22. SCIENCE, RESEARCH, AND INNOVATION

*Science, research, and innovation statistics aims to provide basic data on key activities in the areas of **science, technologies, and innovation** in the Czech Republic from the point of view of financial and qualified human resources entering these activities as well as from the point of view of their results such as innovation, granted patents or external trade with high-tech production.*

***Science** refers to a consistent system of verifiable observations and findings on a given set of phenomena as well as of methods used to obtain, process, explain in theory, and apply these observations and findings.*

***Research and development** 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.*

***Technologies** take three fundamental forms: **tangible**: knowledge embodied in physical objects (machinery, equipment, instruments, etc.); **intangible**: knowledge accumulated in people (human capital), information embodied in electronic media and documents (software, plans, projects, results of observations, mathematical calculations, maps, etc.), and **institutional**: arrangement of activities and relations (organizational structure, management system, standards, regulations, etc.). Thus, while science is concerned about how and why certain things happen, technology is focusing on the means by which they are implemented.*

*An **innovation** is the implementation of a new or significantly improved product (goods or service) or a process, new marketing method, or a new organizational method in business practices, workplace organisation or external relations.*

Data provided in this chapter were obtained mainly from regular statistical surveys of the CZSO, primarily from the survey on research and development, survey on innovation activities of enterprises, survey on licences, and from other data sources of the CZSO. In some cases, data from other national data sources were obtained (e.g. the Industrial Property Office of the CR, the Research, Development and Innovation Council, or the Ministry of Education, Youth and Sports).

Notes on Tables

*Tables **22**-1 and **22**-2. **Persons with tertiary education***

***Tertiary level of education** is defined according to the International Standard Classification of Education (ISCED 2011) and comprises the following levels of the classification: 5 (short-cycle tertiary education), 6 (bachelor's or equivalent), 7 (master's or equivalent), and 8 (doctoral or equivalent). Tertiary education in the Czech Republic is split into higher professional and university education.*

***Higher professional education** includes education in two- to three-and-a-half-year-long programmes to pupils who earned their education at some of secondary schools and completed it by passing of A-level examination. This type of education is completed by passing the final examination called* "absolutorium" *and graduates earn a certified specialist (DiS) degree. It includes also graduates from conservatoires.*

*In the Czech Republic, since 2001, **university education** has been divided to three levels: bachelor programme, master programme, and doctoral programme. **Master's or equivalent level** includes in the Czech Republic graduates from all fields of education at universities before 1989 and master-engineering studies at universities and current 5–6 year long or follow-up 2–3 year long master study programmes. **Doctoral or equivalent level** includes in the Czech Republic graduates from current doctoral study programmes and former scientific preparation (i.e. holders of degrees of PhD, ThD, CSc, and DrSc, which are post nominals).*

***Fields of education** dealt with in this chapter are still defined based on the ISCED 97 classification and include the following categories:*

- *Education (ISCED code 1);*
- *Humanities and arts (ISCED code 2);*
- *Social sciences and law (ISCED code 3 excluding codes 314 and 34);*
- *Economics, Business and administration (ISCED codes 314 and 34);*
- *Natural sciences, mathematics and statistics (ISCED codes 42, 44, and 46);*
- *Computing (ISCED code 48);*
- *Engineering, manufacturing and construction (ISCED code 5);*
- *Agriculture (ISCED code 6);*
- *Health and welfare (ISCED code 72);*
- *Social services (ISCED code 76);*
- *Services (ISCED code 8).*

*Data on persons with completed tertiary education in **science and engineering fields of education** and persons with completed tertiary education in **doctoral programmes** are from the point of view of qualified human resources for research, science, and innovation considered as the most important. Data originate from the Labour Force Sample Survey (LFSS) of the CZSO (the table provides average data of the relevant year). More detailed data and methodology on the LFSS are available in the Chapter **10** Labour Market, part B.*

*Tables **22**-3 and **22**-4. **Science and engineering professionals***

***Science and engineering professionals** 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, mathematics, statistics, computing, architecture, engineering, and technology.*

Science and engineering professionals are defined based upon the Classification of Occupations (CZ-ISCO sub-major group 21) containing the following occupations (minor groups of CZ-ISCO), which are sources of their main income:

211 Physical and earth science professionals (Natural science professionals);

212 Mathematicians, actuaries and statisticians;

213 Life science professionals;

214 Engineering professionals;

215 Electrotechnology engineers;

216 Architects, planners, surveyors and designers.

*Note: Due to the sample size, in the case of the number of persons working in CZ-ISCO 211 and 212 occupations (Table **22**-3) these persons were merged into one category of natural science professionals, mathematicians and statisticians.*

*The data on the **numbers** of science and engineering professionals originate from the Labour Force Sample Survey (LFSS) of the CZSO (the table provides average data of the relevant year). The comparison of the labour force structure in the time series is affected by methodological changes to the LFSS. For example, since 1 January 2011 a new version of the above-mentioned Classification of Occupations (CZ-ISCO), which replaced previously applied KZAM, has been in force. As a result, the comparable time series of the number of science and engineering professionals is available only from the reference year of 2011. More detailed data and methodology on the LFSS are available in the Chapter **10** Labour Market, part B.*

*Data on **wages** of Science and engineering professionals (Table **22**-4) come from structural wage statistics and are available in comparable time series since the reference year of 2011, when they are grossed up for the entire population of the employed persons in the Czech Republic. More detailed data on structural wage statistics in the breakdown by occupation (Classification of Occupations, CZ-ISCO) are available in Chapter **10** Labour Market, part A, namely in the notes below the Tables **10**-4 and **10**-5.*

*Tables **22**-5 to **22**-7. **University students and graduates of science and engineering fields of education***

*The tables contain the **number of higher education (university) students and graduates** (ISCED 97, 5A and 6 levels) in the fields of **natural sciences, mathematics and computing** (life sciences, physical sciences, mathematics and statistics, computing) and **engineering, manufacturing and construction** (engineering and engineering trades, manufacturing and processing, architecture and building) defined in the ISCED 97 (ISCED 4 and 5 broad groups).*

The data were obtained from data sources of the Ministry of Education, Youth and Sports, namely from the "SIMS" *database (i.e. Union Information from Students' Registers). Since a field of education with the same code may have various contents at different universities (and thus it is problematic to classify students to relevant groups of fields of education), **expert estimates** are given for the breakdown by field of education. The expert estimates are based on data by field of education and a table of correspondence between the CBBE (Classification of Basic Branches of Education), the ISCED 97, and fields of education. Total sums of students do not have to be equal to the sums of types of programmes and groups of fields of education, because one student may study more fields at more universities at the same time and in the total indicator such a student is counted only once.*

Due to the revision of the ISCED and the CBBE table of correspondence the data in time series may differ from the previously published data.

Data on students of universities are always related to 31 December of the relevant year; data on graduates apply to the entire school year. The "SIMS" *database is continually completed and updated; the data presented in this Statistical Yearbook refer to the database status as at 20 May 2015. More detailed data and methodology about university education are available in the Chapter **23** Education.*

*Tables **22**-8 to **22**-12. **Research and development (R&D)***

***Research and experimental development (hereinafter only 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 2002, Frascati manual).*

*R&D is always aimed at **new findings**, based on **original concepts** (and their interpretation) or hypotheses. It is largely **uncertain** about its final outcome (or at least about the quantity of time and resources needed to achieve it), it is **planned** for and budgeted (even when carried out by individuals) and it is aimed at producing results that could be either freely **transferred** or traded in a marketplace.*

*The term R&D covers three types of activity: basic research, applied research, and experimental development. **Basic research** is experimental or theoretical work undertaken primarily to acquire new*

knowledge of the underlying foundations of phenomena and observable facts, without any particular application or use in view. ***Applied research*** *is 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 knowledge gained from research and practical experience and producing additional knowledge, which is directed to producing new products or processes or to improving existing products or processes.*

Characteristics of research and development *are observed by the Annual questionnaire on research and development, which includes questions on human and financial resources determined for R&D activities realized on the territory of the Czech Republic in individual sectors of R&D performance. The statistical survey fully complies with methodological principles of the EU and the OECD mentioned in the Frascati Manual (OECD, Paris 2002) and Commission Implementing Regulation (EU) No. 995/2012.*

Reporting units *in the R&D survey are all legal and natural persons performing R&D on 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.*

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 only sectors) – business enterprise, government, higher education, and private non-profit. These sectors were defined based on the Nomenclature of Institutional Sectors and Subsectors used in the National Accounts (the ESA 2010 system) 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, organizations, and institutions, principal activity of which is market production of goods or services for sale to the general public at an economically significant price;*
- ***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 Academy of Sciences of the Czech Republic and other places of research under the competence of ministries. Since 1 January 2007 the statute of most of these entities changed to public research institutions. Among the other entities of the government sector, which perform R&D as their secondary activity are mainly public hospitals (except university hospitals), libraries, archives, museums and other cultural activities (CZ-NACE 91) and workplaces active in the field of administration of the State and the economic and social policy of the community (CZ-NACE 84.1);*
- ***higher education sector*** *comprises all public and private universities and other institutions of post-secondary education with R&D activities (CZ-NACE 85.4: Higher education) irrespective of their institutional sector used in national accounts. It also includes all research institutes, experimental facilities and clinics, work of which is directly controlled or managed by higher education institutions or they are associated with them (university hospitals). This sector is not a separate institutional sector but it has been separately identified by the OECD for its important role in R&D;*
- ***private non-profit sector*** *(S.15: Non-profit institutions serving households, S.14: Households except for S.141 and S.142) comprises private institutions, including private persons and households, whose primary aim is not profit formation but providing of non-market services to households. They include, e.g., associations of research organizations, societies, unions, movements, federations or foundations. The private non-profit sector is insignificant as for R&D performance.*

Research and development activities are measured, especially in the government and higher education sectors, in six ***main fields of science*** *defined according to the Field of Science and Technology Classification:*

- *Natural sciences (Mathematics, Computer and information sciences; Physical sciences; Chemical sciences; Earth and related environmental sciences; Biological sciences, and Other natural sciences);*
- *Engineering and technology (Civil engineering; Electrical engineering, electronic engineering, information engineering; Mechanical engineering; Chemical engineering; Materials engineering; Medical engineering; Environmental engineering; Environmental biotechnology; Industrial biotechnology; Nano-technology, and Other engineering and technologies);*
- *Medical and health sciences (Basic medicine; Clinical medicine; Health sciences; Medical biotechnology, and Other medical science);*
- *Agricultural and veterinary sciences (Agriculture, forestry, and fisheries; Animal and dairy science; Veterinary science; Agricultural biotechnology and Other agricultural sciences);*
- *Social sciences (Psychology and cognitive sciences; Economics and business; Education; Sociology; Law; Political science; Social and economic geography; Media and communications and Other social sciences);*
- *Humanities and the arts (History and archaeology; Languages and literature; Philosophy, ethics and religion; Arts, history of arts, performing arts, music and Other humanities).*

*Table **22**-9. **R&D personnel***

*Persons employed in research and development (hereinafter only **R&D personnel**) include all persons engaged directly in R&D, whether employed by the statistical unit or external contributors fully integrated into the statistical unit's R&D activities, 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 (**occupation**) as:*

- ***researchers**, who 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. Managers and administrators engaged in the planning and management of the scientific and technical aspects of a researcher's work are also classified as "researchers". Their position in the unit is usually equal or superior to that of persons directly employed as researchers; they are sometimes part-time researchers.*
- *technicians and equivalent staff (hereinafter only **technicians**) who are persons whose main tasks require technical knowledge and experience in one or more fields of engineering, physical and life sciences, or social sciences, humanities and the arts. They participate in R&D by performing scientific and technical tasks involving the application of concepts, operational methods and use of research equipment, normally under the supervision of researchers;*
- ***other supporting staff** who are skilled and unskilled craftsmen, and administrative, management, secretarial and clerical staff participating in R&D projects or directly associated with such projects.*

*The number of R&D personnel is collected by two main **measurement units:***

- ***headcount (HC)** of R&D personnel refers to the registered number of persons fully or partially engaged in research and development activities, employed in the reporting units in main or secondary employment as at the end of the reference year. Primarily in the higher education and partially also in the government sector, a huge amount of R&D personnel, especially researchers, have an employment contract in more entities. Therefore, in these sectors, the indicator is overestimated and does not provide the real number of persons working in R&D;*
- ***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. One FTE equals one-year (full-time) work of a member of personnel who is 100% engaged in R&D activities. The FTE indicator also includes the number of persons working for the reporting unit under various contracts for work converted according to the methodology valid for the FTE.*

*Table **22**-10. **R&D expenditure***

***Research and development expenditure** includes all current (labour and other current costs) and capital expenditure determined for R&D performed within a reporting unit (intramural R&D) on the territory of a given country during the reference year regardless the source of the funds. This indicator does not include expenditure on (funding of) extramural R&D, which is the amount of money spent on R&D that is performed outside a reporting unit and transfer of R&D funds that flow between reporting units without a compensatory return flow of R&D.*

The main aggregate statistics used to describe a country's R&D activities is gross domestic expenditure on R&D (GERD), which covers all expenditure for R&D performed in the national territory during a specific reference period. GERD includes domestically performed R&D that is financed from abroad (i.e. from the "rest of the world") but excludes funding for R&D performed abroad.

*The amount of R&D expenditure made in individual sectors of performance is measured by the following **main sources of funds** of R&D activities:*

- *funds from the **business enterprise sector** comprising of own (internal) sources of observed enterprises determined for R&D performed within this enterprise and external funds from the business enterprise sector used for R&D performed on the territory of a given country in other enterprises or at universities or public research institutions. At the government and higher education sectors, financing from business enterprise sources includes mainly income from sale of R&D services (orders for R&D) and income from royalty and licence fees for intangible results of R&D;*
- *funds from the **government sector – national** that originate from the state budget or budgets of regions determined for R&D performed on the territory of the Czech Republic;*
- *funds from the **European Commission and other international organisations**, which include especially revenue from the European Structural Funds. They include also other sources from the EU budget and sources from international organizations outside the EU (CERN, ILL, NATO, UNO, WHO, Norway grants and EEA grants, etc.).*

*Besides the above-mentioned main sources, also **other national** sources contribute to R&D financing, 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.

*Tables **22**-13 to **22**-16. **Direct government support of research and development***

The tables contain data on direct government support of R&D (Government Budget Allocations for R&D) previously called GBAORD (Government Budget Appropriations or Outlays for R&D). Data for the Czech Republic are available since 2000. Starting with 2010, in relation to the Statistical Business Register, they were extended by further breakdowns such as industry (CZ-NACE), size groups, or regions (CZ-NUTS).

Statistics of direct government support of R&D is made with annual periodicity based on the implementing regulation (EU) No. 995/2012 and the methodology provided in the Frascati Manual (OECD, 2002). A list of socio-economic objectives is provided in the NABS classification (Nomenclature for the Analysis and Comparison of Scientific Programmes and Budgets, 1992 revision, Eurostat 1994).

In the Czech Republic, statistics of direct government support of R&D is compiled based on administrative data taken over from the Research and Development and Innovation System of the Czech Republic. Data are partially obtained also directly from individual providers of support of R&D. Statistics of direct government support of R&D takes into account terminology and specification of expenditure pursuant to the Act No. 130/2002 on the support of research and development from public funds (as amended).

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. According to the valid international methodology, the government support of R&D excludes support of R&D via loans to be repaid, pre-financing of programmes of the EU covered by income from the European Union, and support of innovation.

All data on the total direct government support of R&D from the state budget for the area of research, development, and innovation result from data provided in the final account of the State Budget 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).

*Table **22**-16. **Direct and indirect government support of research and development in private enterprises***

Indirect government support of research and development is applied deduction of expenditure on realization of R&D projects from income taxes of legal and natural persons.

Data on indirect government support of R&D (Government Tax Relief for R&D Expenditure) have been observed by statisticians since 2007. Tax returns are the administrative data source. Only legal persons (enterprises) in institutional sectors S.11 and S.12 are surveyed. Information on natural persons (entrepreneurs) is not available.

Indirect government support of R&D is calculated based on the following formula:

Indirect government support of R&D = applied deduction of expenditure on R&D from the tax base x tax rate

Deduction cannot be applied on services and intangible results of research and development. A complete list of properties/eligible costs can be found in the instruction of the Ministry of Finance (D-288/2005).

*Table **22**-17. **Innovating enterprises***

Data on innovations contained in the chapter are obtained based on a statistical survey on innovation in enterprises, which is carried out to map innovation potential of enterprises doing their business in the Czech Republic. The survey is organized within the EU based on the aforementioned Commission Implementing Regulation (EU). The statistical survey population includes reporting units of the business enterprise sector with 10+ employees in selected key activities according to the Industrial Classification of Economic Activities "OKEČ" *(the national version of the NACE Rev. 1.1) and starting from 2008 the CZ-NACE Rev. 2.*

The following are subjects of the statistical survey: technical innovation activities (product innovation, process innovation) and non-technical innovation activities (marketing innovation, organisational innovation).

***Product innovation** – products or services that are either absolutely new or have markedly better basic characteristics, higher technical quality, implemented software or other intangible elements, wider application, higher customer satisfaction.*

***Process innovation** – new and significantly improved production technologies, new and significantly improved ways of providing of services and offering of goods.*

***Marketing innovation** – implementation of a new marketing method containing significant changes in the design of a product or package, placing of a product, product support or award.*

***Organisational innovation** – implementation of a new organisational method in business practices of an enterprise, organisation of a workplace or external relationships to improve innovation capacity of an enterprise or its performance characteristics.*

***Innovating enterprises** are enterprises, which were during the reporting period implementing a technical or non-technical innovation.*

*Table **22**-18. **Expenditure and sales on product and process innovation in enterprises***

*Total innovation costs related to product and process innovation in the surveyed period include: **intramural research and development, purchase of research and development services, acquisition of machinery and equipment** (progressive machines, computer hardware specially purchased to implement new or significantly improved products and/or processes), **acquisition of other external knowledge** (purchase of patent rights and non-patent inventions, licences, know-how, trademarks, software, and other forms of knowledge from other entities in order to use them for company innovation) and since 2012 **expenditure on other innovation activities** (design, training, introduction of innovation to the market, and other activities related to innovation made).*

***Total sales of enterprises with product innovation** are sales of innovating enterprises, which introduced product innovation in the surveyed period. They are broken down to **sales for innovated products** (new on the market, new for the enterprise) and **sales for unchanged or slightly modified products** (products or services, at which the element of "novelty" is missing and they are not considered to be innovated).*

*Table **22**-19. **Patents granted in the Czech Republic***

*A **patent** is a public deed issued by the relevant patent office, which provides legal protection to an invention for the period of up to 20 years (provided that maintenance fees are paid), namely on the territory for which it was issued by the office. Patent protection on the territory of the Czech Republic is ensured by the Industrial Property Office of the CR (hereinafter only IPO CR).*

*Patents are granted for **inventions**, which are novelties; they are a result of activity of inventors and are industrially applicable. The following can be patented: not only products and technologies, but also chemically produced substances, drugs, industrial production microorganisms, as well as microbiological ways and products obtained by those ways. What cannot be patented, on the contrary, are discoveries or scientific theories, programmes for computers, new cultivars of plants and breeds of animals or ways of surgical or therapeutic treatment of human or animal bodies, and diagnostic methods used at human or animal bodies.*

***Patent statistics** brings information about results and successfulness of research, development, and innovation activity in selected areas of technology. Data in this chapter were processed by the CZSO based on data sources of the IPO CR. Patent data are broken down according to the Patent Manual of the OECD (OECD, Paris 2009). Based on the International Patent Classification (IPC) it is possible to classify granted patents to selected technological areas.*

*Patent data by **way of patent granting** are broken down to national granted patents by the IPO CR or European patents validated in the Czech Republic by the IPO CR. The second possibility is used mainly by foreign applicants.*

*Patent data broken down by **applicant's country of origin** are classified using the so-called fractional method (e.g., if two applicants from different countries file together a patent application, a half of the patent is assigned to each country).*

*Data on the number of patents belonging to domestic entities are further available in the breakdown by institutional sector (business enterprise, government, and higher education) defined in accordance with the methodology of sector of research and development performance (see definitions in the notes on Tables **22**-8 to **22**-12. Research and development). Private persons are a separate category.*

*Table **22**-20. **Patent licences***

*A **licence** is one of the possibilities to use industrial rights and intellectual property on a commercial basis. A **licence agreement** refers to granting of the right, in an agreed scope and on an agreed territory, for acquisition or provision of patented or non-patented inventions. The licensor entitles the licence acquirer to exercise industrial property rights in an agreed scope and on an agreed territory and the licence acquirer undertakes to provide some payments (licence fees) or other asset.*

*The basic division of licences is according to whether the subject of a licence is **provided** (active licence) or **acquired** (passive licence).*

*By subject of a licence there are **patent licences**, the subject of which is to provide the right to use a valid patent either in the country of the purchaser or in countries, to which the purchaser of the licence intends to export the licence product, **utility model licences**, the subject of which is an industrial design or utility model, **know-how licences**, the subject of which is to provide unprotected production and technical knowledge or experience.*

*The Czech Statistical Office has been surveying data on licences valid on the territory of the Czech Republic in the area of industrial property protection since the year 2005 by the Annual questionnaire on licences. It is an exhaustive survey. From the point of view of dissemination of results of research and development and their capitalization, the most important subjects of licence agreements are provided **patent licences**, on which the CZSO primarily focuses in its survey. **Reporting units** in the survey on provided patent licences are since 2008 all legal persons with a valid patent for the territory of the Czech Republic as at 31 December of the reference year.*

Data on the number of patent licensors and the value of received royalty and licence fees are always the totals of processed data from collected questionnaires. Since 2007, mathematical and statistical methods have been used to make estimates for non-response (i.e. data for reporting units, which have not submitted the questionnaire in the determined term).

*Data on provided patent licences are available in the breakdown by institutional sector (business enterprise, government, and higher education) defined in accordance with the methodology of sector of research and development performance (see definitions in the notes on Tables **22**-8 to **22**-12. Research and development).*

*Table **22**-21. **External trade in high-tech goods***

***High-tech goods** are goods produced mainly in technology intensive operations. At the same time, development of such products is accompanied by high costs either for innovation and/or for research and development. For the needs of external trade statistics, high-tech goods are defined by the Standard International Trade Classification (SITC).*

In 2010, Eurostat elaborated an updated list of high-tech goods based on the new SITC Rev. 4 classification, which became effective in 2007. Due to significant changes in the new version of the classification, data on external trade with high-tech goods in individual categories before 2007 are not fully comparable and therefore the data are published in the Statistical Yearbook of the CR from 2007. According to the SITC Rev. 4, high-tech goods are divided to the following nine basic aggregations:

- *Electronics-telecommunications,*
- *Electrical machinery,*
- *Pharmacy,*
- *Chemistry,*
- *Aerospace,*
- *Non-electrical machinery,*
- *Scientific instruments,*
- *Computers-office machines,*
- *Armament.*

*Data come from data outputs of external trade statistics (External Trade Statistics Database of the CZSO). More detailed information is available also in the methodological part of Chapter **11** External Trade.*

*Table **22**-22. **Technology balance of payments***

Technology balance of payments monitors sale and purchase of intangible technologies of a given country in relation to other economies. Data on receipts (or payments) received within external trade with technology express technological level of an economy or, to put it more precisely, they inform about the scope of external trade with industrial property and knowledge related to advanced technologies.

*Basic methodology and concept of **technology balance of payments statistics**, which comprises external trade with technology, is based on the Technology Balance of Payments Manual (TBP Manual, OECD, 1990).*

***Data on exports and imports of technology** come from a direct survey of the CZSO among respondents on exports and imports of services. Individual TBP items (receipt/payment items) are defined based on the EBOPS 2002 (the Extended Balance of Payments Services Classification) as follows:*

***Computer services** (codes: 261, 262, and 263) – for more see Chapter **21** Information society.*

***Architectural, engineering and other technical services** (code 280) including especially:*

- *architectural services, which include transactions related to the design of buildings;*
- *engineering services, which include the design, development and utilization of machines, materials, instruments, structures, processes and systems. Services of this type involve the provision of designs, plans and studies related to engineering projects;*
- *scientific and other technical services, which include surveying; cartography; product testing and certification; and technical inspection services.*

***Research and development** (code 279) including especially:*

- *the provision of research and development services that are made-to-order (customized) and development of non-customized research and development, excluding sales of proprietary rights, and sales related to licences to reproduce or use;*
- *sale of proprietary rights arising from research and development;*
- *exchange and transfer of R&D funds are funds with or without a compensatory return flow of R&D.*

***Royalty and licence fees** (code 266; hereinafter only "licence fees") include charges for the use of proprietary rights, such as patents, trademarks, copyrights, industrial processes and designs, trade secrets, and franchises, where rights arise from research and development.*

*Tables **22**-23 and **22**-24. **Basic indicators of enterprises in high-tech sector***

*The group of industries with high technology intensity (hereinafter only **high-tech sector**) comprises economic activities using for their production advanced technologies in a large extent and the development of their outputs is accompanied by high costs either for innovation and/or for research and development. These economic activities at the same time generate a higher value added.*

The high-tech sector consists of group of activities belonging to high-tech manufacturing and high-tech services. A list of relevant activities was updated by Eurostat in 2010 by means of the Statistical Classification of Economic Activities (NACE Rev. 2), which is valid since 2008. Those businesses are classified to the high--tech sector the prevailing activity of which belongs to the following divisions and groups of the CZ-NACE:

***High-tech manufacturing industries** (Table **22**-22):*

Manufacture of pharmaceuticals:
- *division 21 – Manufacture of basic pharmaceutical products and pharmaceutical preparations*

Manufacture of computers and electronic components:
- *group 26.1 – Manufacture of electronic components and boards*
- *group 26.2 – Manufacture of computers and peripheral equipment*

Manufacture of consumer electronics and optical instruments:
- *group 26.3 – Manufacture of communication equipment*
- *group 26.4 – Manufacture of consumer electronics*
- *group 26.7 – Manufacture of optical instruments and photographic equipment*
- *group 26.8 – Manufacture of magnetic and optical media*

Manufacture of scientific electronic equipment:
- *group 26.5 – Manufacture of instruments and appliances for measuring, testing and navigation; watches and clocks*
- *group 26.6 – Manufacture of irradiation, electromedical and electrotherapeutic equipment*

Manufacture of aircraft and related machinery:
- *group 30.3 – Manufacture of air and spacecraft and related machinery*

***High-tech service industries** (Table **22**-23):*

Audio-visual activities:
- *division 59 – Motion picture, video and television programme production, sound recording and music publishing activities*
- *division 60 – Programming and broadcasting activities*

Telecommunications:
- *division 61 – Telecommunications*

IT activities:
- *division 62 – Computer programming, consultancy and related activities*

Information service activities:
- *division 63 – Information service activities*

Research and development:
- *division 72 – Scientific research and development*

*Indicators in these tables, except for R&D expenditure (source: R&D annual survey), were obtained from the annual structural survey of businesses from selected production industries (**SBS – Structural Business Statistics**) providing a more detailed range of final data, which are, however, available with a greater time delay. More detailed information about the data from the annual SBS of selected production industries, including definitions of individual indicators, is available in Chapter **15** Industry and in Chapter **18** Trade, Hotels, Restaurants, and Tourism.*

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Further data can be found on the website of the Czech Statistical Office at:

- www.czso.cz/csu/czso/science_and_research_veda