19. SCIENCE AND RESEARCH

Research and experimental development *(hereinafter referred to only as 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 (OECD 2015, Frascati Manual). For an activity to be a R&D activity, it must satisfy five core criteria; it must be: novel, creative, uncertain in its outcome, systematic, transferable and/or reproducible.*

Characteristics of research and development *are surveyed by the* ***Annual report (questionnaire) on research and development****, which includes questions on human and financial resources earmarked for R&D activities realized in the territory of the Czech Republic in respective sectors of R&D performance and types of entities, in which R&D is performed.* ***Reporting units*** *in the R&D survey are all legal and natural persons performing R&D in the territory of the Czech Republic as their principal (CZ-NACE 72 – Scientific research and development) or secondary economic activity, irrespective of the number of personnel, sector, or CZ-NACE activity*, in which they work.

Sector of research and development performance *is a basic category used in R&D statistics, which groups all institutional units performing R&D based on their main functions, behaviour, and objectives. R&D indicators are usually measured and published, also at an international level, in four sectors of R&D performance (hereinafter referred to as sectors): business enterprise, government, higher education, and private non-profit sector. These sectors were defined based on the Nomenclature of Institutional Sectors and Subsectors used in the national accounts (the European System of National and Regional Accounts (ESA 2010)) and definitions given in the Frascati Manual.*

Business enterprise sector *(S.11: Non-financial corporations; S.12: Financial corporations; S.141: Employers, and S.142: Own-account workers), which comprises all companies, organisations, and institutions, principal activity of which is market production of goods or services for sale to the general public at an economically significant price.*

Entities and workplaces performing *R&D in the business enterprise sector are broken down by type of workplace based on the ownership, namely to the following three categories:* ***public enterprises (corporations), private national enterprises (corporations), and foreign-controlled enterprises (corporations)****.*

Government sector *(S.13: General government) comprises bodies of central and local government, except for publicly managed higher education institutions (CZ-NACE 85.4). This sector includes in the Czech Republic especially* ***workplaces of the Czech Academy of Sciences*** *and other public research institutions (legal form 661), places of research under the competence of ministries, which perform R&D as their main activity (CZ-NACE 72). Other types of R&D workplaces in the government sector performing R&D most frequently as their secondary activity are* ***cultural establishments*** *(CZ-NACE 91) such as public libraries, archives, museums,* ***public health establishments*** *(except for teaching hospitals) with prevailing income coming from the public health insurance (CZ-NACE 86), and* ***other workplaces****.*

Higher education sector *(CZ-NACE 85.4: Higher education) comprises all public and private universities and all research institutes, experimental facilities and clinics, work of which is directly controlled or managed by higher education institutions. R&D workplaces in the higher education sector in the Czech Republic* comprise *mainly* ***individual faculties of 28 public and state universities*** *and, since 2005, in accordance with the OECD methodology, also* ***10 teaching hospitals****.*

Private non-profit sector *(S.15: Non-profit institutions serving households) comprises private institutions, including private persons and households, primary aim* of which *is not generation of profit but providing of non-market services to households. They include, e.g., associations of research organisations, associations, unions,* federations, *movements, or foundations. The private non-profit sector is insignificant as for R&D performance.*

Research and development activities are measured (especially in the government sector and the higher education sector) in six ***broad fields of science*** *(broad knowledge domains) defined according to the Fields of Research and Development Classification (FORD classification) based on prevailing field of R&D workplaces surveyed. They are as follows: Natural sciences, Engineering and technology, Medical and health sciences, Agricultural and veterinary sciences, Social sciences, Humanities and the arts.*

Persons working in research and development (hereinafter referred to as ***R&D personnel****) are persons working at R&D workplaces in individual reporting units who* ensure direct services for those workplaces. *R*&D personnel *(R&D workers) are broken down according to the* ***activity*** *they perform to three categories.* ***Researchers****, who are engaged in the conception or creation of new knowledge, products, processes, methods, and systems or who manage such projects. Technicians and equivalent staff (hereinafter referred to as* ***technicians****) who participate in R&D by performing scientific and technical tasks involving the application of concepts and operational methods.* ***Other supporting staff*** *in R&D are managers, administrative, secretarial, and clerical staff, and craftsmen participating in R&D activities or involved in such activities.*

The number of R&D personnel is usually ***expressed (surveyed)*** *by means of* ***two main measurement units****:*

- ***Headcount (HC)*** *of R&D personnel refers to the* ***registered number of persons fully or partially*** *active (engaged) in research and development activities, employed in main or secondary employment* ***as at the end of the reference year*** *in entities, in which R&D is performed.*

  Note*: Primarily in the higher education sector and partially also in the government sector, a huge amount of R&D personnel, especially researchers, have an employment contract* ***in more entities concurrently****. Therefore, in these sectors, the indicator is overestimated and does not provide the real number of persons working in R&D, but rather a number of jobs (working times) of persons performing R&D as at the end of the reference year. For both the national and international comparisons it is therefore* ***recommended*** *to use the below mentioned indicator of the full-time equivalent (FTE) of R&D personnel.*

- ***Full-time equivalent (FTE)** of R&D personnel – this indicator clearly describes the **real time** devoted to R&D. One FTE equals one-year of full-time work of an employee, who is 100% engaged in R&D activities. The indicator is important mainly as for R&D personnel (R&D workers) whose job content consists also of other activities than R&D (e.g. academics), because it includes only that part of their working hours/times, which they devote to R&D activities*

***Research and development expenditure** includes all current expenditure (labour costs and other current costs) and capital costs* (*investment expenditure) spent during the reference year on R&D performed within a reporting unit (intramural R&D) in the territory of a given country regardless the source or the way of funding.*

*Note: Surveyed (intramural) R&D expenditure **does not include** extramural expenditure on R&D performed outside a reporting unit, sector, or country. The intramural R&D expenditure thus excludes expenditure spent on purchase of external R&D from* other *entities, sources transferred to other experts within a common R&D project, and subsidies or contributions (financial transfers) provided to third persons for R&D performed by them.*

*The amount of R&D expenditure made in individual sectors of performance is measured by the following **main sources of funding** of R&D activities. Funds from the **business enterprise sector** comprising mainly of own (internal) sources of surveyed enterprises earmarked for R&D performed within these enterprises and sources of parent companies funding R&D in their foreign affiliations in the Czech Republic. At the government sector and the higher education sector, funding from business enterprise sources includes mainly income from sale of R&D services (orders for R&D) and income from royalties and licence fees for intangible results of R&D. Funds from the **government sector – national** that come from the state budget or budgets of Regions earmarked for R&D performed in the territory of the Czech Republic. Funds from the **government sector – from abroad**, which include especially revenue from the European Structural Funds. They include also other sources from the EU budget and sources from international organisations outside the EU (CERN, ILL, NATO, UNO, WHO, Norway grants and EEA grants, etc.). Besides the aforementioned main sources, also **other national** sources contribute to R&D funding, which comprise mainly own sources of universities and private non-profit institutions originating neither from the state budget, the business enterprise sector, nor from abroad. These sources are insignificant in the CR within the total R&D expenditure.*

*Statistics of **direct government support of R&D** provides detailed information on the financing of research and development from the state budget according to **socio-economic objectives** based on administrative data taken over from the R&D Information System. Data are partially obtained also directly from individual providers of public support of R&D.*

*Direct government support of R&D includes in the case of the Czech Republic all **financial sources provided from the state budget to support R&D**, including sources flowing to the R&D abroad. All data on the total direct government support of R&D from the state budget for the area of research, development, and innovations result from data provided in the State Final Account of the Czech Republic for the area of R&D. It applies to expenditure, which was really drawn for R&D from the state budget in the given year (not to amounts approved in the Act on the State Budget of the CR for the given year). Besides breakdown by socio-economic objectives, detailed data are also available as follows: by type of funding (project* support *versus institutional), by main provider, and beneficiary of the support.*

***Statistics on indirect government support of R&D** (government tax relief for R&D expenditure) measures use of tax deductions for indirect funding of R&D performed in enterprises. This type of support was introduced in the Czech Republic in 2005. The CZSO has been publishing detailed data on the indirect government support since the reference year of 2007, namely based on data from tax returns of legal persons. The amount of an indirect government support of R&D (tax relief) is calculated as a financial volume of R&D expenditure deducted from the income tax base of legal persons multiplied by the income tax rate valid in the relevant year. The following are measured: data on the number of private enterprises, which made a tax deduction of R&D expenditure, data on the amount of the tax deduction, and data on the amount of the tax relief, namely broken down by ownership, size, and economic activity (industry) of the enterprise.*

***Patent statistics** brings information about results and successfulness of research, development, and innovation activity in selected areas of technology. Data in the Chapter were processed by the CZSO based on data sources of the Industrial Property Office of the Czech Republic (IPO CR), which ensures patent protection for the territory of the Czech Republic.* Patents are granted for inventions*, which are novelties, they are a result of activity of inventors, and are industrially applicable. Tables contain only data on patent activity of entities doing their business in the territory of the Czech Republic. Since the reference year 1995, the CZSO has been processing and publishing detailed statistical data on patent activity of domestic entities* by means of *data on patent applications submitted at (filed with) the IPO CR, patents granted in the given year, and on valid patents for the territory of the Czech Republic as* at *31 December. Data on patents are classified (broken down) using the so-called fractional method and are available by type of applicants and in the case of enterprises also by their size, ownership, and economic activity (industry).*

*Data on (university) **students** **of** **and graduates from science and engineering fields of education** were obtained from data sources of the Ministry of Education, Youth, and Sports, namely from the Union Information from Students' Registers (the "*SIMS*" database). Data are continually added to the source* SIMS *database and the database is continually updated, including retrospective corrections. Data published in this Yearbook correspond to the state of processing as at 20 January 2020. Data on university students are always as at 31 December of the reference year; data on graduates are for the whole school year. **Studies of science and engineering fields of education** are defined based on the international classification of the ISCED-F 2013, broad fields 05 and 07. Numbers of students and graduates are given as headcount, i.e. each student is included in a particular piece of data only once, including students, who study in more study programmes concurrently. The total numbers of students and graduates thus do not have to be equal to the sums of students and graduates of respective types of study programmes.*

***Education at universities** presented in* this publication *belongs to the tertiary level of education and includes a **bachelor, follow-up master, master**, and **doctoral** study programme. The follow-up master and master study programmes are given in tables together as **master study programmes**.*

***Science and engineering professionals** are a narrow group of experts. Within their work activities, they conduct research, improve or develop concepts, theories and operational methods, or apply scientific knowledge relating to fields such as physics, astronomy, meteorology, chemistry, geophysics, geology, biology, ecology, pharmacology, medicine, mathematics, statistics, architecture, engineering, design, and technology. Science and engineering professionals are defined since 2011 based on the Classification of Occupations (CZ-ISCO) containing* all *groups of **occupations of the CZ-ISCO sub-major group 21**, which are sources of their main income.*

***Data on the numbers of science and engineering professionals** come from the Labour Force Sample Survey (LFSS). In order to ensure higher reliability and to eliminate considerable year-on-year fluctuations of values for this group of employees, data in the table are provided as three-year moving averages* (*for example, the value for 2018 is calculated as an average* of *values for* the years *2017, 2018, and 2019.*

*Data on **wages of science and engineering professionals** come from the structural employee wage statistics, which is generated by merging of databases of the sample survey of the **Information System on Average Earnings** of the Ministry of Labour and Social Affairs, which covers the **wage sphere**, and from the administrative data source of the **Salary Information System** of the Ministry of Finance, which exhaustively covers the **salary sphere**.*