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COMMUNICATION

ON RESEARCH AND DEVELOPMENT STATISTICS FOR 2018

As the official producer of research and development (R&D) statistics in Montenegro, the Ministry of Science is publishing key R&D statistics for 2018. This year, all mandatory indicators with breakdowns defined in the EU Commission Implementing Regulation for statistics on science and technology (995/2012) have been produced, in line with the methodological guidelines defined in the Guidelines for collecting and reporting data on research and experimental development (Frascati Manual, OECD, 2015). Data are produced within 18 months following the end of the year observed, and are published nationally and submitted to Eurostat.

R&D statistics provide internationally comparable data on total R&D spending and R&D staff. R&D data are collected pursuant to the Statistical Survey Programme for 2016, adopted by the Government of Montenegro, according to which the Ministry of Science is the official collector and producer of R&D statistics since 2016.
Data are collected from reporting units – entities conducting R&D activities based on their financial and staff records. Data have been collected from units within four sectors of implementation: higher education, government, business-entrepreneurial and private non-profit sector, on a census basis.

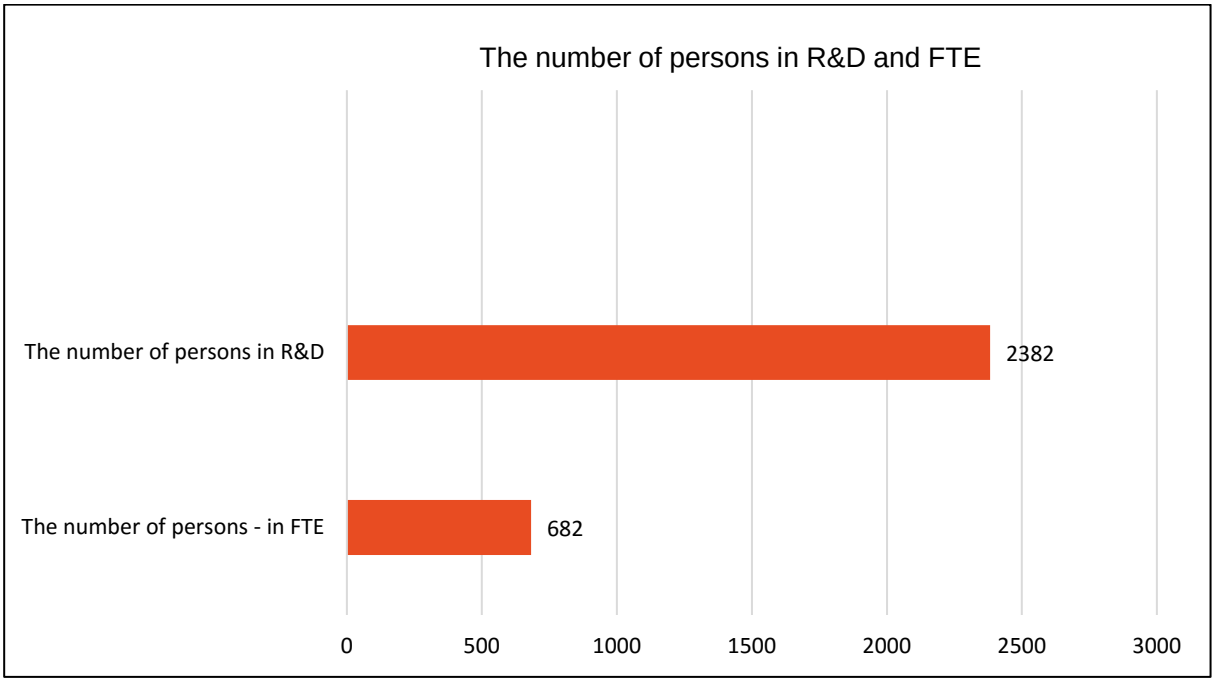
The results of this survey indicate the following:

- The total domestic spending on research and development in 2018 amounted to 0.50% of GDP[1], i.e. gross expenditures for R&D amounted to **EUR 23,490,044**.

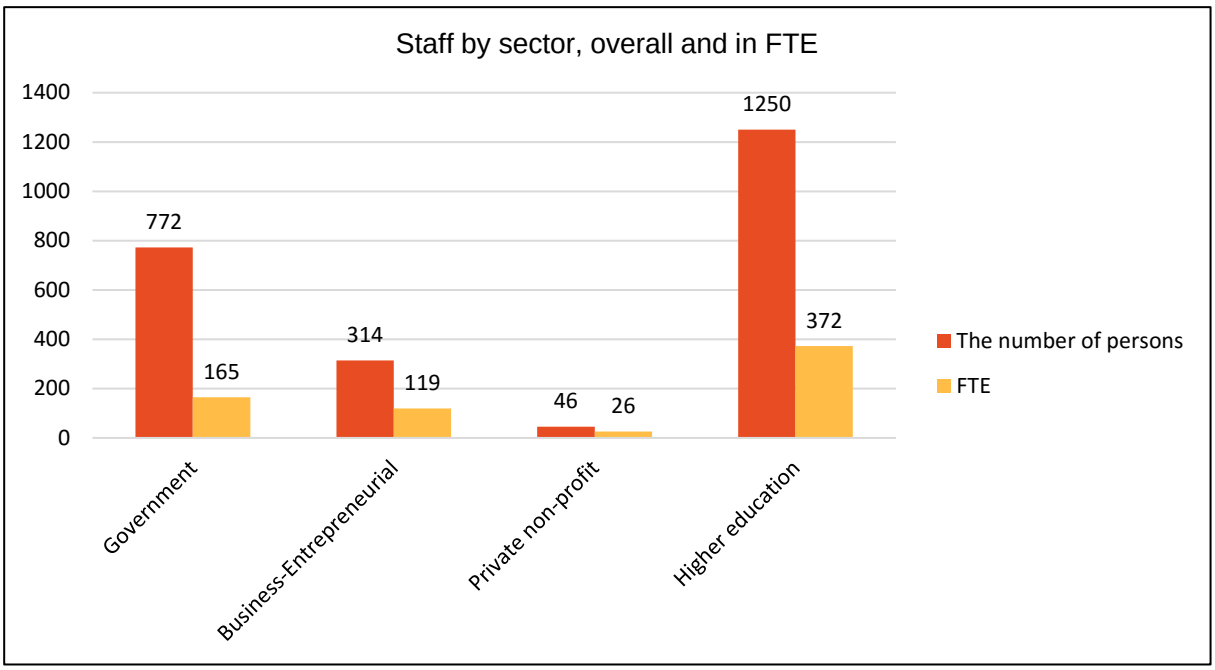
- In 2018, **2382 persons** were engaged in research and development activities in organisations, institutions and companies active in this field, including **1596 researchers, 501 professional associates and 285 supporting staff members.**

- Given that R&D activities represent only part of the work engagement of most employees, actual engagement is shown through the full-time equivalent, which is the ratio of hours devoted by one employee to R&D and the total number of working hours. In 2018, FTE amounted to **682 persons** (2382 persons were involved in R&D in total), which is best illustrated by the following chart.

[1] GDP (at current prices) of Montenegro in 2018 amounted to EUR 4,663,000,000 (Monstat)

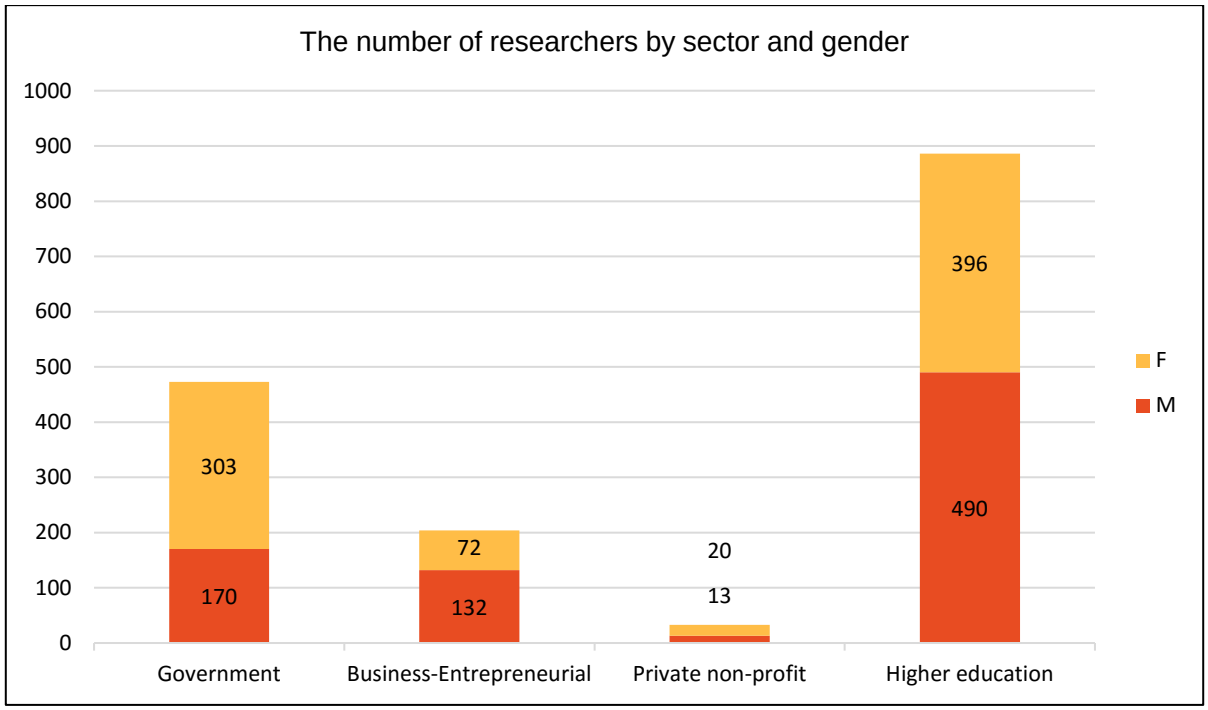


The chart below shows the overall number of employees in research and development by sector of implementation, and the corresponding full-time equivalent values.

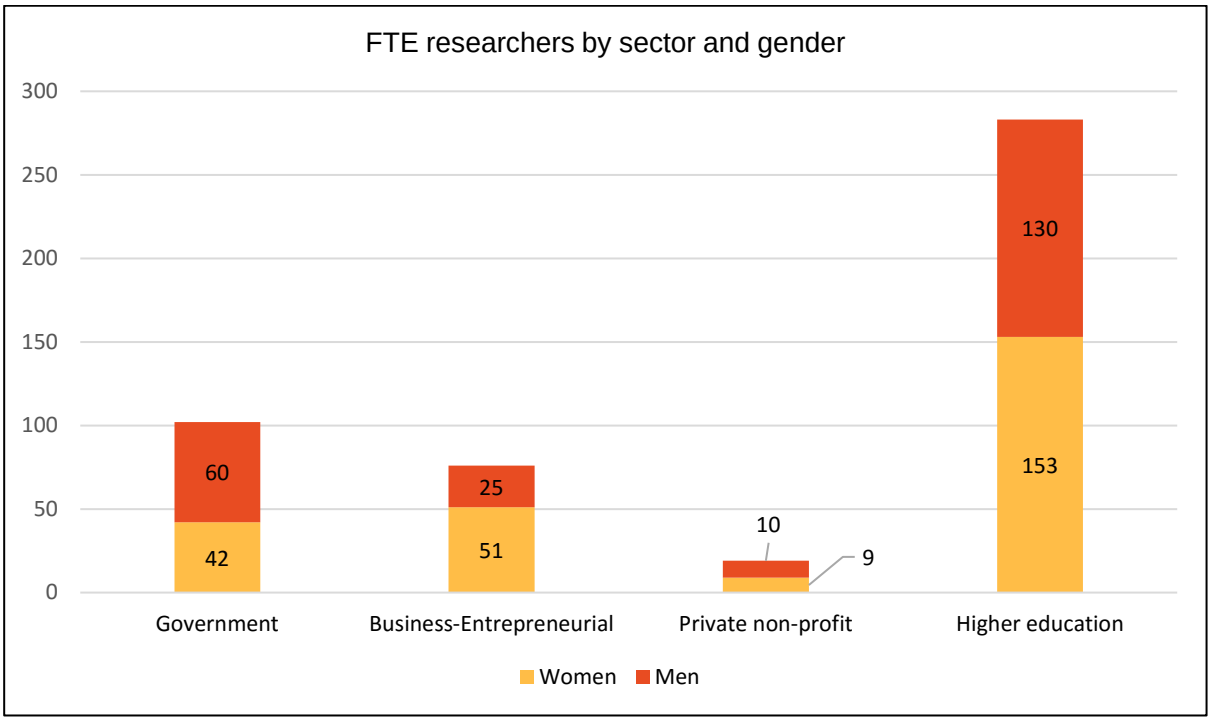


Data on staff

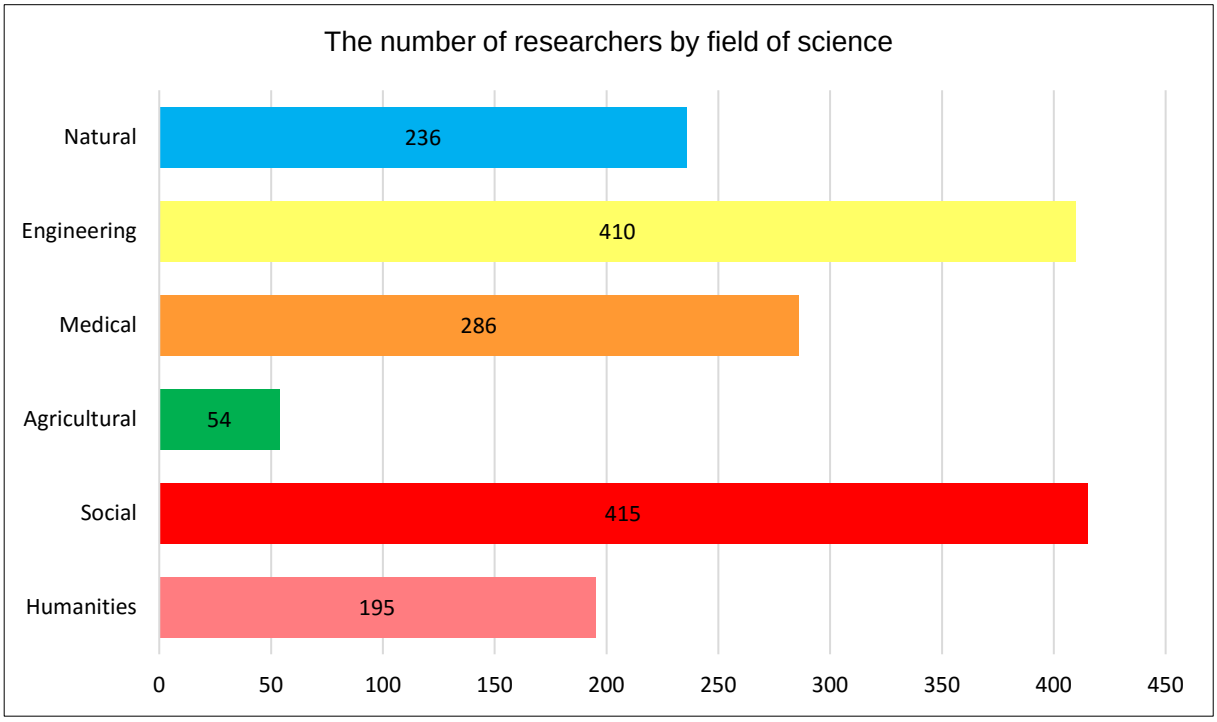
As regards the key staff in research and development – **researchers, in 2018, there were 1596 of them**, including 809 researchers with doctoral degree (ISCED 8), 632 with master's degree (ISCED 7), and 155 who completed the first higher education cycle.
Out of the total number of researchers, 791 were women, and 805 men. The chart below shows their distribution by sector of implementation.



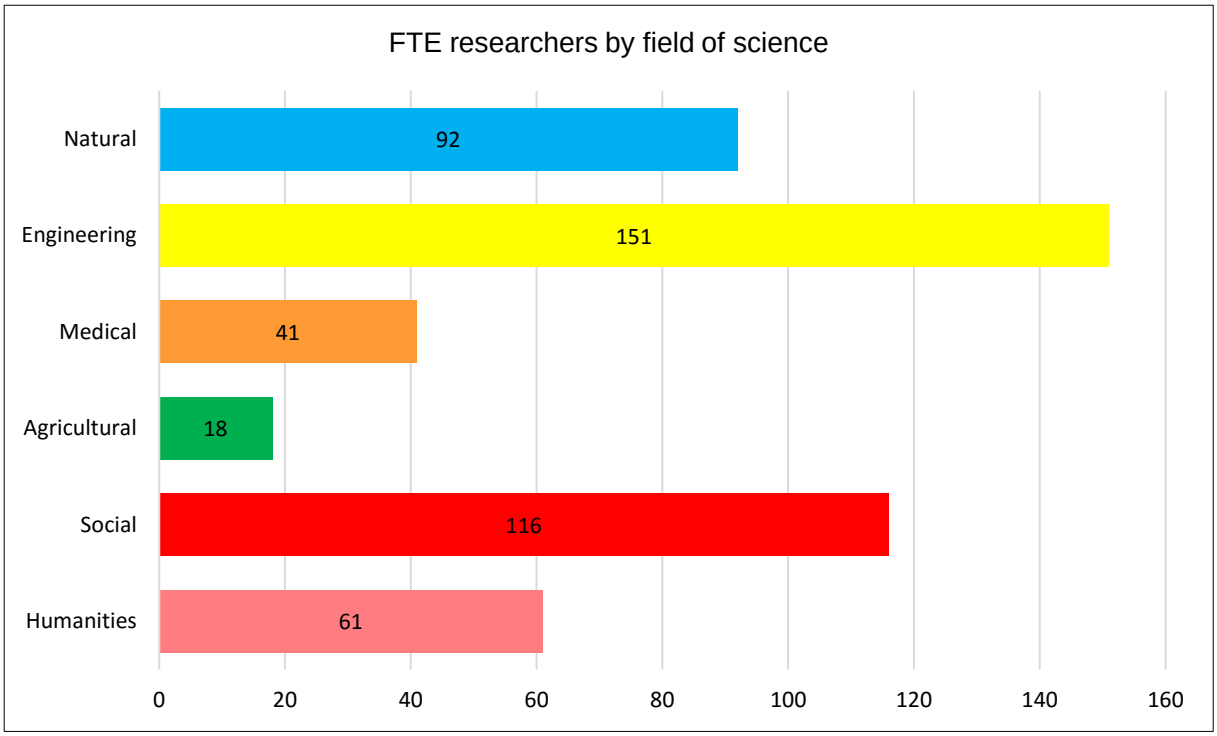
The chart below shows the full-time equivalent researchers by sector and gender.



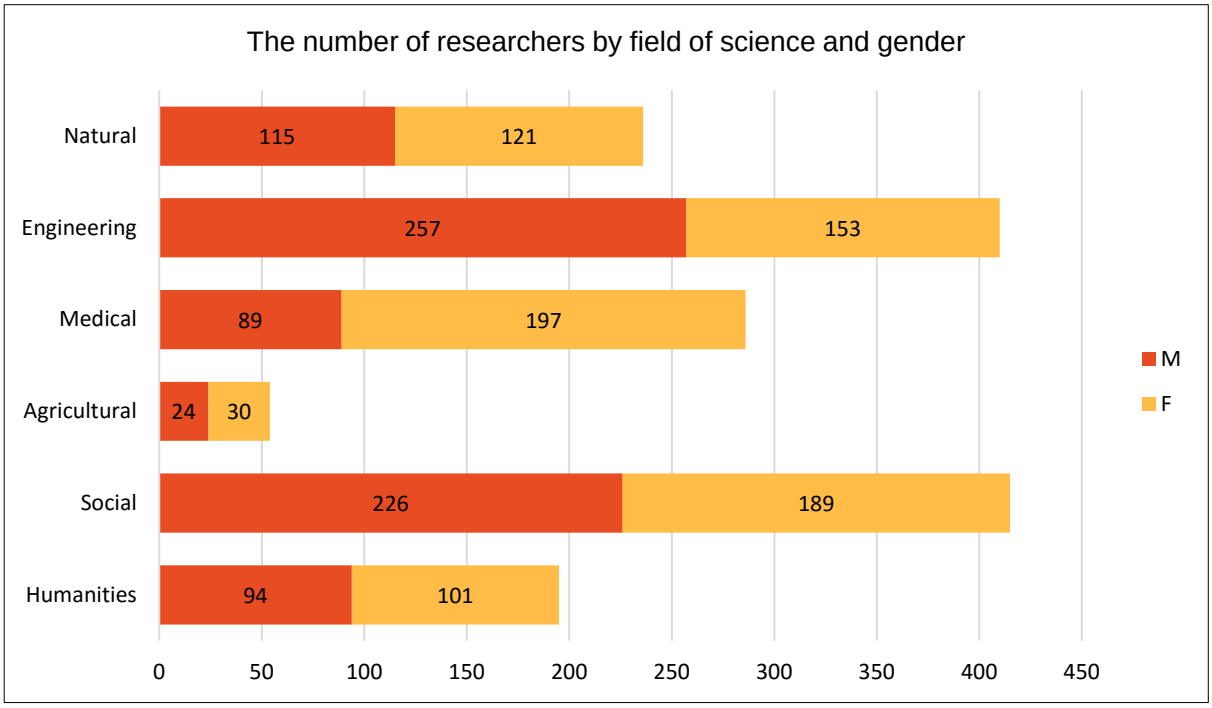
The chart below shows the number of researchers by field of science.



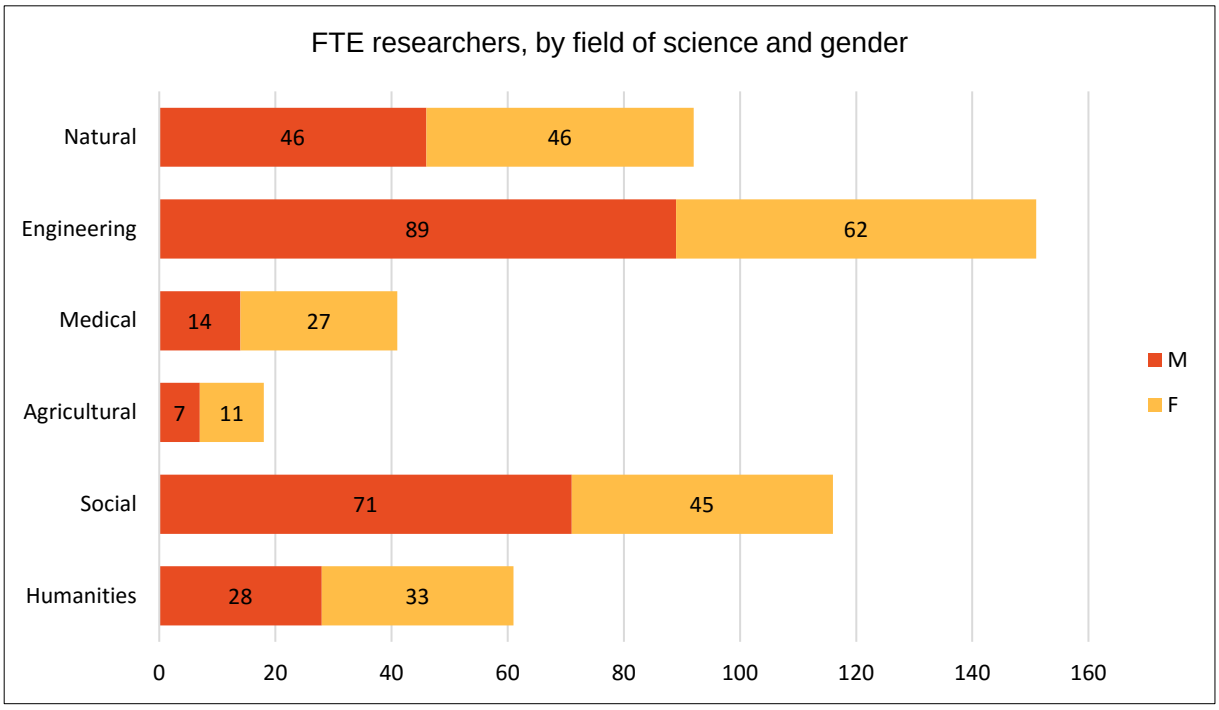
The chart below shows the distribution of researchers by the field of science, expressed in full-time equivalent. The comparison between the number of researchers (chart above) and the number of FTE points to differences in intensity of engagement of researchers on research and development, depending on the field of science.



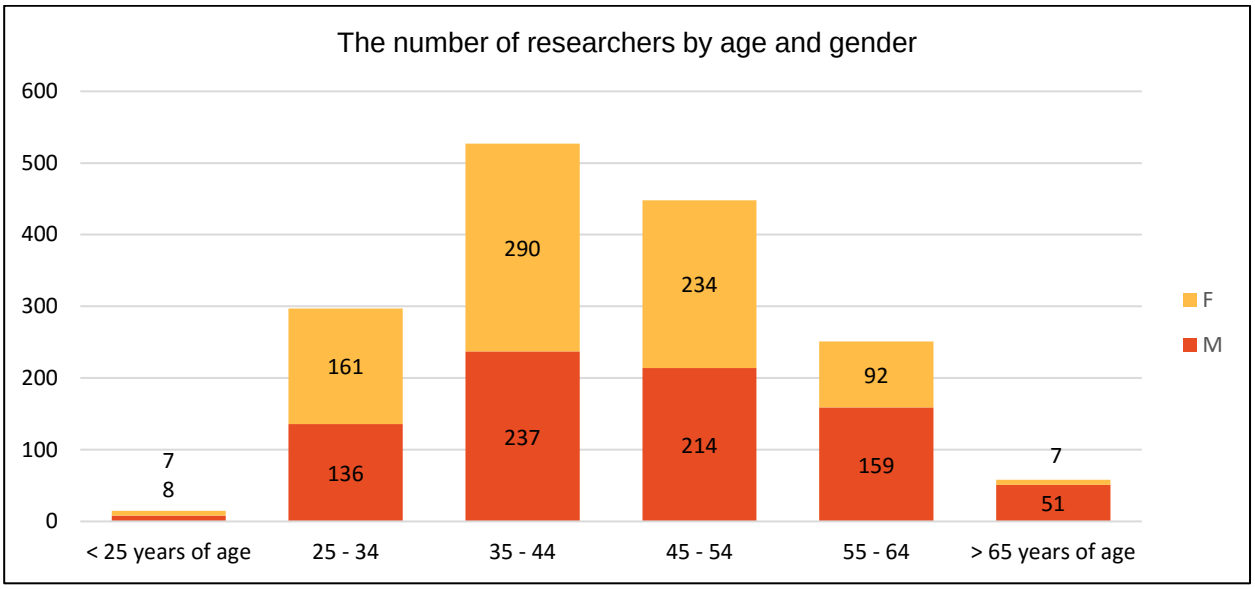
The chart below shows the distribution of researchers by field of science and gender.



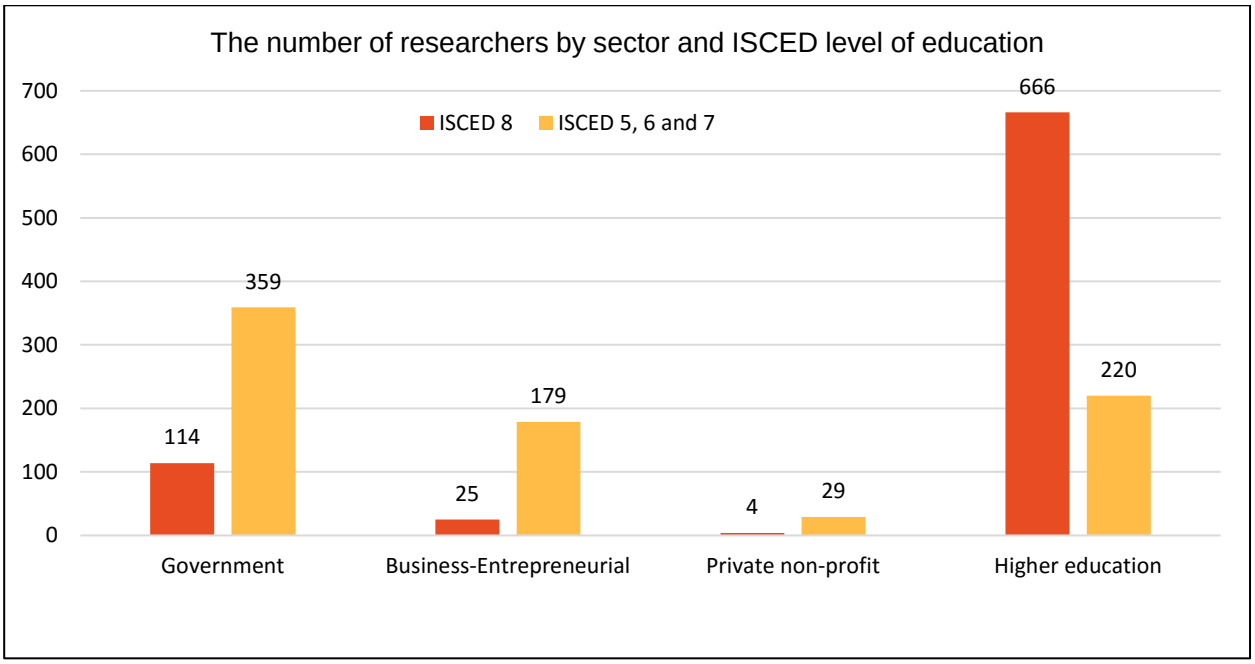
The chart below shows the distribution of researchers by field of science and gender, expressed in full-time equivalent.



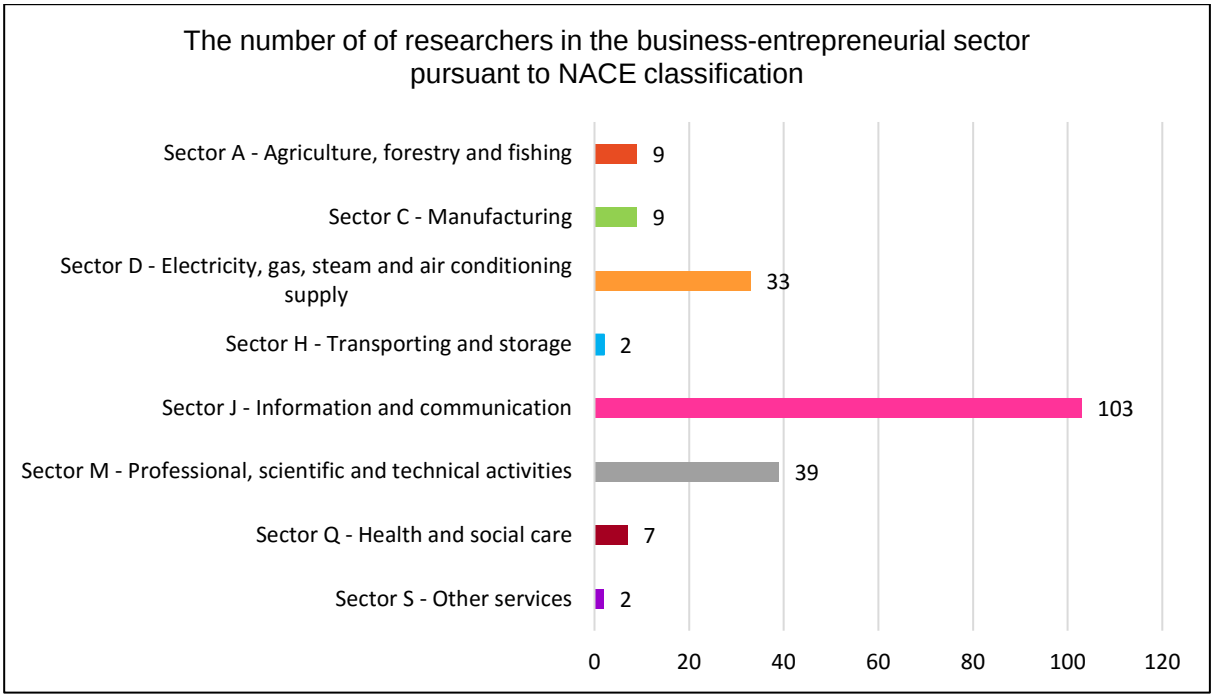
The chart below shows the distribution of researchers by age and gender.



The chart below shows the distribution of researchers by sector and ISCED level of education:



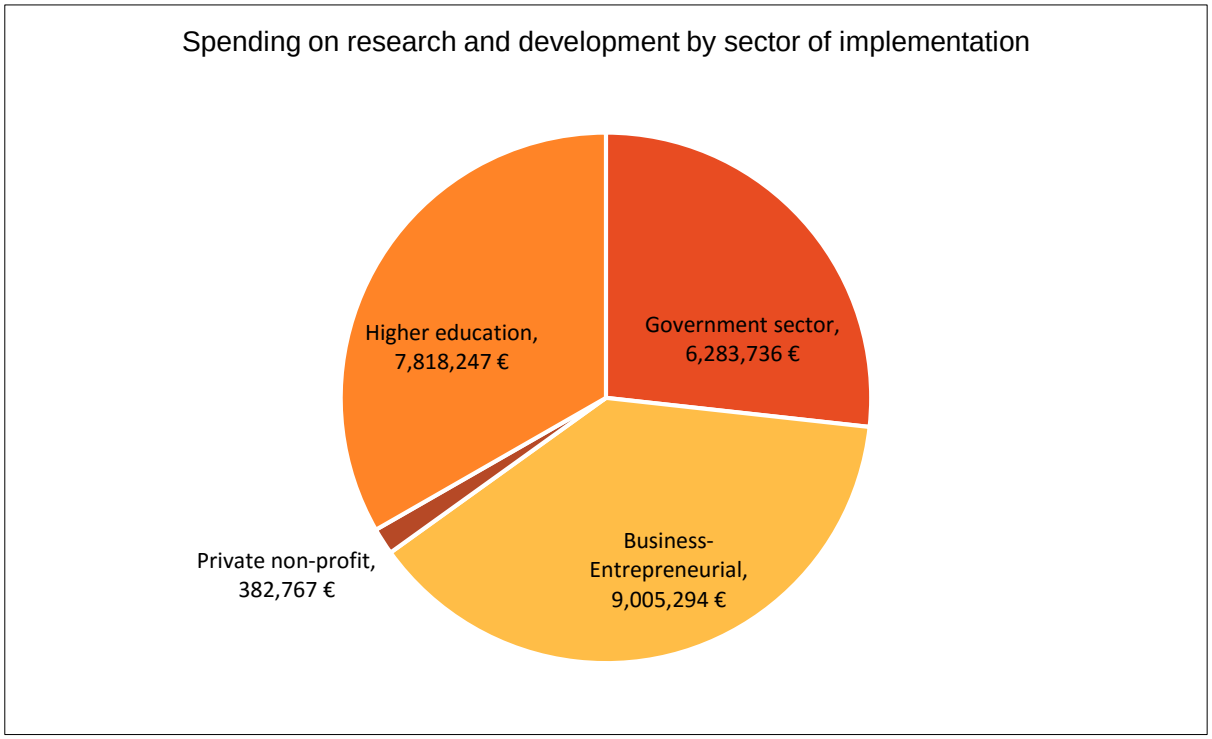
The chart below shows the distribution of researchers in the business-entrepreneurial sector by the field of economic activity (pursuant to the Law on Classification of Activities – NACE):



Data on spending

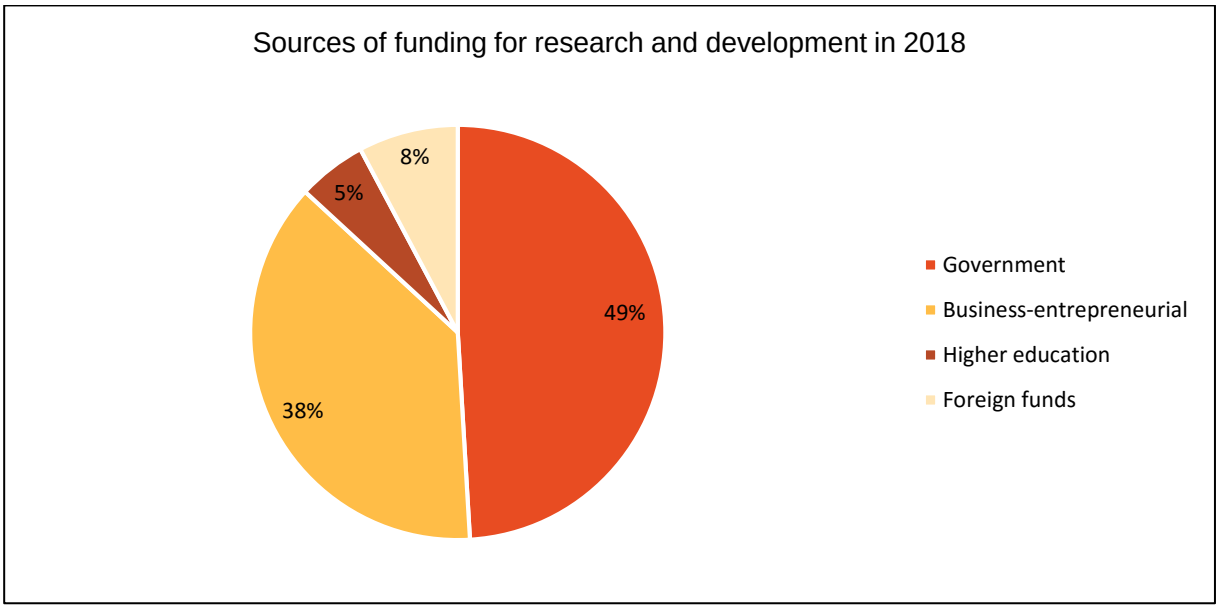
Out of EUR 23,490,044 spent in total, EUR 14,182,165 accounted for current expenditures (60%), while EUR 9,307,878 accounted for capital expenditures (40%).

The chart below shows R&D spending by sector of implementation, indicating that the most of the funds earmarked for research and development in 2018 were spent in the business-entrepreneurial sector (38%). Follows sector of higher education (33%), while the government sector accounted for 27%, and private non-profit sector for 2%.

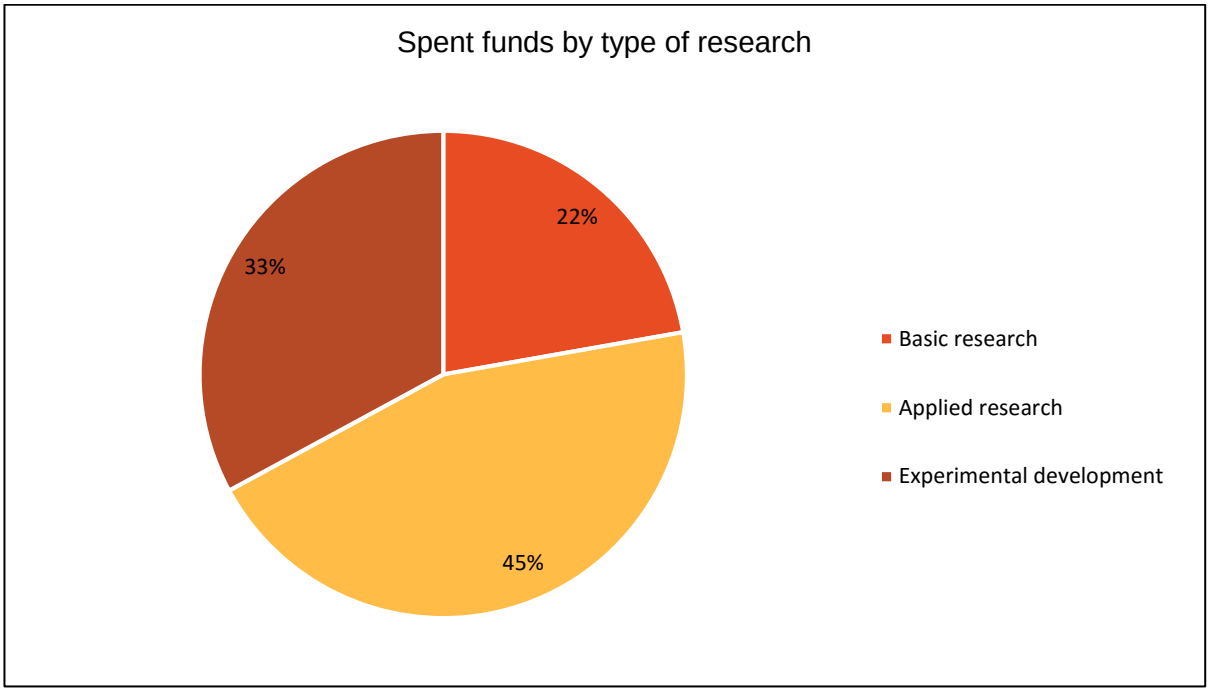


The table and chart below show spending on research and development by the source of funding.

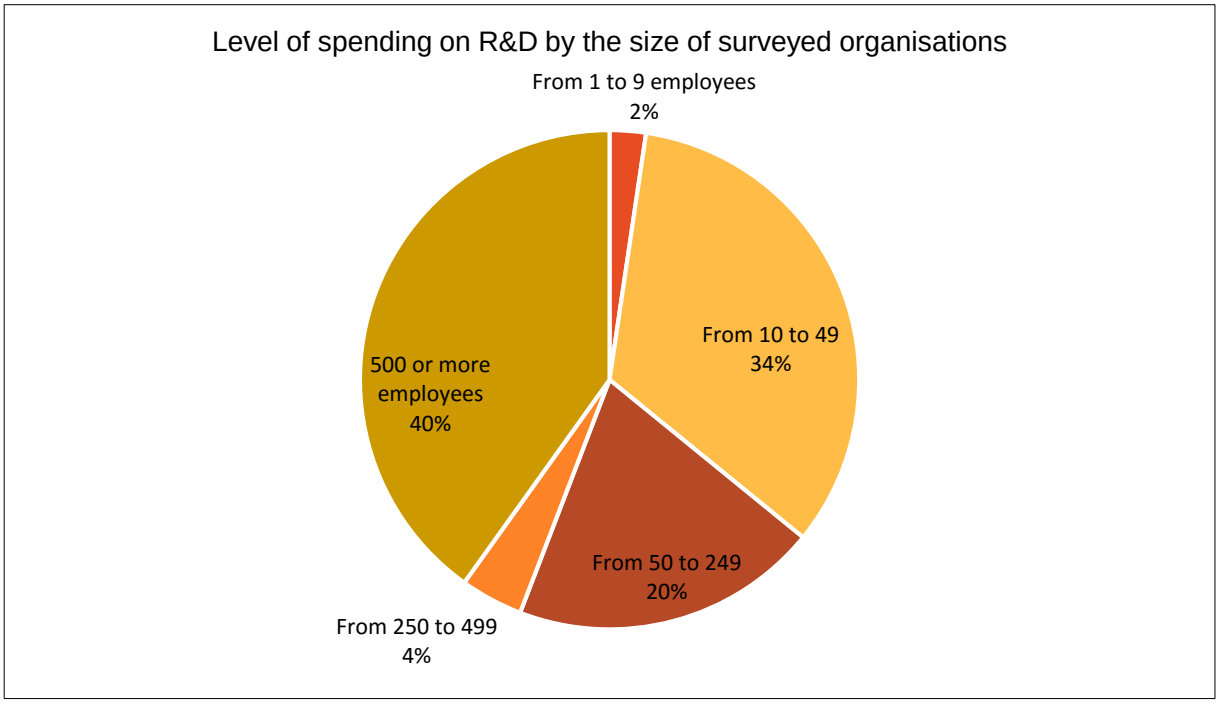
Expenditures on research and development by the source of funding (EUR)	
Domestic funds by sector	**21,664,875.00**
Government	11,516,264.00
Business - entrepreneurial	8,870,996.00
Private - non profit	17,080.00
Higher education	1,260,535.00
Foreign funds	**1,825,169.00**
TOTAL EXPENDITURES	**23,490,044.00**



The chart below shows the share of funds spent on different types of research.



The chart below shows the level of spending by the size of reporting units.



Methodological remarks

1. Legal basis

The legal basis for implementation of statistical surveys in the field of research and development in Montenegro has been established by the Law on Statistics and Statistical System of Montenegro (Official Gazette of Montenegro 18/12), the Five-Year and Annual Plan of Statistical Surveys of the Statistical Office of Montenegro (Monstat), which include the obligations arising from the process of accession of Montenegro to the European Union. The Annual Plan of Statistical Surveys for 2016 identified, for the first time, the Ministry of Science as the public administration body responsible for collecting, processing and publishing statistical data on research and development, i.e. the Ministry has thus taken over this responsibility from the Statistical Office of Montenegro, which processed the data until and inclusive of 2014.
Methodological solutions, standards (classifications, nomenclature, definitions and so on) and the forms necessary for conducting the survey for 2017 have been defined by the Ministry of Science, in line with the existing national and international standards.

2. Aim and content of statistical survey

The aim of R&D statistics is to provide R&D data on the basis of input indicators – R&D staff, as well as R&D spending. The statistical data are collected through a national R&D survey, where all institutions active in the field of research and development submit data in the form of annual reports. The survey for 2018 was conducted by interviewers who filled out the survey reports in the reporting units themselves. The aggregation of data from the reports results in internationally comparable data (human resources and GERD – gross domestic expenditure on research and development).
R&D spending as a percentage of GDP (R&D intensity) – GERD is one of the structural indicators analysed by the Ministry of Science and the Government of Montenegro in relation

to the strategic goals in terms of the funds earmarked for science and experimental development.

3. Coverage

The survey covers statistical units that carry out research and development activities in the reporting year, within four sectors: government, business-entrepreneurial, private non-profit and higher education. The units are classified into sectors according to the legislation pursuant to which they have been established.

4. Statistical units

Statistical units are entities from the four sectors in which research and development activities are carried out. The 2015 Frascati Methodological Manual recommends that the statistical unit is the smallest homogeneous unit predominantly included in one of the six fields of science and for which a complete (or almost complete) set of input data can be provided. The examples of statistical units would include faculties, academies, medical clinics, research institutes, business development centres. A statistical unit is an organisation about which and for which R&D data are collected, which is engaged in research and development and has at least one researcher, permanently employed or as an external associate.

5. Directory of statistical units in research and development

The survey is based on the census principle, i.e. it includes all statistical units that have been identified as potential implementers of R&D activities in a given year. The directory of statistical units is created in the following manner:
a) All institutions from the register of licensed scientific research institutions, maintained by the Ministry of Science (it includes units from all four sectors);
b) Additional units from the register of higher education institutions, maintained by the Ministry of Education (other than those licensed by the Ministry of Science), so that the survey includes all higher education institutions;
c) Government sector units that have incurred R&D expenditures in the previous year, as recorded by the Ministry of Finance (other than those licensed by the Ministry of Science). Examples of such statistical units are the Academy of Sciences, governmental agencies and offices, clinics, museums and other state authorities or local self-government bodies that are beneficiaries of the state or local budget;
d) Units in any sector that have used R&D support programmes of the Ministry of Science, or those that have participated in EU R&D programmes, or are otherwise known to engage in this activity.
e) Units that have participated in the statistical survey for the preceding year.

6. Basic concepts and definitions

Scientific research activity means creative activity on scientific discoveries, application and use of scientific results, training of researchers for scientific research work and professional development of researchers (Law on Scientific Research Activity of Montenegro, Official Gazette of Montenegro 80/10, 40/11, 57/14).

Types of research and development

Scientific research activity encompasses: basic research, applied research and experimental development. Scientific research activity also includes training of researchers for performing scientific research work.

Basic research consists of theoretical and experimental work performed primarily with a view to acquiring new knowledge or discovering new areas of research, with long-term goals of application.
Applied research implies creative work performed for the sake of targeted application of the results of basic research in certain areas of science.
Experimental development means systematic work based on the application of results of research or practical experience and the creation of new knowledge aimed at design of new or improvement of existing products or processes.
The results of scientific discoveries contain elements of authenticity and originality and are evaluated through publication in scientific publications or through testing in application. (Law on Scientific Research Activity).

The main difference between R&D and non-R&D activities is the presence of novelty elements and the resolution of a certain scientific or technological ambiguity where the solution to a problem is not directly accessible to someone familiar with the basic corpus of knowledge and techniques in a particular field.
For an activity to be an R&D activity, it must satisfy five core criteria, i.e. it must be:
1. novel
2. creative
3. uncertain
4. systematic
5. transferable and/or reproducible (Frascati Manual, OECD, 2015).

7. R&D staff

R&D staff includes all persons employed directly on tasks of R&D, as well as those who provide services related directly to R&D. The staff engaged in R&D activities includes researchers, professional associates and supporting staff.

Researchers – Scientific research activities are performed by persons with research titles and persons with scientific titles, in accordance with the Law on Scientific Research Activity of Montenegro, as well as by persons who have been awarded academic and associate titles in a higher education institution. Scientific research activity may also be performed by a person holding a university degree, master's degree and doctoral degree who has not been awarded a research or scientific title within the meaning of the above Law, provided that he/she has references underpinned by published scientific papers that enable him/her to perform scientific research activity. Doctoral students are also included in the category of researchers.

In the broadest sense (Frascati Manual 2015), **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.

Professional associates and technicians cooperate directly with researchers, performing professional or technical tasks related to scientific research and development tasks (laboratory technicians, engineers and engineering technicians, drafters, librarians, curators, documentarians, IT professionals, proof-readers, etc.).

Supporting staff deals exclusively or mainly with organisational, administrative, legal, or financial affairs (managers, lawyers, treasurers, secretaries, etc.) in relation to R&D activities.

Headcount (HC) of R&D personnel – A variable that measures the total number of persons employed (mostly or partially) in R&D positions. The survey records all persons potentially involved in R&D, even if their activity in a given year amounted to zero. In this way, the stability in monitoring of the total R&D staff is achieved, while the following variable indicates their

actual activity within a year, which often depends on changeable circumstances (obtaining funds for a project, concluding a specific market contract, etc.).

Persons employed in R&D, full-time equivalent – is a term that expresses the intensity of staff engagement in R&D. If a person is engaged on R&D 100% of their working time, the corresponding full-time equivalent is 1 person-year. If a person usually spends 30% of his/her working time on R&D tasks and the rest on other duties (e.g. teaching, administration, consultations with students), the full-time equivalent is 0.3 person-year. Similarly, if an employee annually spends only six months on R&D tasks, with full-time engagement, the full-time equivalent is 0.5 person-year.
The survey proposes one of four ways to determine the intensity of engagement in R&D (i.e. FTE coefficient):

- definition in a specific legal act
- staff self-assessment with records system in place
- organisational unit management assessment
- institution management assessment

The survey has established limits for recording staff activity coefficient at between 0.1 and 0.9 (i.e. values below 0 = 0; values above 0.9 = 1).

8. R&D activity expenditure

R&D expenditure includes all R&D expenditures incurred by the reporting unit in the reporting period, regardless of the source of funding. Both current and capital expenditures are included.

The aggregation of data on expenditures received from reporting units within all four sectors results in data on gross domestic expenditure on research and development – GERD, which is the basic data indicator for international comparisons of R&D spending.
Expenditures are also classified by source of funding, so it is possible to produce data on spending from domestic and foreign sources.