



INSTRUCTION MANUAL

Questionnaire on Research and Experimental Development (R&D) Statistics

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INTRODUCTION

The survey on Research and Experimental Development (R&D) Statistics forms part of the strategy of the UNESCO Institute for Statistics (UIS) to improve its statistical programme and to develop and deliver timely, accurate and policy-relevant statistics. The objective of this questionnaire is to collect the most recent data on science, technology and innovation (STI), specifically on resources devoted to R&D.

This questionnaire aims to collect data for the year **2013** and prior. These data will be used to update the UIS STI database which can be accessed through the UIS Data Centre at <http://www.uis.unesco.org/datacentre> and will be published in reports prepared by UNESCO, other UN agencies, and public and private institutions or individuals worldwide. This instruction manual has been prepared to help data producers in Member States to complete the questionnaire **UIS_RD_2014**.

The definitions and classifications presented in this manual are based on the *Recommendation concerning the International Standardization of Statistics on Science and Technology* (UNESCO, 1978) and the *Frascati Manual* (OECD, 2002).

Submission of questionnaires

The electronic questionnaires are available at:
<http://www.uis.unesco.org/UISQuestionnaires/Pages/country.aspx>

Completed questionnaires should be sent by email attachment to: uis.survey@unesco.org

If you experience problems accessing the site or for any questions related to the data collection, please contact the UIS at uis.survey@unesco.org or by telephone at +1 514 343 6880.

1. COVERAGE OF THE QUESTIONNAIRE

The tables in this questionnaire refer to resources devoted to R&D, as defined in **Definition 1**.

Definition 1. Research and experimental development (R&D)

R&D comprise creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of humanity, culture and society, and the use of this stock of knowledge to devise new applications. The term R&D covers three activities: basic research, applied research and experimental development.

Basic research is experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundation of phenomena and observable facts, without any particular application or use in view.

Applied research is also original investigation undertaken in order to acquire new knowledge. It is, however, directed primarily towards a specific practical aim or objective.

Experimental development is systematic work, drawing on existing knowledge gained from research and/or practical experience, which is directed to producing new materials, products or devices, to installing new processes, systems and services, or to improving substantially those already produced or installed. R&D covers both formal R&D in R&D units and informal or occasional R&D in other units.

The questionnaire is designed to include data on all institutions carrying out R&D activities in your country. These include the four sectors as defined by the *Frascati Manual* (see also **Definition 2**):

- Business enterprises;
- Government;
- Higher education; and
- Private non-profit organizations.

Only one questionnaire per country should be completed, filled in either by the institution responsible for science and technology (S&T) policy or STI statistics (i.e. Ministry of Science and Technology, Ministry of Research and Higher Education, or National S&T Council) or the National Statistical Office.

The reported data should cover all sectors (described in Definition 2), even if some institutions fall under the authority of other ministries or data are collected by various institutions. Additionally, the **UIS encourages all countries to make their own estimations of missing or incomplete data**, since the UIS does not always have all the necessary elements for making the most accurate estimations.

Definition 2. Sectors

The **business enterprise** sector includes:

- All firms, organizations and institutions whose primary activity is the market production of goods or services (other than higher education) for sale to the general public at an economically significant price.
- The private non-profit institutions mainly serving them.

The **government** sector is composed of:

- All departments, offices and other bodies which furnish, but normally do not sell to the community, those common services, other than higher education, which cannot otherwise be conveniently and economically provided, as well as those that administer the state and the economic and social policy of the community. (Public enterprises mainly engaged in market production and sale of goods and services are included in the business enterprise sector.)
- Non-profit institutions controlled and mainly financed by government, not administered by the higher education sector.

The **higher education** sector is composed of:

- All universities, colleges of technology and other institutions providing tertiary education (i.e. ISCED 5, 6, 7 or 8), whatever their source of finance or legal status.
- It also includes all research institutes, experimental stations and clinics operating under the direct control of or administered by or associated with higher education institutions.

The **private non-profit** sector includes:

- Non-market, private non-profit institutions serving households (i.e. the general public).
- Private individuals or households.

For more detailed definitions and guidelines on their application, please refer to the OECD *Frascati Manual* (OECD, 2002).

2. INSTRUCTIONS FOR COMPLETING THE QUESTIONNAIRE

R1. GENERAL INFORMATION

Question 1 identifies the person responsible for completing the questionnaire, as well as information related to the head of the institution. This information will be used to update the UIS database of “National Institutions Responsible for R&D Statistics”. Therefore, **it is very important to complete this section**, even if your country has no new information to provide. The person identified as being responsible for completing the questionnaire will act as liaison should the UIS need further clarification on responses.

If data are not for the calendar year, **Question 2** requests you to provide information on the starting and ending date of the data reported in this questionnaire. Expenditure data in this questionnaire should be reported in millions of national currency. Question 2 also requests you to provide the name of the currency which is reported in this questionnaire.

Question 3 covers the basic methodologies used to collect the data. This information will be incorporated into a database of metadata and will aid in the assessment of data comparability and quality. If the methodologies for collecting data on R&D personnel and R&D expenditure (*please see Definitions 3 and 8 of this manual*) are different within the same sector, please indicate R&D personnel with a “P” and R&D expenditure with an “E” under the respective methodologies. Any additional information on methodologies used should be written in the “Notes” section.

To identify the scope of the responses provided, please identify in **Question 4** whether the data provided cover the whole country or only a limited number of sectors or parts of sectors (i.e. some or all of the following: business enterprises, government institutions, higher education or private non-profit organizations). If coverage of some sectors is partial, please give details in the “Notes” section (i.e. which institutions or sub-sectors are included and which are not). If coverage of data related to R&D personnel and R&D expenditure is different within the same sector, please provide details.

HUMAN RESOURCES IN R&D

Tables R2 to R5 seek detailed information on human resources devoted to R&D, especially researchers (*see Definition 3*).

Definition 3. R&D personnel

R&D personnel are all persons employed directly on R&D, as well as those providing direct services such as R&D managers, administrators, and clerical staff. Persons providing an indirect service, such as canteen and security staff, should be excluded.

Headcounts (HC) and full-time equivalents (FTE): Data for this section should be reported in headcounts (HC) and full-time equivalents (FTE) respectively. These are two different methods of accounting for human resources. HC are data on the total number of persons who are mainly or partially employed in R&D. This includes staff employed both “full-time” and “part-time”. FTE

data are a measure of the actual volume of human resources devoted to R&D and are especially useful for international comparisons.

Definition 4. Measurement units of R&D personnel

Headcount data reflect the total number of persons employed in R&D, independently from their dedication. These data allow links to be made with other data series, such as education and employment data, or the results of population censuses. They are also the base for calculating indicators analysing the characteristics of the R&D workforce, with respect to age, gender or national origin.

One **full-time equivalent** may be thought of as one person-year. Thus, a person who normally spends 30% of his/her time on R&D and the rest on other activities (such as teaching, university administration and student counselling) should be considered as 0.3 FTE. Similarly, if a full-time R&D worker is employed at an R&D unit for only six months, this results in an FTE of 0.5. However, for reporting purposes, the total sum of FTEs should be rounded to the next integer, avoiding the reporting of decimals.

A number of restrictions apply to the actual measurement of FTE. It is therefore impossible to avoid differences in the methodology used for different countries and sectors. The most precise method, which is applied in some OECD countries in the higher education sector, involves carrying out time-use surveys for each individual researcher. However, more approximate methods are often used in practice. One method often used consists of counting the number of positions for each category of personnel, then multiplying by appropriate R&D coefficients. In some cases, the R&D coefficients used are founded on survey data of some sort, while in others they are simply based on assumptions made by those who compile the statistics.

The following formula can be used to calculate R&D personnel in FTE:

FTE=(dedication to the employment: full-time/part-time) x (portion of the year active on R&D) x (time or portion spent on R&D)

For example:

- A full-time employee spending 100% of time on R&D during a year: $(1 \times 1 \times 1) = 1$ FTE
- A full-time employee spending 30% of time on R&D during a year: $(1 \times 1 \times 0.3) = 0.3$ FTE
- A full-time R&D worker who spends 100% of time on R&D and is employed at an R&D institution for only six months: $(1 \times 0.5 \times 1) = 0.5$ FTE
- A full-time employee spending 40% of time on R&D during half of the year (person is only active for 6 months per year): $(1 \times 0.5 \times 0.4) = 0.2$ FTE
- A part-time employee (working 40% of the year) engaged only in R&D (spending 100% of time on R&D) during a year: $(0.4 \times 1 \times 1) = 0.4$ FTE
- A part-time employee (working 40% of the year), spending 60% of time on R&D during half of the year (person is only active for 6 months per year): $(0.4 \times 0.5 \times 0.6) = 0.12$ FTE
- 20 full-time employees spending 40% of time on R&D during a year: $20 \times (1 \times 1 \times 0.4) = 8$ FTE

Reference year: Since this survey seeks to update and complete the UIS database, **Table R2** requests data for the last five years (2009 to 2013). If data for previous years are available, please complete and submit a separate questionnaire and indicate if they replace data submitted to the UIS in previous questionnaires.

Tables R3 to R5 request data for only the **latest available year**. If data for 2013 are not available, then please provide data for the latest year in the period 2009-2013. The reference year is set to 2013 by default and is indicated at the top of each table. If the most recent data available are for a different year, please enter the relevant reference year in the space provided above the table. If you have detailed data for other years in this period, please complete and submit a separate questionnaire for the given reference period.

Each table in the questionnaire includes a “Not specified” column or row or both. If some of the data requested in a particular table cannot be listed by the categories given, please include such data in the “Not specified” column or row or both (depending on the table) and describe the nature of these data using a comment.

TOTAL R&D PERSONNEL

In **Tables R2 and R3**, please report data on R&D personnel by occupation, sex and sector of employment.

Table R2: R&D personnel by occupation and sex (headcounts and full-time equivalents)

This table measures the total number of R&D personnel and its breakdown by occupation (see **Definition 5**) and sex, based on the classification provided in the *Frascati Manual*.

Definition 5. R&D occupations

Researchers are professionals engaged in the conception or creation of new knowledge, products, processes, methods and systems and also in the management of the projects concerned. Postgraduate students at the PhD level (ISCED level 8) engaged in R&D should be considered as researchers.

Technicians and equivalent staff are persons whose main tasks require technical knowledge and experience in one or more fields of engineering, physical and life sciences (technicians) or social sciences and humanities (equivalent staff). They participate in R&D by performing scientific and technical tasks involving the application of concepts and operational methods, normally under the supervision of researchers.

Other supporting staff includes skilled and unskilled craftsmen, secretarial and clerical staff participating in R&D projects or directly associated with (or providing services to researchers involved in) such projects.

Table R3: R&D personnel by occupation, sector of employment and sex (headcounts and full-time equivalents)

This table measures sectoral distribution of the total number of R&D personnel and its breakdown by occupation and sex, based on the classification provided in the *Frascati Manual*.

RESEARCHERS

Data requested in **Tables R4 and R5** seek information on **researchers** instead of R&D personnel.

Table R4: Researchers by sector of employment, qualification and sex (headcounts and full-time equivalents)

This table reflects the educational qualifications of researchers (ISCED level of the **highest level of education** attained), broken down by the sector in which they develop their R&D activities and sex (see **Definition 6**). Please note that it applies to researchers only, and not technical and other staff.

The breakdown by level of qualification is designed to classify researchers according to the highest education level completed: Doctoral or equivalent level (ISCED 8), Master's or equivalent level (ISCED 7), Bachelor's or equivalent level (ISCED 6), short-cycle tertiary education (ISCED 5) and all other types of diplomas or qualifications, including other post-secondary non-tertiary diplomas, secondary diplomas (ISCED 0-4), etc. If some of the data cannot be listed by education level, please include such data in the "Not specified" row and describe these data using a comment.

Please note that definitions for ISCED levels are based on the ISCED 2011 classification, available at: <http://www.uis.unesco.org/isced>

Table R5: Researchers by sector of employment, field of science and sex (headcounts and full-time equivalents)

This table reflects the distribution of researchers by field of science of their main R&D activity, broken down by the sector in which they are employed and sex.

The classification of **fields of science** follows the guidelines specified by UNESCO in the Recommendation of 1978, adopted by the OECD in the *Frascati Manual* (and *Revised Fields of Science and Technology Classification*, 2006) (see **Definition 7**) and, in this survey, is limited to the first level.

Definition 6. ISCED levels

ISCED level 8 – Doctoral or equivalent level. Programmes at ISCED level 8 are designed primarily to lead to an advanced research qualification. Programmes at this ISCED level are devoted to advanced study and original research and are typically offered only by research-oriented tertiary educational institutions such as universities. Doctoral programmes exist in both academic and professional fields (UNESCO-UIS, 2012, §259).

ISCED level 7 – Master’s or equivalent level. Programmes at ISCED level 7 are often designed to provide participants with advanced academic and/or professional knowledge, skills and competencies, leading to a second degree or equivalent qualification. Programmes at this level may have a substantial research component but do not yet lead to the award of a doctoral qualification. Typically, programmes at this level are theoretically-based but may include practical components and are informed by state-of-the-art research and/or best professional practice. They are traditionally offered by universities and other tertiary educational institutions (UNESCO-UIS, 2012, §241).

ISCED level 6 – Bachelor’s or equivalent level. Programmes at ISCED level 6 are often designed to provide participants with intermediate academic and/or professional knowledge, skills and competencies, leading to a first degree or equivalent qualification. Programmes at this level are typically theoretically-based but may include practical components and are informed by state-of-the-art research and/or best professional practice. They are traditionally offered by universities and equivalent tertiary educational institutions (UNESCO-UIS, 2012, § 224). First degree programmes at this level typically have a duration of three to four years of full-time study at the tertiary level (UNESCO-UIS, 2012, §229).

ISCED level 5 – Short-cycle tertiary education. Programmes at ISCED level 5 are often designed to provide participants with professional knowledge, skills and competencies. Typically, they are practically-based, occupationally-specific and prepare students to enter the labour market. However, these programmes may also provide a pathway to other tertiary education programmes. Academic tertiary education programmes below the level of a Bachelor’s programme or equivalent are also classified as ISCED level 5 (UNESCO-UIS, 2012, §207).

All other qualifications (ISCED 4 and below). This includes ISCED 4 (post-secondary non-tertiary education), ISCED 3 (upper secondary education) and below.

Definition 7. Fields of science and technology

Recommendation concerning the International Standardization of Statistics on Science and Technology (UNESCO, 1978) and Frascati Manual (OECD, 2002 and Revised Fields of Science and Technology Classification, 2006)

1. NATURAL SCIENCES

1.1 Mathematics

1.2 Computer and information sciences

1.3 Physical sciences

1.4 Chemical sciences

1.5 Earth and related environmental sciences

1.6 Biological sciences

1.7 Other natural sciences

2. ENGINEERING AND TECHNOLOGY

2.1 Civil engineering

2.2 Electrical engineering, electronic engineering, information engineering

2.3 Mechanical engineering

2.4 Chemical engineering

2.5 Materials engineering

2.6 Medical engineering

2.7 Environmental engineering

2.8 Environmental biotechnology

2.9 Industrial biotechnology

2.10 Nano-technology

2.11 Other engineering and technologies

3. MEDICAL AND HEALTH SCIENCES

3.1 Basic medicine

3.2 Clinical medicine

3.3 Health sciences

3.4 Health biotechnology

3.5 Other medical sciences

4. AGRICULTURAL SCIENCES

4.1 Agriculture, forestry and fisheries

4.2 Animal and dairy science

4.3 Veterinary sciences

4.4 Agricultural biotechnology

4.5 Other agricultural sciences

5. SOCIAL SCIENCES

5.1 Psychology

5.2 Economics and business

5.3 Educational sciences

5.4 Sociology

5.5 Law

5.6 Political science

5.7 Social and economic geography

5.8 Media and communications

5.9 Other social sciences

6. HUMANITIES

6.1 History and archaeology

6.2 Languages and literature

6.3 Philosophy, ethics and religion

6.4 Art (arts, history of arts, performing arts, music)

6.5 Other humanities

EXPENDITURE ON R&D

This section seeks detailed information on the actual expenditure on R&D (see **Definition 8**) in order to better understand the activities carried out by countries. These data also describe the environment in which researchers conduct their work.

Definition 8. R&D expenditure

R&D expenditure includes all expenditure for R&D performed within a sector of the economy, including both:

- *current costs* (labour costs, such as annual wages and salaries and all associated costs of researchers, technicians and supporting staff; and other current costs, such as non-capital purchases of materials, supplies and R&D equipment, i.e. water, fuel, gas, electricity; books, journals, reference materials, subscriptions to libraries, scientific societies; and materials for laboratories); and
- *capital expenditure* (annual gross expenditure on fixed assets used in the R&D programmes of statistical units, i.e. expenditure on land and buildings, instruments and equipment, and computer software. It should be reported in full for the period when it took place and should not be registered as an element of depreciation).

The **full procedure for measuring R&D expenditure** (adapted from the *Frascati Manual*) is as follows:

- Identify the institutions (statistical units) that perform R&D in the different sectors.
- Identify (survey) the intramural expenditure on R&D (the expenditure carried out within the boundaries of an institution, i.e. not out-contracted) performed by each statistical unit.
- Identify the sources of funds for these R&D expenditure as reported by the performer.
- Aggregate the data by sectors of performance and sources of funds to derive significant national totals.

This section includes five tables (Tables R6 to R10), requesting the total expenditure on R&D and its breakdown by sector of performance, source of funds, field of science, type of costs and type of R&D activity.

Reference year: Since this survey seeks to update and complete the UIS database, **Table R6** requests data for the last five years (2009 to 2013). If data for previous years are available, please complete and submit a separate questionnaire and indicate if they replace data submitted to the UIS in previous questionnaires.

Tables R7 to R10 request data for only the **latest available year**. If data for 2013 are not available, then please provide data for the latest year in the period 2009-2013. The reference year must be stated in the space provided above the table.

Currency and unit: Expenditure data in this questionnaire are requested in **millions of national currency**.

Table R6: Total expenditure on R&D in millions of national currency

This table measures the **total amount of expenditure on R&D** over the various years. If the data on actual amounts spent on R&D are not available, please provide estimated data calculated using budget allocations for R&D or other methodologies and explain these data using a comment.

Data are expected to be reported in **millions** of current national currency (this is expenditure at current prices in national currency) for each year, without adjusting to constant currency and without using exchange rates. Question 2 in Table R2 already requested the name of the currency which is reported in this questionnaire.

Table R7: Total expenditure on R&D by sector of performance and source of funds (millions of national currency)

This table measures the amounts spent on R&D for the latest available year by institutions corresponding to each of the different sectors (business enterprise, government, higher education, private non-profit organizations), financed by the different sectors of the economy (business enterprise, government, higher education, private non-profit organizations), as well as from abroad. If the sectors in which certain R&D was performed are unknown, or if the source for some financing of R&D is not available, include the relevant R&D expenditure in the "Not specified" column and/or row and describe such data using a comment.

Definitions for the different sectors can be found in **Definitions 2 and 9**.

Definition 9. Sources of funds

Definitions for institutional coverage for different sectors (business enterprise, government, higher education, private non-profit organizations) which financed R&D can be found in Definition 2. In addition to these sectors, funds from 'Abroad' should be considered.

Abroad consists of:

- All institutions and individuals located outside the political borders of a country; and
- All international organizations (except business enterprises), including facilities and operations within the country's borders.

For the correct identification of a **flow of funds between institutions**, two criteria must be fulfilled:

- There must be a direct transfer of resources; and
- The transfer must be both intended and used for the performance of R&D.

Table R8: Total expenditure on R&D by sector of performance and field of science (millions of national currency)

This table measures the amounts spent on R&D for the latest available year in the main fields of science (natural sciences, engineering and technology, medical and health sciences, agricultural sciences, social sciences, humanities) in each of the sectors of performance (business enterprise, government, higher education, private non-profit organizations). If the sectors in which certain R&D was performed are unknown, or if the fields in which certain R&D was performed are unknown, include relevant R&D expenditure in the “Not specified” row and describe such data using a comment.

Definitions for the different fields of science are provided in Definition 7.

Table R9: Total expenditure on R&D by sector of performance and type of cost (millions of national currency)

This table measures the amounts spent on R&D for the latest available year by type of cost (i.e. current costs and capital expenditure) in each of the sectors of performance (business enterprise, government, higher education, private non-profit organizations). If the type of cost for certain R&D is unknown, include relevant R&D expenditure in the “Not specified” row and describe such data using a comment.

Definitions for the different types of cost can be found in Definition 8.

Table R10: Total expenditure on R&D by sector of performance, type of R&D activity and cost (millions of national currency)

This table measures the amounts spent on R&D for the latest available year on different types of R&D activities (i.e. basic research, applied research, experimental development) in each of the sectors of performance (business enterprise, government, higher education, private non-profit organizations). Data are requested separately for total expenditure on R&D (current and capital) and for current cost only. If the types in which certain R&D was performed are unknown, include relevant R&D expenditure in the “Not specified” row and describe such data using a comment.

Definitions for the different types of R&D activities can be found in Definition 1.