R&D) surveys, either by the national statistical office or a line ministry (such as the Ministry for Science and Technology).

3.f. Data compilers (COMPILING_ORG)

The UNESCO Institute for Statistics (UIS), Organisation for Economic Co-operation and Development (OECD), Eurostat (Statistical Office of the European Union) and the Network on Science and Technology Indicators – Ibero-American and Inter-American (RICYT), African Science, Technology and Innovation (STI) Indicators Initiative (ASTII) of the African Union Development Agency-NEPAD (AUDA-NEPAD).

3.g. Institutional mandate (INST_MANDATE)

The UNESCO Institute for Statistics (UIS) is the statistical branch of the United Nations Educational, Scientific and Cultural Organization (UNESCO). The Institute produces internationally comparable data and methodologies in the fields of education, science, culture and communication for countries at all stages of development.

4. Other methodological considerations (OTHER_METHOD)

4.a. Rationale (RATIONALE)

The indicator is a direct measure of the number of research and experimental development (R&D) workers per 1 million people referred to in the target.

4.b. Comment and limitations (REC_USE_LIM)

Research and experimental development (R&D) data need to be collected through surveys, which are expensive, and are not done on a regular basis in many developing countries. Furthermore, (developing) countries do not always cover all sectors of performance. In particular the business sector is not always covered.

4.c. Method of computation (DATA_COMP)

Computation of the indicator Researchers (in full-time equivalent) per million inhabitants uses available population data as denominator.

The number researchers (in full-time equivalent - FTE) per million inhabitants *($RES_{Density}$)* is calculated as:

$$RES_{Density} = \frac{Total\ researchers\ (FTE)}{Total\ population\ of\ the\ country} \times 1{,}000{,}000$$

where *'Total researchers (FTE)'* is calculated as:

$$Total\ researchers\ (FTE) = Number\ of\ full-time\ researchers + \left[\frac{Number\ of\ working\ hours\ spent\ on\ R\&D\ by\ part-time\ researchers}{Number\ of\ normative\ or\ statutory\ working\ hours\ of\ a\ full-time\ researcher}\right]$$

4.d. Validation (DATA_VALIDATION)

For each questionnaire received from countries where the UNESCO Institute for Statistics (UIS) sends questionnaire to, the UNESCO Institute for Statistics (UIS) executes a series of quality checks and sends back a data processing report identifying problematic issues/inconsistent data to countries for their feedback, corrections as well as validation of indicators.

4.e. Adjustments (ADJUSTMENT)

To inform of any discrepancies between standard classifications and national practices, appropriate footnotes are accompanied with data/indicators to adequately document the results and provide explanations.

4.f. Treatment of missing values (i) at country level and (ii) at regional level (IMPUTATION)

- **At country level**
  Missing data are not estimated by the UNESCO Institute for Statistics (UIS).

- **At regional and global levels**
  Imputations are based on interpolations or extrapolations of data for other reference years. Second option is to make an estimate for full-time equivalent (FTE) based on available headcount data. In case no data are available at all, the unweighted regional average is used as an estimate.

4.g. Regional aggregations (REG_AGG)

Missing data are imputed using the methodology described above. The data for researchers in full-time equivalent (FTE) are then added up by region and divided by the population data for that region. Similar for the global total.

4.h. Methods and guidance available to countries for the compilation of the data at the national level (DOC_METHOD)

Countries are responsible themselves for the collection of research and experimental development (R&D) data at the national level, compile national totals and submit them to international organisations. All countries follow the guidelines of the Frascati Manual: http://www.oecd-ilibrary.org/science-and-technology/frascati-manual-2015_9789264239012-en.

All countries follow the international guidelines of the Organisation for Economic Co-operation and Development (OECD) Frascati Manual: http://www.oecd-ilibrary.org/science-and-technology/frascati-manual-2015_9789264239012-en. Countries starting to measure research and experimental development (R&D) can use the UNESCO Institute for Statistics (UIS) Technical Paper 11 for assistance, which can be downloaded here: http://uis.unesco.org/sites/default/files/documents/guide-to-conducting-an-rd-survey-for-countries-starting-to-measure-research-and-experimental-development-2014-en.pdf.

4.i. Quality management (QUALITY_MGMNT)

The UNESCO Institute for Statistics (UIS) maintains a set of data processing guidelines/standards as well as data processing tools to facilitate processing of data and ensure the quality of data.

4.j Quality assurance (QUALITY_ASSURE)

The process of quality assurance includes review of survey documentations/metadata, examination of reliability of data, make sure they comply with international standards (including the Organisation for Economic Co-operation and Development - OECD Frascati Manual), and examine the consistency and coherence within the data set as well as with the time series of data and the resulting indicators. During the data processing stage, for each questionnaire received from countries where the UNESCO Institute for Statistics (UIS) sends questionnaire to, the above quality aspects are looked into and a data report is produced identifying problematic issues/inconsistent data for each respective country. The UNESCO Institute for Statistics (UIS) sends such data reports, including the calculated indicators for target 9.5, providing the countries with the opportunity to review the data/indicators and submit any clarifications or modifications/additions before releasing data at the UNESCO Institute for Statistics (UIS) Data Centre and submitting the data to UN Statistics Division for inclusion in the global SDG Indicators Database.

4.k Quality assessment (QUALITY_ASSMNT)

The data should comply with the concepts/definitions and guidelines provided in the international standards (i.e. the Organisation for Economic Co-operation and Development - OECD Frascati Manual) and should cover all sectors of performance, representing all institutions, which are engaged in research and experimental development (R&D) activities in the country. Criteria for quality assessment include: data sources must include proper documentation; data values must be nationally representative, if not, should be footnoted; data are plausible and based on trends and consistency with previously published/reported values.

5. Data availability and disaggregation (COVERAGE)

Data availability:
Data available for over 140 countries for Researchers (in full-time equivalent - FTE) per million inhabitants

Time series:
Data available in the UNESCO Institute for Statistics (UIS) database since reference year 1996, but historical data available back to 1981

Disaggregation:
Researchers can be broken down by sector of employment, field of science, sex and age.

6. Comparability / deviation from international standards (COMPARABILITY)

Sources of discrepancies:
There are no differences in the underlying data. Difference may occur due to the use of difference data for the denominator used to calculate indicators.

7. References and Documentation (OTHER_DOC)

URL:

www.uis.unesco.org

References:

OECD (2015), Frascati Manual 2015: Guidelines for Collecting and Reporting Data on Research and Experimental Development, The Measurement of Scientific, Technological and Innovation Activities, OECD Publishing, Paris. DOI: http://dx.doi.org/10.1787/9789264239012-en.

UNESCO Institute for Statistics (UIS) Data centre: http://data.uis.unesco.org/index.aspx?queryid=3685