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Institute for Statistics

# Metadata for Other Policy Relevant Indicators (OPRI) – R&D

## Percentage of female researchers (in headcounts - HC)

### Definition

- Researchers (HC) - % Female:
  The number of female researchers, measured in headcounts - HC, in the national territory during a specific reference period expressed as a percentage of the total number of researchers (male and female, also measured in headcounts – HC).
- Female researchers as a percentage of total researchers (HC) – Sector of employment:
  The number of female researchers at a given sector of employment, measured in headcounts – HC, in the national territory during a specific reference period expressed as a percentage of the total number of researchers at the same sector (male and female, also measured in headcounts – HC). The following sectors of employment are considered: Business enterprise, Government, Higher education, and Private non-profit.

The following concepts, taken from the Frascati Manual (OECD, 2015)[1] 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. The term R&D covers three types of activity: Basic research, Applied research, and Experimental development.
- R&D personnel include all persons engaged directly in R&D, as well as those providing direct services for the R&D activities (such as R&D managers, administrators, technicians and clerical staff). R&D personnel are classified according to their R&D function: Researchers, Technicians and Other supporting staff. They are measured in Full-time equivalent (FTE) and Headcounts (HC).

[1] The main methodological guide, which provides international standard guidelines for measuring 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://dx.doi.org/10.1787/9789264239012-en).

- 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 headcount (HC) of R&D personnel is defined as the total number of individuals contributing to intramural R&D, during a specific reference period (usually a calendar year).
- The Full-time equivalent (FTE) of R&D personnel is defined as the ratio of working hours actually spent on 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.
- Sector of employment:
  - Business enterprise sector (for R&D data): The Business enterprise sector comprises: i). All resident corporations, including not only legally incorporated enterprises, regardless of the residence of their shareholders. This group includes all other types of quasi-corporations, i.e. units capable of generating a profit or other financial gain for their owners, recognised by law as separate legal entities from their owners, and set up for purposes of engaging in market production at prices that are economically significant; ii). The unincorporated branches of non-resident enterprises are deemed to be resident because they are engaged in production on the economic territory on a long-term basis; iii). All resident non-profit institutions (NPIs) that are market producers of goods or services or serve business; iv). This sector comprises both private and public enterprises.
  - Government sector (for R&D data): The Government sector consists of the following groups of resident institutional units: i). All units of central (federal), regional (state) or local (municipal) government, including social security funds, except those units that provide higher education services or fit the description of higher education institutions (see the definition of Higher education sector); ii). All non-market NPIs that are controlled by government units that are not part of the Higher education sector; iii). This sector does not include public corporations, even when all the equity of such corporations is owned by government units. Public enterprises are included in the Business enterprise sector.
  - Higher education sector (for R&D data): The Higher education sector comprises: i). All universities, colleges of technology and other institutions providing formal tertiary education programmes (i.e. ISCED levels 5, 6, 7, or 8), whatever their source of finance or legal status; ii). All research institutes, centres, experimental stations and clinics that have their R&D activities under the direct control of, or are administered by, tertiary education institutions.
  - Private non-profit sector (for R&D data): The Private non-profit (PNP) sector comprises: i). All non-profit institutions serving households (NPISH), except those classified as part of the Higher education sector; ii). Households and private individuals engaged or not engaged in market activities.

**Purpose**
This indicator shows the gender composition of the research workforce. The indicator helps to assess the need for opportunities and incentives as well as to strengthen the participation of women in the research profession.

**Calculation method**

- Researchers (HC) - % Female:
  The indicator is calculated by dividing the number of female researchers (measured in headcounts - HC) in the national territory during a given year by the total number of researchers (male and female, also measured in headcounts – HC) and multiplied by 100.

$$Researchers\ (HC) -\ \%\ Female_{\square} = \frac{Female\ researchers\ (HC)_{\square}}{Total\ researchers\ (HC)} \times 100$$

where '*Researchers (HC)*', for '*Total*' and '*Female*' is derived as:

$$Researchers\ (HC) = Number\ of\ full\ time\ researchers + Number\ of\ part\ time\ researchers$$

- Female researchers as a percentage of total researchers (HC) – Sector of employment:
  The indicator is calculated by dividing the number of female researchers at a given sector of employment (measured in headcounts - HC) in the national territory during a given year by the total number of researchers at the same sector (male and female, also measured in headcounts – HC) and multiplied by 100.

$$Female\ researchers\ as\ a\ percentage\ of\ total\ researchers\ (HC)_{(sector\ of\ employment:\ x)} = \frac{Female\ researchers\ (HC)_{(sector\ of\ employment:\ x)}}{Total\ researchers\ (HC)_{(sector\ of\ employment:\ x)}} \times 100$$

where '*sector of employment: x*' are: Business enterprise, Government, Higher education, and Private non-profit.

and '*Researchers (HC)*', for '*Total*' and '*Female*' is derived as:

$$Researchers\ (HC) = Number\ of\ full\ time\ researchers + Number\ of\ part\ time\ researchers$$

**Interpretation**
Values approaching 50% indicates gender parity in the composition of the research workforce.

**Type of data source**
National R&D surveys, and/or data compiled through administrative data sources.

**Disaggregation**
Researchers can be typically broken down by sector of employment, field of R&D, level of qualification, age, and sex.

**Data required**
R&D personnel by function, sector of employment and sex (number): Total number of R&D personnel and its breakdown by function (Researchers, Technicians and equivalent staff, and Other supporting staff) and sex, with further disaggregation by the sectors they are employed in (business enterprise, government, higher education and private non-profit organizations). They are measured in headcounts (HC) and full-time equivalents (FTE).

**Data sources**
At the national level, data sources for R&D statistics are nationally representative R&D surveys, and/or data compiled through administrative data sources or data derived by a combination of the two, by the National Statistical Offices or relevant line ministries such as the Ministry of Science and Technology.

**Quality assurance**
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.

The process of quality assurance includes review of survey documentations/metadata, examination of reliability of data, making sure they comply with international standards (including the OECD Frascati Manual), and examining 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 UIS sends questionnaires to, the above quality aspects are looked into and a data report is produced identifying problematic issues/inconsistent data for each respective country. The 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 UIS Data Centre and submitting the data to UN Statistics Division for inclusion in the global SDG Indicators Database.

The underlying R&D data compiled at the national level should comply with the concepts/definitions provided in the international standards (i.e., Frascati Manual). According to the guidelines, the reported data should cover all sectors of performance (government, higher education, business enterprise and private non-profit sectors, as defined in the Frascati Manual), representing all institutions, which are engaged in R&D activities in a particular 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.

**Limitations and comments**

R&D data need to be collected through surveys, which are expensive. In addition, they are not collected on a regular basis in many developing countries and not all sectors of R&D performance (those mentioned above in the section of 'Data required') are fully covered. In some cases, certain sectors are partially covered, and in particular, the business enterprise sector is often not covered.

## Metadata for Other Policy Relevant Indicators (OPRI) – R&D

### Percentage of female researchers (in full-time equivalents - FTE)

**Definition**

- Researchers (FTE) - % Female:
  The number of female researchers, measured in full-time equivalents - FTE, in the national territory during a specific reference period expressed as a percentage of the total number of researchers (male and female, also measured in full-time equivalents - FTE).
- Female researchers as a percentage of total researchers (FTE) – Sector of employment:
  The number of female researchers at a given sector of employment, measured in full-time equivalents - FTE, in the national territory during a specific reference period expressed as a percentage of the total number of researchers at the same sector (male and female, also measured in full-time equivalents - FTE). The following sectors of employment are considered: Business enterprise, Government, Higher education, and Private non-profit.

The following concepts, taken from the Frascati Manual (OECD, 2015)[2] 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. The term R&D covers three types of activity: Basic research, Applied research, and Experimental development.
- R&D personnel include all persons engaged directly in R&D, as well as those providing direct services for the R&D activities (such as R&D managers, administrators, technicians and clerical staff). R&D personnel are classified according to their R&D function: Researchers, Technicians and Other supporting staff. They are measured in Full-time equivalent (FTE) and Headcounts (HC).
- 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.

[2] The main methodological guide, which provides international standard guidelines for measuring 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://dx.doi.org/10.1787/9789264239012-en).

- The Full-time equivalent (FTE) of R&D personnel is defined as the ratio of working hours actually spent on 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.
- The headcount (HC) of R&D personnel is defined as the total number of individuals contributing to intramural R&D, during a specific reference period (usually a calendar year).
- Sector of employment:
  - Business enterprise sector (for R&D data): The Business enterprise sector comprises: i). All resident corporations, including not only legally incorporated enterprises, regardless of the residence of their shareholders. This group includes all other types of quasi-corporations, i.e. units capable of generating a profit or other financial gain for their owners, recognised by law as separate legal entities from their owners, and set up for purposes of engaging in market production at prices that are economically significant; ii). The unincorporated branches of non-resident enterprises are deemed to be resident because they are engaged in production on the economic territory on a long-term basis; iii). All resident non-profit institutions (NPIs) that are market producers of goods or services or serve business; iv). This sector comprises both private and public enterprises.
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**Purpose**

This indicator shows the gender composition of the research workforce. The indicator helps to assess the need for opportunities and incentives as well as to strengthen the participation of women in the research profession.

**Calculation method**

- Researchers (FTE) - % Female:
  The indicator is calculated by dividing the number of female researchers (measured in full-time equivalents - FTE) in the national territory during a given year by the total number of researchers (male and female, also measured in full-time equivalents - FTE) and multiplied by 100.

$$Researchers\ (FTE)\ -\ \%\ Female_{\square} = \frac{Female\ researchers\ (FTE)_{\square}}{Total\ researchers\ (FTE)} \times 100$$

where '*Researchers (FTE)*', for '*Total*' and '*Female*' is derived as:

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

- Female researchers as a percentage of total researchers (FTE) – Sector of employment:
  The indicator is calculated by dividing the number of female researchers at a given sector of employment (measured in full-time equivalents - FTE) in the national territory during a given year by the total number of researchers at the same sector (male and female, also measured in full-time equivalents - FTE) and multiplied by 100.

$$Female\ researchers\ as\ a\ percentage\ of\ total\ researchers\ (FTE)_{(sector\ of\ employment:\ x)} = \frac{Female\ researchers\ (FTE)_{(sector\ of\ employment:\ x)}}{Total\ researchers\ (FTE)_{(sector\ of\ employment:\ x)}} \times 100$$

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**Interpretation**
Values approaching 50% indicates gender parity in the composition of the research workforce.

**Type of data source**
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**Disaggregation**
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**Data required**
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**Limitations and comments**

R&D data need to be collected through surveys, which are expensive. In addition, they are not collected on a regular basis in many developing countries and not all sectors of R&D performance (those mentioned above in the section of 'Data required') are fully covered. In some cases, certain sectors are partially covered, and in particular, the business enterprise sector is often not covered.

Data on R&D personnel (including 'researchers') are typically compiled/reported in headcounts (HC) and full-time equivalent (FTE). These are two different units of measurement to account for human resources devoted to R&D. However, the unit of underlying data (i.e., number of researchers broken down by sex) used for the following indicators, "Percentage of female researchers (in full-time equivalents - FTE)" is in FTEs. In some developing countries, data on the number of researchers broken down by sex are only collected/reported in HCs and they lack the data based on FTEs.